Gradus ad…? Rethinking musicianship in the training of performers of new music

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Abstract

New music is quite old. However, the institutional training structures that aim to teach those musicians who intend to specialise in its performance are young. These structures have been subject to little scrutiny, and few texts exist to guide and support those responsible for constructing courses and delivering training. This study is intended to help fill this gap. Using a combination of practice research and traditional research methods, I investigate how new music performer training is currently offered. I discover that while trainees have access to a rich store of technical instrumental tuition and project-specific artistic guidance, their instrument- and work-independent (musicianship) needs are not generally being met. I look within new music's characteristic materials, gestational processes, and professional taboos, to understand why this is the case. Taking a cognition-in-action approach, I then offer a novel practical vocabulary intended to expand the meaning and relevance of musicianship in new music performance contexts. In two extensive dialogues, one investigating pitch and the other rhythm, I sketch how instructors and curriculum-setters might deploy the terms in this vocabulary when interacting with trainees. The dialogues are idealised learning journeys. Since it is not meaningful to set learning targets such as 'play/sing in tune' or 'in time' without musical context, the dialogues present thought experiments alongside practical musicianship exercises and make no attempt to separate skills of ear and body from skills of thought. While the tools developed here are drawn from and targeted at an existing new music repertoire, they are also transferable between projects and are not limited to specific acts of performance. The immediate envisaged impact of this study is to guide my own practice as performer-pedagogue. It is also intended to lay the groundwork for future developments in this young field.

Declaration

I declare that this thesis is a presentation of original work and I, John Clement Power (known as Clement Power) am the sole author. This work has not previously been presented for a degree or other qualification at this University or elsewhere. All sources are acknowledged as references.

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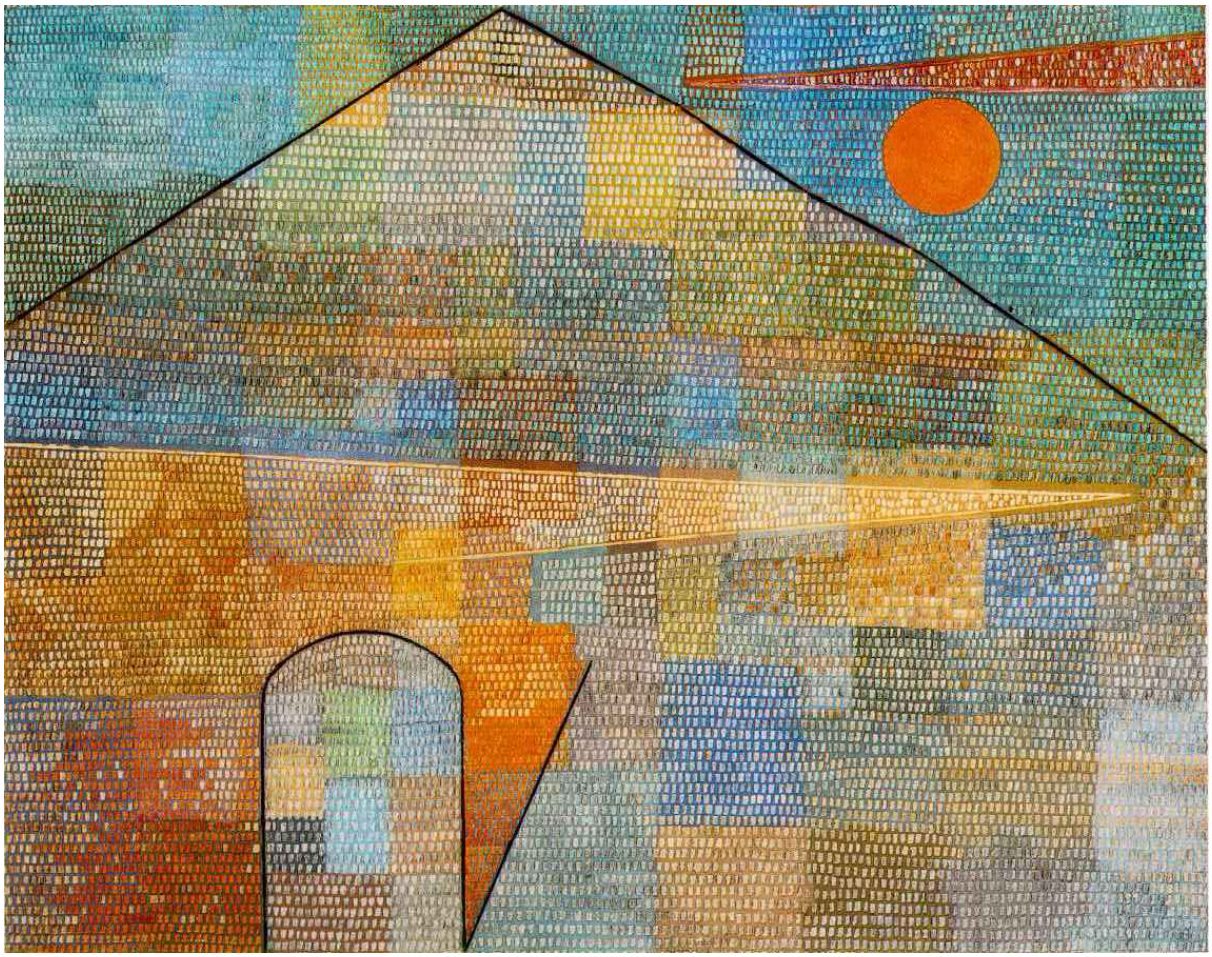

Paul Klee, *Ad Parnassum*, 1932, oil on canvas, 100×126 cm, Kunstmuseum Bern.

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Preface

I work as a conductor of (mostly) new music.[1] I am also sometimes invited to work with or assess students who specialise in the performance of new music, and, as I write in July 2024, have just been appointed as professor of new music performance at a large European conservatoire. It may therefore dismay those musicians who hope to benefit from my advice to discover that I did not study 'new music' or 'new music performance' in any formal setting, and that this is also true of most performers over the age of forty who specialise in new music. This is because the creation of institutions and sub-institutional divisions that offer dedicated, specialised, and explicitly-named courses that aim to teach the performance of new music is largely a phenomenon of the current century. In this text I call such teaching *new music performer training* — henceforth NMPT. Where such training takes place within dedicated institutional contexts, such as conservatoires that offer specialised new music performance pathways, new music residential academies, and side-by-side schemes with new music ensembles, it is referred to as *institutional NMPT*. This text is underpinned and made possible by my conception of (good practice) institutional NMPT as a field with a strong and distinct identity, despite its youth. I draw contrasts throughout to the longer-established traditions of composer training from which it emerged, and whose characteristic ways of thinking and priorities remain highly influential within it. These two broad training approaches, I argue, should not be assumed to share working methods, models of best practice, nor conceptual underpinnings, even in contexts that favour collaborative working and seek to blur the identities of composer and performer.

The key questions addressed in this text are: within an institutional NMPT programme, is there, or should there be, a role for dedicated musicianship training — and if there is, how might it be conceived and carried out, and with the help of what kind of resources? Before addressing these questions we need to take a brief broad view of the field itself. A first obstacle — or perhaps advantage — is a relative lack of established vocabulary among practitioners. Although most musicians of my generation and above did not themselves receive institutional NMPT, the majority of instructors on these courses are from this age-group. This means that in most cases — in contrast to the default situation in the training of older 'classical' musics — their teaching approaches are freighted with fewer of the benefits and the burdens associated with long-standing pedagogical traditions. From instructors in this age-group I have repeatedly heard variations on the phrase *I had to work all this out for myself*. Many of the methods and priorities of institutional NMPT are new and/or in rapid flux. This is reflected in the continually-changing names and declared identities of its constituent courses.

I had been curious about this situation long before starting this project. Since my performing colleagues have included numerous NMPT instructors, for years I had unwittingly performed acts of informal research by asking them (over coffees in rehearsal breaks and beers after concerts) variants of a naïve question: *If you were creating a course to teach new music performance from scratch, what would be on your ideal curriculum?* I received a great variety of answers. Some saw the question in instrumental-technical terms, their responses evoking

[1] See, for example, 'Artist biographies: Clement Power', *Eclat – Musik der Jahrhunderte*, 2024, accessed Jul 4, 2024, https://www.eclat.org/en/kuenstlerin/clement-power/; and 'Directory of Artists', *Lucerne Festival*, 2024, accessed Jul 4, 2024, https://www.lucernefestival.ch/en/program/directory-of-artists/clement_power/91.

a shopping list of techniques that a student should acquire: executing wind or string multiphonics, playing inside the piano, and so on. Others saw it in terms of repertoire choice; these figures assumed that the word 'what' referred to the selection of compositions to be studied. On this reading the term *new music* was particularly troublesome: was it a moving trawl, capturing forever the musical output of the past thirty years or so, or a historical period with a fixed start date (perhaps as long ago as 1912, when the ink of *Pierrot lunaire* and *Le sacre du printemps* was still wet, or the historical caesurae of 1945 or 1989?) with the implication that — whichever date was chosen — the realm of new music would thus increase by one year, every year? Very commonly, it was felt that the 'new music' eligible for inclusion on such a course was defined by musical style and approach rather than chronology: compositions such as Ivan Wyschnegradsky's *Chant douloureux et Étude* (1918), Henry Cowell's *Fabric* (1920), or Edgard Varèse's *Hyperprism* (1922/1923), would probably be eligible, despite them lying closer on a timeline to the death of Beethoven than to the present day, while works by Max Richter (b. 1966) or Eric Whitacre (b. 1970) would not. (Curiously, in this way of thinking it might even be possible for a composer's earlier works to count as new music, and their later ones not: examples of this would be Krzysztof Penderecki and Peter Maxwell Davies.) Some pursued this line further, feeling that the main criterion for eligibility as primary materials on such a course should be that the repertoire encode an experimental stance of some kind, regardless of chronology or cultural allegiances: these instructors mentioned figures such as Mauricio Kagel, Éliane Radigue, Lucia Dlugoszewski, and Anthony Braxton, and would even consider including historically-distant experimentalists such as Heinrich Biber (1644–1704) or Nicolo Vicentino (1511–1575 or 1576). Others focused pragmatically on preparing students to deal with compositions arising from the current (predominantly European) *Neue Musik* / *musique contemporaine* ecosystem of new music ensembles and festivals. Voicing wider concerns in this ecosystem, these instructors pointed to a potentially problematic split in allegiances between a NMPT course's curatorial responsibility for 'old new music' versus 'new new music', since new music is by now so old that an awareness of its aging (as diagnosed by Adorno in 1954)[2] is itself a venerable trope. The cultural worlds of L'Itinéraire in the 1970s or Darmstadt in the 1980s, for example, feel very distant from the preoccupations of the 2020s but their compositional outputs nevertheless remain largely unassimilated into other training structures such as 'non-specialised' conservatoire programmes; should a NMPT course seek to re-animate these worlds, perhaps by taking cues from colleagues in historically-informed performance (HIP) departments, or let them fade away? For other instructors, all these questions of repertoire choice were secondary to the burning imperatives of increasing equality, diversity, and inclusion within the field. For them, the priority was first to redress historical wrongs through direct action; only afterwards would it be meaningful to take an overview of the reconfigured landscape. Others considered that any choice of repertoire should follow from a more fundamental re-examination of performing behaviours and procedures, their responses evoking a spectrum of such practices that they felt a NMP trainee should sample: improvisation free and/or structured, and engagement with notions such as the 'creative performer' including devised scores and assorted generative collaborative processes. These instructors tended to emphasise the importance of preparing trainees for working in interdisciplinary contexts; they observed that, since a NMP trainee would be unlikely to spend their future

[2] Theodor W. Adorno, 'Das Altern der Neuen Musik' ('The Aging of the New Music'), in *Dissonanzen. Einleitung in die Musiksoziologie*, Gesammelte Schriften Band 14, (Germany: Suhrkampf, 1973), 143.

career sitting behind a music stand wearing concert dress, they should be trained in various aspects of stagecraft. Some instructors stressed the importance of including areas that they saw as commonly neglected, including musicians' health (physical and psychological) and professional development skills such as networking and marketing. A few — perhaps fewer than might have been expected if the question had been asked twenty years ago — explicitly mentioned familiarisation with new technologies. I suspect that this reflects the degree to which such technological interactions (amplification, sound manipulation, duetting with fixed media, working with clicktracks and video synchronisation, the use of sensors on the instrument or performer's body, etc.) have become so naturalised in some areas of new music practice that they hardly merit special mention. Most of the colleagues I asked combined elements of several of these priorities in their answers: a preference for teaching a particular set of instrumental techniques or notational strategies, for example, obviously implies a preference for the repertoire that employs these most intensively. One meta-response was to propose that the best NMPT programme would be one where the trainee were as free as possible to choose their own pathway from as great a variety of potential encounters as possible.

Respectable doctoral theses define their terms at the outset. However, given such a clamour of voices among my immediate network alone, it would seem foolhardy for me to attempt a sharp definition of the words 'new music' in NMPT. Nietzsche noted that 'all concepts in which an entire process is semiotically concentrated defy definition; only something that has no history can be defined',[3] and new music — on whatever reading — has a great deal of history indeed. Other formulations are available that attempt to tie up the bundle of musical practices under examination here. 'Contemporary art music' is one option; a recent study claimed this to be an 'impartial term'.[4] Even lengthier alternatives have been offered, arising from ongoing attempts to decolonise *the* (cue a warning klaxon!) curriculum and *the* (honk!) canon, and so put this repertoire in its historical-cultural place (an awareness of *positionality* and a move towards *decentering*, in the jargon). All the terminological options here are troublesome, so I have opted for brevity.[5] Since this text is intended as a critical companion to existing structures rather than a historical reconceptualization of a repertoire, I can half-heartedly offer the circular definition that new music (here) means the musical practices that are prioritised in the training approaches discussed in this text. As I note in Chapter 2, the programmes that declare a specialism in the performance of new music are concentrated in continental

[3] Friedrich Nietzsche, *On the Genealogy of Morality and Other Writings*, trans. Carol Diethe (Cambridge: Cambridge University Press, 2017), 54-55.

[4] 'We use the term "contemporary art music" to refer to a large set of current genres and aesthetics, both institutional and underground, that are generally included within current experimental music practices. This is an impartial term that takes the place of other common terms such as "new music", "contemporary and experimental music" or "avant-garde music."' Katarzyna Grebosz-Haring and Martin Weichbold, 'Contemporary Art Music and Its Audiences: Age, Gender, and Social Class Profile', *Musicae Scientiae* 24, no. 1 (2020): 60-77. All such 'impartial' definitions have their problems: here, these include the assumption that all composers in this category are inevitably 'experimental' (whatever that means), that 'art music' is necessarily distinct from commercial music, and the outdated distinction between 'institutional' and 'underground': into which category would the musics played in London's Café OTO or Berlin's Musikbrauerei be placed? (Perhaps 'institutional underground'?)

[5] I have a mild preference for using the term 'new music' rather than 'contemporary music' in this institution-focused text because the latter term has seen significant adoption by institutions that focus on popular and commercial musics that are outside the scope of this text (e.g. the London College of Contemporary Music and the Master of Music in Contemporary Performance programme offered by Berklee Valencia), and is used in the naming of radio formats for entirely unconnected musical practices (e.g. 'adult contemporary.') In addition to the various tribal usages of the terms in English, there are translation traps here: *musique contemporaine* is a closer translation of *Neue Musik* than *musique nouvelle* would be.

Europe, consequently, the repertoire referred to here reflects the preferences of their instructors. This does not imply that the repertoire under discussion exclusively arises from the overlapping 'scenes' that comprise the European *Neue Musik* / *musique contemporaine* (etc.) ecosystem, but rather to acknowledge that repertoire from outside this structure has been viewed through a European lens. (A composer may be prominent in a musical culture outside this ecosystem but barely acknowledged within it, and vice versa.) While this ecosystem is not monolithic,[6] it is and always has been subject to sweeping trends: compositional approaches (and therefore composers' precarious careers) pass in and out of fashion with brutal rapidity. Even in the course of compiling this text, I have been conscious that I am on rapidly-shifting ground. I have attempted to identify and engage with some of the most recent developments in 1.2.1, 1.2.6, and 4.2 below. Since in chapters 3–7 I diagnose, and attempt to offer alternatives to, a widespread conception of performer training that is (in my judgment) overly bounden to the imperative to engage with a succession of individual compositional voices (whether heard via conventional scores or other communicative methods), I hope that even if many of my examples and exercises seem to be stamped on the underside 'Made in the EU' and marked with an imminent sell-by-date, they may be usefully applied to other and future repertoires, whether after minor tweaks or a thoroughgoing *détournement*. (To put it another way: people can do as they please with the materials offered here.) I have attempted to select examples that best illustrate the point under discussion, and not to give undue weight to my own repertoire preferences. However, I am not blind to the fact that inclusion in or exclusion from this kind of text carries its own little influence: while recent histories including those by Jennie Gottschalk, Tim Rutherford-Johnson, and Kate Molleson resist the implication that, in giving an example, they are contributing to the formation of a canon,[7] I cannot see a way around this effect. One unusual feature that might excuse this text from accusations of canonisation is that the majority of my examples are drawn from musical situations which presented problems of various sorts, some were selected due to their generic (or, to put it more charitably, *representative*) nature, and a few — anonymised appropriately — are of frankly bad practice.

I do not offer my own answer to my broad, pre-PhD, question here. Indeed, as my familiarity with the subject has increased, I have become increasingly convinced that we should not look for answers about

[6] Nevertheless, there is a perhaps surprisingly high degree of in-group consensus about its dominant figures. For its January 2017 issue the Italian magazine *Classic Voice* polled 'a jury of more than 100 leading experts in contemporary music: music critics, musicologist, artistic directors, conductors' (i.e. highly in-group figures) to compile two lists: of the 'best music works written from 2000 onwards' and the most 'prominent living composers'. Of the composers, top rank went to Georg Friedrich Haas, followed by Simon Steen-Andersen, Rebecca Saunders, Helmut Lachenmann, Salvatore Sciarrino, Enno Poppe, Kaija Saariaho, Bernhard Lang, Francesco Filidei, Beat Furrer and Stefano Gervasoni. The relatively lowly places ascribed to some well-known older figures (Louis Andriessen came last) may be ascribed to the survey's vaguely-phrased questions: was it about current relevance or the value of a total body of work? While the methodology of the survey could be described as suspect at best (some respondents ignored the stipulation that the composer should still be alive), and the exercise was obviously intrinsically trivial, primed for self-confirmatory bias, and skewed by some Eurovision-style partisan nationalist voting, its results give a sense of where the European lens is focused. Of the 74 listed composers, only five were from the USA (John Adams at #26, Steve Reich #35, Michael Gordon #57, John Luther Adams #68, David Lang #72), and three from the rest of the world: the Korean (but Germany-based) Unsuk Chin, the Israeli (USA-based, but with strong links to Europe) Chaya Czernowin, and the Japanese Toshio Hosokawa. Only nine women were listed, and precisely zero BIPOC composers. The survey's glaring problems did not prevent the publishing house Ricordi from making use of it in its promotional materials: 'Expert survey: Haas is the most important living composer', *Ricordi*, 2017, accessed 4 Jul, 2024, https://www.ricordi.com/en-US/News/2017/01/Expert-survey-Haas.aspx.

[7] Jennie Gottschalk, *Experimental Music Since 1970* (New York and London: Bloomsbury, 2016); Tim Rutherford-Johnson, *Music after the Fall: Modern Composition and Culture since 1989* (Oakland: University of California Press, 2017); Kate Molleson, *Sound Within Sound: A History Of Radical Twentieth Century Composers* (London: Faber, 2022).

overall NMPT curriculum content from any single person but rather from a network. The concern of this project — the role of musicianship training within NMPT — arose partly from this informal line of questioning (or, rather, from what I noticed was lacking in the responses I received), and partly from observations within my own practice. These observations, over some years, came to resemble the diagnosis of a cryptic medical syndrome. At first I noted a series of small concerns with few obvious links except my nagging intuition that something was amiss. Gradually a more interconnected, and graver, picture came into view.

Musicianship

This word has a split identity: it is the province of children and of musical gods, but is less obviously applicable to those of us who are in neither category. In the former set of associations, it may evoke dimly-remembered early-years Kodály or Orff sessions, or obligatory undergraduate ear-training classes. In the latter, musicianship is the highest imaginable praise for a musician — a deliberately imprecise term that indicates the onset of the ineffable and the moment that discussion should cease. Martha Argerich's *sheer musicianship* — the last word on the subject — transcends her physical pianism or any details of her interpretations. Musicianship training is associated with the former and not the latter associations. Consequently, the preoccupations of this study may initially seem didactic or unwarrantably basic in comparison to the more glamorous rhetoric surrounding today's NMPT courses (collaboration! adventure! co-creativity!) I will not attempt to counter this perception at the outset. Instead, I hope that a more enticing and vivid picture of what musicianship might mean in new music contexts will emerge in the course of the text. A thread that runs throughout is my attempt to evoke and get to know the special character of new-music-focused musicianship, which I think has a real and distinct existence, even as it is scantily documented. I argue that the notion may be deployed to help NMP trainees gain a sense of well-founded confidence, and that developing this confidence is often sorely needed, even though powerful taboos in professional and pedagogic practice have hampered trainees' freedom to express this need, and instructors' confidence to meet it (2.4.2, 3.2.)

The governing terms *sensitivity* and *flexibility* are freighted with specific meanings here with the intention of clarifying this confidence-gaining process. In this text, musicianship is conceived less as a faculty that an individual might possess and develop in isolation (and even be individually assessed on) than a way of pointing to what lies between musicians: a lingua franca with no finalised grammar nor vocabulary but with enough overlapping or shared content to be teachable in some degree of isolation from individual instances of practice. Although outside the discourse of new music the term is often accompanied by words like *basic* and *fundamental*, despite its paradoxical marginalisation in training models (2.1, 3.2), I nowhere claim that this text's area of interest is conceptually prior to other desirable areas of the hypothetical NMPT utopia evoked by my initial question. However, I do argue that it has been structurally neglected, and seek to understand why this is the case.

While new-music-focused musicianship cannot be fully defined in this Preface, I can give an initial sense of what I mean by the term. 'What lies between musicians' can be taken literally to mean what remains of such

intercourse when performers' principal instruments are taken away. In the early 2000s the musicians of Cologne's Ensemble Musikfabrik embarked on a grand project: they commissioned, and committed to learn to play, a reconstruction of the microtonal instruments of Harry Partch.[8] The immediate goal was to perform Partch's stage-work *Delusion of the Fury* at the 2013 Ruhrtrienniale festival; many further touring performances and related projects followed. Some of the musicians learned a Partch instrument that closely resembled their own main instrument: the violinist played the Adapted Viola, the keyboardists the harmonium-like Chromelodeons, and the percussionists the Diamond Marimba, Boos (bamboo marimba), and Zymo-Xyl. (I retain the composer's idiosyncratic capitalisations.) However, in other cases there were significant differences: the flautist played the Cloud Chamber Bowls (suspended Pyrex carboys, struck with mallets), the clarinettist played the Harmonic Canon (a zither with movable bridges), the oboist played the Koto (a thirteen-string psaltery) and the trumpeter and hornist played the Kitharas (large string instruments whose pitch is altered with sliding Perspex rods). For all the musicians this was a steep learning curve. The challenges included negotiating the physical demands of unfamiliar instruments and the idiosyncrasies of Partch's tablature- and ratio-based notation, the need to become rapidly familiar with some novel intervals and chords along with their elaborate and indigestibly-explained theoretical underpinnings, and the fact that much of the music had to be performed from memory for staging reasons. For some ensemble members, and especially those who had learned Partch instruments that differed strongly from their principal instrument, the curve was so steep that they sometimes talked as if the Partch project had forced them to start again from scratch — 'like little children', as one put it to me. However, of course this was not the case. These musicians did not come naked to the Partch instrumentarium but richly clad in musicianship. Even if their individual musicianship faculties had been honed through years of intensive dialogue with a particular instrument, and bore the indelible marks of that specialising encounter — for example, an oboist being particularly sensitive to fine microtonal inflections, or a percussionist being particularly proficient with polyrhythms — there was more than enough common ground lying between the ensemble's members to make the learning journey of the Partch project not only a feasible undertaking but one with highly successful outcomes.[9] While instrumentally-independent musicianship might strike the reader as a rather abstract or elusive notion, its existence in this case was bankably concrete, since if the musicians — or their funders, or their concert promoters — had had doubts about their artistic capacity to deliver this very expensive project at a high standard, it would have been rejected at an early stage. The qualities of instrumental virtuosity, enthusiasm, and the spirit of adventure (although present in spades) would not have sufficed. The key saleable product was musicianship.

The real existence of this common ground was even more in evidence in a connected initiative: the pitch43_Tuning the Cosmos project (2015-2018), in which Musikfabrik commissioned composers to write

[8] The instruments were constructed by the percussionist and instrument builder Thomas Meixner. For video documentation see 'YouTube: Ensemble Musikfabrik: Harry Partch', accessed Jul 4, 2024. https://www.youtube.com/playlist?list=PLCBjLKWALYep-oItw70GW5NVbHA0_JiD6.

[9] Anthony Tommasini, 'Review, "Delusion of the Fury," With New Partch Instruments', *New York Times* July 24, 2015, https://www.nytimes.com/2015/07/25/arts/music/review-delusion-of-the-fury-with-new-partch-instruments.html; Neil T. Smith, review, 'Harry Partch, Delusion of the Fury. Ensemble Musikfabrik. Wergo, Wer 6871 2,' *Tempo* 77, no. 303 (2023): 96-98. The last line of Smith's review reads, 'What a commitment. What a performance. What a group.'

for the Partch instruments in combination with the ensemble's usual instrumentarium.[10] I conducted some of these premieres, and found the task challenging and revelatory. The composers — already a diverse group — had been presented with a tangle of instrumental affordances and accordingly produced a wild variety of results: almost every piece seemed to offer a novel interactional grammar and a new notational approach. From the players' (and my) point of view, it was often challenging to move gracefully between multiple ways of thinking about pitch. In some moments, when playing Partch's ratios on the conventional instruments, we could use our memories of these ratios as a reference, while in others we found it useful to think in terms of specific deflections from equal temperament or from known points of reference on the instrument. Sometimes it felt more appropriate to tune to a colleague whose pitch could be relied on in that moment, or to a sample, deprioritising any attempt to understand the pitch in categorical terms. At other times the ensemble used grouped pitches to create effects like squeaks, grunts, and throbs. In these cases the pitch-finding reference was a specific timbre; achieving it might feel no less precise than conventional intervallic pitch-finding.

The agility that this project demanded of its performers as they danced between frames of reference is a recurring theme in this text. I argue that it is very often desirable for a performer (a musician characterised by the capacity for quick, on-the-hoof, musical thinking) to call on sets of musicianship skills that may contrast strongly with those that the composer (a musician characterised by the capacity for slow, deliberative, musical thinking) seemed to have used in their compositional process. In the pitch43 project, *doing* pitch — that is, not simply the potentially-measurable ability to hit absolute pitch-targets indicated in the scores, but internally-experienced acts of live cognition, including the ability to rapidly assess the proper tolerances for a particular pitch-finding situation, and to make appropriate adjustments to the sounds of colleagues — seemed to take on an existence of its own in the rehearsal studio. While the capacity to perceive and categorise fine differences within a particular system of reference was an essential starting-point for such work (this is the special meaning of *sensitivity* in this text), the most intensive acts of cognition — the moments where musicianship seemed to reveal itself in its full glory — were translative in nature: that is, they entailed moving between (translating) different systems of reference. The ability to do so gracefully is the special meaning of *flexibility* in this text. Musicianship (here) = sensitivity + flexibility.

As I explore critically in Chapters 2, 3, and 4, the discourse in this area strongly prioritises the documentation of individual embodied experience and interactions with specific instruments, and sees attempts to identify or construct cross-instrumental abstractions as associated with outdated theoretical endeavours and therefore to be resisted. While it is true to say that during the pitch43 project everyone was busily engaged in their tussles with the instruments at hand (particularly the recalcitrant Kitharas!), the studio's air was also thick, so to speak, with intensive pitch cognition that was not solely linked to instrumental affordances nor to particular physical gestures. If a mischievous demon had somehow forced every player to exchange instruments with a colleague at random, or to sing the parts instead of playing

[10] The composers included Simon Steen-Andersen, Caspar Johannes Walter, Carola Bauckholt, Klaus Lang, Sampo Haapamäki, Claudia Molitor, Phillip Sollmann, Martin Smolka and Helge Sten. Thirteen programmes were performed between 2015 and 2018 in festivals including Salzburg Biennale, Kunstfestspiele Herrenhausen, Klangspuren Schwaz, Ultima Oslo, and Huddersfield Contemporary Music Festival.

them, the resulting sound might have changed beyond a casual listener's recognition, but a great deal would have remained. A quite abstract, or 'dis-embodied', notion of shared pitch-work seemed here to take on palpable form. Chapter 6 is my attempt to characterise and make teachable this way of thinking with a view to its application in a wide variety of new music contexts. In Chapter 7 I endeavour to do likewise in relation to the musical parameter of rhythm — a parameter that is even more obviously gestural and embodied, but which nevertheless can be productively developed off-instrument for NMPT purposes.

This conception of performer-focused musicianship, as denoting the aspects of music-making that are maximally instrument-independent, is my starting-point. Although I have led with cases where the stripping-away of a performer's principal instrument has revealed this quality starkly, it may also be amply present in projects where performers play those instruments in conventional ways. A common example of this arises when a clarinet and a flute play a long high note in (intended) unison, ***pp*** ***ff***. As the crescendo builds, the flute tends to push sharp while the clarinet tends flat. All wind players know this in advance and are conscious of the need to adjust the intonation — but how? One player does not do so solely in relation to the other, as a violinist might tune to a tuning fork, since in this context neither instrument provides a reliable reference. Rather, both tune to a projected — non-sounding — point of reference that might be considered to lie at the midpoint between the players' chairs, and only after this zone has been approximately reached, 'to each other'.[11] The aptitude to project and sustain such internal reference points forms an elementary part of the pitch component of musicianship in the sense of this text. While there exist a great number of similar situations in which off-instrument musicianship thinking is relevant when performers play their principal instruments, 'stripping' contexts are particularly frequent in new music practice: players are commonly asked to sing, chant, whistle, and play a great variety of auxiliary instruments. In these contexts some players can feel uncomfortably exposed and can even become distressed. This alone would be an argument for increased musicianship training to build confidence in NMP trainees. In addition to these contexts, performers of new music are habitually asked to change their modes of interaction within ensembles. Not only are the line-ups of such ensembles far more varied than the more stable formations of earlier practices (symphony orchestra, string quartet, wind quintet, etc.), the role of the individual performer is subject to rapid change. A trombonist, conditioned through orchestral training to sit at the back, might need to provide rhythmic initiative by 'leading,' or even 'conducting', a singer may give orientational signals to a percussionist, a 'born to lead' violinist or conductor may find their autonomy constrained by a clicktrack, and a bassoonist may be asked to play soloistic improvisational flourishes in response to samples. As roles are conceived with increasing fluidity, the need for a shared musical workspace — musicianship — becomes more, not less, relevant.

Clearly, an entirely instrumentally independent (or disembodied, or abstract) notion of musicianship would be a nonsense. The types of cognition discussed here all fall into the category of 'cognition-in-action' (2.2.3, 4.2.) In this text I recommend that NMPT should encourage deliberate stepping-away from a performer's

[11] In expert performances the adjustments I describe happen so rapidly and instinctively that the process is not accessible to a listener. My characterisation of the process is a deliberately slow-witted one — or alternatively describes how less-experienced players may approach the process. It also elides the fact that most of this adjustment work happens — or should happen — in the rehearsal phase, the sensorimotor memory of which is carried into the concert.

main instrument to a much greater extent than it habitually does. However, in every case this temporary gesture of removal is done with practical considerations in mind and in the service of real-world performances. That proposition may seem paradoxical in a Preface. The success or failure of this text may be measured by whether it remains so at the end.

Tools

The construction of tools and materials to train musicianship involves, by definition, some degree of generalisation and the concomitant willing acceptance of some loss of detail, or musical grain. A principal concern of Part II is discerning the most useful degree of such generalisation. This task may be compared to deciding the appropriate scale of a map to take on a hike. We can start by discarding some limits: ultra-specific considerations such as the precise location of a harp multiphonic, the exact degree of bow overpressure required to elicit a particular effect, or the shape of a particular phrase, approach a 1:1 scale. They may be important concerns in a particular project, but lack portability between projects. On the other extreme, some terms of recommended musical and pedagogical practice (including ones that I have made use of here, including Pauline Oliveros, 'deep listening' and Pablo Casals, 'expressive tuning') are so broad that, if no further information is given, they seem to approach a 1:∞ scale. These extremes of scale lie outside the realm of musicianship here, which may be described as that set of desirable musical qualities that are held in the midpoint between the gravitational poles of maximum actionable usefulness and maximum cross-project portability. Consequently, my zone of interest is the middle ground — in map terms, decisions such as whether to bring an OS Explorer (1:25,000) or a Landranger (1:50,000). In Part II I propose the cultivation of *scenarios* — a performer's internal playbook of ways they have previously recognised and successfully negotiated classes of obstacles — as a helpful structuring principle for NMPT musicianship at this range of scales.

The terrain that NMP instructors seek to guide their trainees across is not well-ordered but tangled and thorny. Its features and obstacles are not the inevitable consequences of fundamental laws but reflect the thoroughly historically contingent musical preferences and priorities of its current participants and those within its inherited legacy. For this reason, I avoid the language of 'basic' or 'fundamental' musicianship. Everything here is drawn from, and applies to, this peculiar repertoire, which is also a minority one when seen in social terms (whichever of my colleagues' definitions of new music is preferred). Due to its tangled nature, for every suggestion of a general guiding principle, a thousand exceptions and counterexamples will spring to mind. Nevertheless, I argue here that we should actively resist the reflex to move to ever-larger mapping scales (to zoom in) when creating musicianship tools. With a view to gaining resilience and portable skills, the default stance of a training performer should embrace rules of thumb and generalisations — including some quite bold ones about compositional practice — that would (rightly) be seen as inappropriate in other contexts. Even when shorn of claims about epistemic priority like 'fundamental', this proposition pushes strongly against the prevailing current. A recurring theme of Part I is my attempt to explain how and why a powerful anti-generalising reflex has taken hold within NMPT, and to suggest ways that it may be overcome.

The voices of others in this text

This text is a document of practice research.[12] As such it owes a debt to those who fought for the academic respectability of this approach;[13] it is a mark of the success of these pioneers that I do not feel the need to justify the working method itself. It differs from practice research projects authored by instrumentalists or singers in that, because I am a conductor (a 'silent musician', as Mark Wigglesworth nicely puts it),[14] my principal instrument is other people. I do not see NMPT as something that only takes place in conservatoires and academies as a prelude to the main events of professional rehearsals and performances: it is a lifelong project. I see all my professional interactions as combinations of performance and pedagogy in differing degrees, since to manage a rehearsal phase is also to oversee a learning process in which the direction of learning is not one-way. In this text 'trainee' and 'instructor' describe roles and not permanent conditions: in some contexts I am a trainee and in others an instructor. Consequently, the quoted voices of colleagues and students run through this text, in particular in the sections that focus on NMPT institutions (1.2, 3.1-3). However, this is emphatically not an empirical survey of, for example, 'views on the state of NMPT in the early 2020s'. (If such a study were to exist, it would have made this project much easier.) I have significant personal investment in the field, and write from an emic, not an etic perspective;[15] for this reason I could not write such a study even if I wished to.

Nevertheless, I conducted interviews with twenty-one NMP trainees and instructors during the period November 2021—December 2023. This comprised: eleven performer-instructors who held (at time of interview) official teaching positions at conservatoires in the UK, the USA, France, Germany, Switzerland, and two other countries which I do not identify for reasons given below, all of whom also had also instructed on the summer academies and short courses referred to in 1.2 below; four performers without formal conservatoire positions but also with extensive instructor experience in these short courses; four trainees enrolled on full-time NMPT courses; and two recent graduates from such courses, both of whom had teaching practices of their own. This selection was not intended to constitute a representative sample of NMPT but rather hand-picked to fill specific gaps in my knowledge and experience. The interviews were open and free-ranging in nature, varying in length from thirty minutes to two hours, with a total duration of just over thirty hours. I undertook them not to test my own hypotheses but rather to inform myself about what mattered most to my interviewees. In all cases, I started with my initial question ('If you were creating a course to teach new music performance from scratch, what would be on your ideal curriculum?') and subsequently allowed the interviewee to hold forth freely, except where I had specific questions. In addition to my desire to allow the interviewees to lead the conversations, a reason for my not asking direct

[12] Practice research is characterised by Ben Spatz as 'understanding your practice in terms of its knowledge structures.' Interview, quoted in James Bulley and Özden Şahin, *Practice Research - Report 1: What Is Practice Research? And Report 2: How Can Practice Research Be Shared?* (London: Practice Research Advisory Group UK, 2021), 5.

[13] See Henk Borgdorff, *The Conflict of the Faculties: Perspectives on Artistic Research and Academia* (Leiden: Leiden University Press, 2012), and Anders Førisdal and Christina Sofie Kobb, 'Enquête: Artistic Research! Where are we today?' *Music & Practice*, 10 (2023).

[14] Mark Wigglesworth, *The Silent Musician: Why Conducting Matters* (London: Faber, 2019).

[15] 'The introduction and formalization of the concepts emic/etic should be credited to the American linguist Kenneth L. Pike.' Till Mostowlansky and Andrea Rota, s.v. 'Emic and etic', *The Open Encyclopedia of Anthropology* (formerly *Cambridge Encyclopedia of Anthropology*), ed. Felix Stein (Online, 2020). Although the authors caution against the conflation of the oppositions 'emic/etic' with 'insider/outsider perspectives', they also note that this is the general way the terms are understood.

questions about the focus of this project — the role of musicianship within NMPT — was that I felt that the notion had not yet been sufficiently tightly characterised to be effectively communicated in a single word. As it turned out, many interviewees did choose to talk about matters that fall within the domain of musicianship in the sense of this text, including microtonal audiation and rhythmic training. The interviews helped me widen my understanding of the poorly-documented NMPT field significantly, in particular informing me about practice in non-conducted contexts, and about which secondary resources my interviewees found pedagogically useful. Where I found a comment particularly striking and/or, in my view, representative of an area of consensus I have included it. However, the interviews themselves are not the primary research materials of this project (they are completely absent from Part II), nor do I intend to imply that any assertion or conclusion here comes with the automatic backing of my interviewees.

The interviews were conducted according to a procedure approved by the Arts and Humanities Ethics Committee at the University of York, UK. All interviewees signed the form provided in Appendix A indicating that they gave informed consent for their views to be used in this project. Some of my interviewees preferred anonymity, while others were happy to be identified. After careful consideration of the ethical implications, I have made the choice to anonymise all contributions. This is because, while the great majority of the conversations had a positive tone and tended to emphasise good practice (as perceived by my interviewees), some interviewees made comments that either directly criticised, or could be construed as criticising, the practices of institutions and individuals. There was a clear potential for reputational harm both for the interviewee and the referent. For some readers it would not be difficult to trace these back to their sources; accordingly, I have not only concealed names but any information that I think would help identify the speaker. I use the singular they / their pronouns in all anonymised cases. I rejected the idea of naming those who declined anonymity while retaining the anonymity of others; this would have given undue prominence to the named individuals and create a misleading impression of an opposition of the views of named Pollyannas versus anonymous Eeyores. Where I give a direct quote from a person interviewed in the course of this project, I make this explicit. In a small number of cases I have quoted from interactions that took place outside this project and its ethical review process. These are from contexts where it was obvious the speaker intended the comment for widespread consumption: for example, a conductor speaking to a large orchestra in an open rehearsal, a public masterclass, or public pre-concert talks. In one case (the quoted dialogue in 3.1) I sought and received retrospective permission to document an interaction. I also make use of some composite quasi-quotes: patterns of speech that I have heard on numerous occasions in similar but not identical wordings. These are written in italics and appear without quotation marks. Despite the texturing presence of all these voices, this is a project with a single author. All errors and misunderstandings are mine alone.

Terminology

This text is focused on the experiences of performers and takes a 'performer's-eye view' throughout. For that reason, a composer here means someone who has made musical *demands* — however such demands were transmitted — of a performer or performers prior to an act of performance. (The composer and the performer may be the same person, but the acts of composition and performance are considered separately

here.[16]) This differs in emphasis from Jonathan Impett's definition of composers, which corresponds more closely to the usual use of the term: '... artists who take responsibility for conceiving and producing a musical phenomenon that has some degree of boundedness and identity, regardless of how reproducible it might be or at what remove the composer stands from a listener's experience. On some level, at some point, they com-pose – they put together.'[17] For the purposes of this text I am less interested in the results of such putting-together: i.e. musical works, or (following Paulo de Assis) 'mobile entities' or 'assemblages'.[18] In 4.2 I note that this shift in priorities mirrors an ongoing change in what a significant number of composers seem to value most about their practice: there is a broad move away from focusing on the value of individual works (even if the notion is loosened to 'assemblages' or even 'instances of practice') and towards seeing the composer-performer relationship as an end in itself. Additionally, performers specialising in new music are already very much at home with the notion of 'mobile entities', since even when we receive a printed score, it is rarely presented on Urtext-like tablets of stone. New scores more usually exist in a mess of updates (many optimistically marked 'final version'), incorporating emailed lists of corrections and improvements, scribbled fingerings, beating solutions and practical adaptations of all sorts, semi-decipherable mnemonics for hazily-remembered interactions with the composer in rehearsal breaks or over Zoom… Consequently, in this text I do not address questions of authorship and credit, even though these matters are socially important and very often poorly communicated to outside observers, including concertgoers. For example, when conducting what was billed as the premiere of a piece by a well-known composer (by 'well-known' I mean universally recognised within the archipelago of new music scenes, although a household name nowhere), the players and I felt some frustration that the sketchy notational prompts that this composer had supplied were given full authorial credit, while our detailed responses to these prompts were not. During a rehearsal, a bass player had demonstrated an explosive varying-overpressure wavy glissando that yielded a shower of transient harmonics and multiphonics. (It reminded me of embers flying from the strike of a blacksmith's hammer.) This enticing feature, along with my colleagues' delicate pointillistic responses to it, became an impressive feature of the performance. The bass player counts as a composer for the purposes of this text, even though — for reasons of communicative efficiency alone — most of my examples are taken from conventionally-notated scores. Although no notation was made and no verbal demands were voiced (e.g. 'copy this!'), the glissando made its own musical demands. What was published on the concert hall's website and in the programme does not concern us here. The implications of changing conceptions of the composer-performer relationship for the notion of musicianship are discussed further in 4.2 below. Impett's definition, unlike the one I use here, encompasses 'one-man-bands'; this text takes no account of solitary musicians who make no direct demands of performers, such as solo creators of acousmatic music. Despite my awareness of the long line of thought

[16] John Rink observes that performers influence music's very content: John Rink, 'The Work of the Performer', in *Virtual Works – Actual Things: Essays in Music Ontology*, ed. Paulo de Assis (Leuven: Leuven University Press, 2018, 89-114.) While few performers would disagree, it does not follow that teaching approaches must merge the identities of composer and performer; see Chapters 3-8 below.

[17] Jonathan Impett, 'Dissociation and Interference in Composers' Stories About Music: The Renewal of Musical Discourse,' in *Sound Work: Composition as Critical Technical Practice*, ed. Jonathan Impett. (Leuven: Leuven University Press, 2020).

[18] Paulo de Assis, *Logic of Experimentation: Rethinking Music Performance through Artistic Research* (Leuven: Leuven University Press, 2018).

that has thoroughly undone the work-concept within certain sectors of musicology,[19] I use the terms 'piece' and 'work' here promiscuously in their everyday (and, I think, non-doctrinaire) sense as used by performers, to avoid prolixity and improve readability for readers from outside academe.

An overview

The overall structure of this text is as follows: In Chapter 1 I provide a contextualised overview and brief history of institutional NMPT provision. In Chapter 2 I review the existing resources that are currently used, or that I feel could be productively used, to support such training. I identify a rich provision of materials that relate to the specifics of instrumental techniques, and a comparatively poor supply of musicianship materials, and make some preliminary suggestions about the reasons for this imbalance. In Chapter 3 I look more deeply for the causes of this imbalance within institutions and within NMPT's characteristic pedagogic procedures. In Chapter 4 I look for obstacles to the creation of such materials within new music's characteristic materials (4.1) and gestational processes (4.2). In Part II I attempt to overcome these obstacles. I start by proposing a glossary of terms (Chapter 5) then attempt to bring them into practical application with reference to the musical parameters of pitch (Chapter 6) and rhythm (Chapter 7). Finally, in an Afterword (Chapter 8) I suggest some ways that the approach argued for in Part 1 and developed in Part II might be integrated into NMPT programmes. As well as being a piece of practice research, then, this text is a manifesto in that it argues for a rebalancing of the priorities of NMPT (Part I and Afterword) and is also intended to lay the groundwork for a future textbook-like resource (Part II.)

Gratitude

This project was initially intended to be a simpler, predominantly practical undertaking, and I extend my warmest thanks to my institutional collaborative doctoral award (CDA) partners, who supported me during the project's earlier phase in particular: Thomas Fichter and Peter Veale at Cologne's Ensemble Musikfabrik, and Stephan Meier at the Birmingham Contemporary Music Group. While Covid-19 intervened to make early testing of the teaching model impractical, the enforced isolation of lockdown had the benefit of reminding me how much I still had to learn, giving me some extra time to fill some of the more gaping holes in my knowledge, and making me realise that I could not avoid addressing some of them in this text. The virus may therefore be thanked, or blamed, for this project's metastasis from slender volume of musicianship exercises to its present state.

It is not false modesty to say that every insight that may be found in this text arose from my interactions with others. A conductor learns on the job, and I have been remarkably fortunate in counting among my teachers members of (I say this without hyperbole) some of the foremost cultural treasures of our age: those ensembles and orchestras that have, fearlessly beating against the tide, chosen to specialise in the performance of new music. It is particularly regrettable that, due to the considerations detailed above, I am not able to thank my interviewees by name here. You know who you are, and how much I owe you! Accordingly, the list of people receiving my thanks is much shorter than I would wish it to be. While I have

[19] Since (at least) Lydia Goehr, *The Imaginary Museum of Musical Works: An Essay in the Philosophy of Music* (Oxford, 1994; online edn., Oxford Academic, Nov 1, 2003).

attempted to avoid claiming credit for insights that are not my own, in a text with a very broad scope which attempts to identify and discuss widespread patterns of thought, including unexamined procedures and default positions, some attributions will inevitably have slipped the net. In these cases I offer my apologies in advance, and welcome corrective feedback.

My wise supervisory team at the University of York in the United Kingdom — initially Prof William Brooks, then Dr John Stringer, with valuable additional input from Dr Mark Hutchinson — treated me with far more patience and understanding than I deserved as I disappeared for months on end, periodically re-surfacing to present them with vast chunks of text written in airports, on trains, in quarantine in hotel rooms, in rehearsal halls during breaks and even on occasion during the intervals of my concerts. Thank you. I also received help from Prof Phillippe Kocher at the Zurich University of the Arts, Prof Rainer Polak at the RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, the publishing team at the Associated Board of the Royal Schools of Music, the director, faculty, and students of the Haute école de musique de Genève (Geneva Conservatoire), the members of the NEXT training scheme of the Birmingham Contemporary Music Group, Daniel Spreadbury and Lillie Harris at Dorico, the classicist Eloise Power, and the librarians of the University of York, who kept my postman busy during Covid lockdowns. I thank the many composers and publishers who kindly agreed to allow me to reproduce extracts of their scores; while full acknowledgement is given alongside each extract, here I signal my thanks to Ricordi, Bärenreiter, Boosey & Hawkes, Lucero Print, BabelScores, and in particular Liam Mattison at Faber Music and Ian Mylett at Schott (London) for going the extra mile. I thank my funder, the White Rose College of the Arts & Humanities (WRoCAH), distributing funds from the UK's Arts and Humanities Research Council (AHRC). This project would not have been possible without my cherished friend Prof Martin Suckling at the University of York, whom I tried (and failed) not to use as a 24/7 technical, artistic, and intellectual support line.

Finally, I thank some people outside the world of new music performance: my dear parents, Drs Martin and Natalia Power, who helped untangle some of my knottier sentences, my infinitely-adored partner Claudia Wilton, and my children Orlando and Hartley. This text is dedicated with love to the three last-mentioned. (Boys — that doesn't mean that you have to read it!)

A health warning to the reader

In this long text I sing the praises of a **triage stance** — the strategic prioritisation of a performer's finite attention and energies. NMPT instructors who are already working along the lines that I argue for in Part I (Approaches) may wish to perform an act of self-protective triage and skip straight to Part II (Applications).

Part I

Approaches

Chapter 1: Institutional NMPT and its alternatives

1.1 What does not count as institutional NMPT? Ad hoc approaches to performer training

While institutional NMPT is largely a twenty-first century phenomenon, it would certainly not be true to say that NMPT did not take place during the twentieth century. In most cases such training was given by individuals or very small groups, and did not take place in the context of dedicated 'new music' courses or institutions. There were institutional exceptions. France's Centre Acanthes, from its foundation in 1977, took account of the requirements and contributions of performers alongside those of composers (see 1.2.3 below). In the USA, from the early 1960s, musicians linked to the Association for the Advancement of Creative Musicians developed what George E. Lewis has called 'alternative pedagogies of experimental music'[20] via the Experimental Band; this offered 'cooperative situations where musicians could both learn new ideas and techniques from others, and bring in their own music and hear it performed.'[21] Although the AACM may have been a 'composer-centered' initiative[22] — its members making pedagogical and / or autodidactic use of highly systematising, composition-focused, texts by Joseph Schillinger, Arnold Schoenberg, and Paul Hindemith — this emphasis should be understood in context: since the learning journeys of its members (in contrast to those in most classical music training pathways) developed from their existing performing / improvising practices, the AACM may also be viewed as a pioneer of institutional NMPT. In the course of this text I make reference to other twentieth-century institutional exceptions, including the musicianship-led teaching approach of Pauline Oliveros during the 1970s at the Center for Music Experiment, UC San Diego. When viewed against the background of 'conventional' classical music performer training then and now, such initiatives were clearly exceptional, and some were short-lived. None offered, nor claimed to offer, a synoptic training programme in new music performance comparable to the courses offered by (for example) the International Ensemble Modern Academy, or to the other programmes discussed in 1.2 below. Instead, during the twentieth century, passionate individuals transmitted their arcane skills, some operating like black-ops 'splinter cells' in the shadows of conservatoires and university music departments, others providing contributions at a distance by offering guest masterclasses or short residencies, while others remained institutionally unattached. Word of mouth would lead interested students to these alternative instructors. Even if a conservatoire student devoted all their time to new music, the formal qualification they received almost always remained repertoire-unaligned (a Magister, Diplôme, or PGDip simply in 'Clarinet', for example.) The under-documented pedagogical contributions of their pioneering instructors mostly fall outside the scope of this brief history.[23] However,

[20] George E. Lewis, *A Power Stronger than Itself: the AACM and American Experimental Music* (Chicago and London: University of Chicago Press, 2008), 55. Lewis highlights the contributions of Walter Dyett and Richard Wang, among others.
[21] Ibid., 69.
[22] Ibid.
[23] The documentation of new music in the twentieth century privileged the works and processes of even quite obscure composers over the thinking of prominent performers. Since their careers predated the flourishing of practice research projects, the thoughts and workflows of once-renowned performers (e.g. Ernest Bour, Michael Gielen, the Kontarsky brothers, Stefano Scodanibbio, and many others) remain only in scanty interviews, imperfect recordings, and reminiscences. This has led to frequent re-treading of ground. For example, the experimental tuba player Melvyn Poore passed an endoscope through his tuba in the 1970s, only to be amused when asked to do the same half a century later by the interdisciplinary composer Simon Steen-Andersen (in *Transit*, staged concerto for tuba, ensemble and live-endoscopy, 2021).

in the not-infrequent cases where these individuals were also the authors of manuals on 'extended' instrumental techniques, they return in my discussion of this literature in 2.2.1 below.

This earlier approach to NMPT, in which training is offered according to the priorities of enthusiastic individual instructors in the absence of institutional direction, is still widespread. It is referred to in this text as the ad hoc or curriculum-absent model. It might also be called a composer-led, late twentieth century default, or even a 'no model' model. Impelled at least partly by harsh economic forces,[24] composers had entered tertiary institutions *en masse* long before performers, and had consequently had become heads of new music departments by default. The debates about the worthiness of practice researchers to hold academic positions, which were most heated in the early 2000s and now largely resolved,[25] may be viewed as the direct successors to twentieth century debates about the academic respectability of composers. During the second half of the twentieth century it was often taken for granted that the mere presence of a composer on the staff of a conservatoire or university would suffice to *look after the new music side*.[26]

Such looking-after generally took the form of overseeing the programming of a new music ensemble. The mere existence of a named performing group within an institution, such as the Manson Ensemble at London's Royal Academy of Music, the NYKY Ensemble at Helsinki's Sibelius Academy, or the Webern Ensemble Wien at Vienna's mdw – University of Music and Performing Arts, does not automatically imply that that institution offers institutional NMPT provision in the sense of this text: if it did, almost every conservatoire in the world would qualify for discussion. Indeed, the dominance of a single named new music ensemble, whose membership changes every year with the flux of students and whose identity, like Neurath's ship,[27] only admits of piecemeal, on-the-go, renovation, seems to be a marker of the ad hoc approach. Although such conservatoires have access to wide and deep pools of individual instructor expertise, including many world-class performers, they do not currently possess internal structures dedicated to NMPT analogous to the various *Institute für Neue* (or *Zeitgenössische*) *Musik* within some German conservatoires, nor is there a staff role assigned with the responsibility of ensuring that the skills addressed

[24] The composer Christopher Fox assesses the situation in the UK as follows: 'Many musicians also subsidise their work by teaching and one of the not very well-kept secrets is that the universities and conservatoires have become de facto patrons of new music.' In a 'Faustian pact', institutions thus 'bought the souls of several generations of artists.' Christopher Fox, 'Music for a Dis-Uniting Kingdom?', *Journal of Music*, June 22, 2015, accessed Jul 5, 2024, https://journalofmusic.com/opinion/music-dis-uniting-kingdom.

[25] Borgdorff, *Conflict*.

[26] This quote is a composite of my memories of interactions with holders of senior conservatoire positions in the UK in the early 2000s, and my interviewees' memories of their training in the last two decades of the twentieth century. Although I treat the ad hoc model here as a default starting point for NMPT, with a wider historical perspective it may be viewed as an aberration of the second half of the twentieth century. The 'creative performer' notion is not a recent invention. Earlier teachers often combined the roles of performer- and composition-instruction: Orlando Morgan (1865-1956), for example, was a Professor of Pianoforte and Composition at London's Guildhall School of Music for fully 64 years (1887-1951), during which time he taught Fred Astaire composition and attempted to dissuade Noël Coward from writing parallel fifths. In this text I try to avoid erecting straw men such as 'traditional teaching approaches' — David Dolan has encouraged us to ask what tradition really means, and how old it really is — but may not have always succeeded. See David Dolan, Henrik J. Jensen, Pedro Mediano, Miguel Molina-Solana, Hardik Rajpal, Fernando Rosas, and John Sloboda, 'The Improvisational State of Mind: A Multidisciplinary Study of an Improvisatory Approach to Classical Music Repertoire Performance,' *Frontiers in Psychology* 9, no. 1341 (2018), 2.

[27] 'We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom. Where a beam is taken away a new one must at once be put there, and for this the rest of the ship is used as support. In this way, by using the old beams and driftwood the ship can be shaped entirely anew, but only by gradual reconstruction.' Otto Neurath, 'Anti-Spengler,' in *Empiricism and Sociology* (Boston: Riedel, 1973), 199.

in Part II of this text are taught. In their ad hoc model, organised NMPT arises and disappears in accordance with the alignments of the performing calendar, and therefore is subject to the caprice of external forces: the decisions of promoters and directors of festivals, composers' anniversaries, the availability of project funding, and so on. Students at London's Royal College of Music in 2006 received extensive training from members of the London Sinfonietta on Helmut Lachenmann's instrumental techniques because that composer happened to be visiting: after Lachenmann's departure, such training lapsed. Similarly, the coaching on the techniques and sound-world of Gérard Grisey that students at the Royal Academy of Music received in 2008 to prepare them for an external professional performance of *Les espaces acoustiques* (promoted by the South Bank Centre) did not arise from a pedagogical initiative within the conservatoire, and, unsurprisingly, had no obvious lasting impact.[28] In the rueful words of an (interviewed) senior figure in one such conservatoire, contrasting their institution with a more developed NMPT model in an institution in continental Europe, 'Well, in the UK we make it up as we go along.'

The absence of a dedicated new music performance programme does not necessarily imply that an individual trainee will receive inadequate training, however, nor is its presence a guarantee of good practice. I have encountered trainees who felt they had had excellent experiences with well-matched instructors in UK conservatoires (or who had at least been present when an interesting project had happened to coincide with their period of study), and also graduates of specialised Master's programmes in Germany who expressed discontentment. The ad hoc model is characterised by arbitrariness and lack of accountability, by islands of excellence amid swamps of neglect. There seems to be little correlation between the prestige of the institution (as measured by conservatoire ranking tables, for example) and the intensity or perceived quality of organised NMPT provision. My interviewees reported that in some institutions the supervising composers were seen as possessing significant practical competence and the willingness to invest energy into performer training, while in others, they were unable to make an impact among training performers. In some cases, interviewees felt that this was due to the composers' own lack of practical skills, while others cited resistance from performance departments, which were reported to use their influence over timetabling and venue-booking (major levers of power in a conservatoire) to sideline new music projects. An interviewed member of a European new music ensemble characterised the status of NMPT in composer-led new music departments as 'a bit like the Wild West', adding that their advice to prospective performer trainees was to 'pay no attention to [the institution's] reputation or what they put on their website' (they were particularly impatient with 'meaningless' institutional statements about 'commitment to new music') and to 'choose very carefully' by attempting to discover by direct enquiry what tuition was actually being offered and by whom. One British performer I interviewed — a veteran of multiple new music performance projects and a UK conservatoire professor — found even the notion of a NMPT curriculum a novel and surprising idea. They noted that while their students 'pick up some useful bits and pieces' relevant to new music performance — learning to decode some notational features (they cited bridge clefs and microtonal accidentals) and practising some 'extended' techniques (overpressure, circular bowing) — in their experience no-one had ever proposed that these might cohere into or form part of a wider skillset, nor that

[28] The recent (June 2023) appointment of the singer and conductor Barbara Hannigan as Reinbert de Leeuw Professor of Music at the RAM, with responsibility for overseeing and directing student ensembles, may help to update the model of NMPT within that institution, although it is only a visiting role.

such a skillset might be relevant to trainees across instrumental families, nor that someone in the conservatoire might have overall responsibility for ensuring the transmission of such a skillset. As they put it, 'It's as it comes up, really,' adding bluntly that they '[couldn't] think of many composers who would be up to teaching all that.' When asked for clarification, they confirmed, 'yes — *up to*, not *up for!*'

Composer-led NMPT can be found in tertiary institutions worldwide, seemingly dominating in South Korea, the USA (although not exclusively), and the United Kingdom. Because it is marked by the absence of a responsible overseeing figure, the syndrome can be difficult to diagnose. It may be masked when an institution invites a well-known specialist performer to visit for masterclasses and the like; such encounters are often well-publicised but brief. Within UK institutions, there exist exceptions where in-house performers and performer-researchers have a greater voice, including the Universities of Huddersfield and York, and the Goldsmiths and City constituent institutions of the University of London. Due to their research focus, publications from these institutions are relatively well represented in the published discourse. However, not all of these offer dedicated NMPT programmes, and the number of students that do receive such training in these institutions (in courses such as those led by the violinist and researcher Mira Benjamin at Goldsmiths, for example) is very small compared to the throughput of conservatoire programmes, which document their practice much more sparsely. The pianist and scholar Ian Pace has argued that higher education music departments in the UK are caught between two conflicting frameworks of excellence: research success (as measured by the Research Excellence Framework), and reputational success within the performing profession (as measured by commissions from performing groups, repeat performances, and recordings).[29] These metrics do not move in lockstep with each other, and indeed may interact inversely.[30] As a result, institutional heads and appointment panels have a difficult task when selecting composers to lead new music departments, since it is not clear which metric of excellence they should prioritise, even before other factors, including (currently burning) concerns about diversity and representation, are considered. An assessment of a candidate composer's competence to oversee the training of performers may consequently be only an incidental consideration — if it is considered at all. Nor are adequate metrics available to appointment panels to assist in making such a judgment. For example, it would be regarded as an absurdity or even an affront to attempt directly to test the pitch and rhythm skills of candidates for such a post. There are good reasons for this reluctance in some cases. These skills may only be of tangential relevance to certain ways of being a composer, such as the production of acousmatic music and sound art, composition as performance art, conceptual art, or institutional critique. Such a test, if it were rigidly conceived, would tend to exclude composers who espouse these practices,

[29] Ian Pace, 'Academic Music in the United Kingdom and the Dalliance with Practice,' (lecture, Faculty of Music, Oxford University, Oxford, April 25, 2023.) E-text accessed Feb 3, 2024, https://openaccess.city.ac.uk/id/eprint/30326/?fbclid=IwAR1vFo55Mnt0vvhusxWdJPtooaqn3X3kMLVnB04MRK7UoOrBdpYlOO0KcM.

[30] While it would be highly unusual for an academically-attached composer to turn down an opportunity for an external performance, reciprocal respect for success within tertiary institutions is not always present. In the words of one institutionally-unattached composer who receives relatively frequent performances and has been the artistic director of several festivals, 'success to me means not having to take on an academic job.' In my professional interactions, I have often found it striking that figures perceived to be of high status in each field are not always familiar with the work, or even the existence, of their counterparts, and so are at risk of talking past each other.

instead risking the hiring of a succession of competent but dull Kapellmeister-like clones.[31] A less good reason for abandoning such attempts at assessment is a tacit denotation of skills of pitch and rhythm as lowly or elementary, and the consequent, incorrect, assumption that such matters will have been covered somehow in a previous search process (prospective Lucasian Professors of Mathematics do not sit an arithmetic test). Part II of this text, in which I repeatedly put the opposition of 'basic' and 'advanced' training in relation to pitch and rhythm into question, may be read in its entirety as a counterargument to any assumption that such skills are comparable to simple arithmetic.

Where a tertiary institution contains a sufficient number of interested students but ducks responsibility for oversight of NMPT, a skills vacuum is created which is filled by roles that emerge and disappear on an ad hoc basis. An example of such an ephemeral role is the institutional figure of the accidental composer-conductor — the composer (sometimes a member of staff, or even a student) who fell into conducting student ensembles due to the lack of appropriate professional support. Until quite recently this 'gentleman amateur' conception of the institutional new music conductor was common — the outdated and gendered language being all too appropriate here, even bearing notable exceptions such as Odaline de la Martinez, Véronique Lacroix, and Lorraine Vaillancourt in mind.[32] It contributed to a widespread misunderstanding that I still sometimes encounter among training composers: that the purpose of a conductor in new music is merely to coordinate musical verticalities — a reduced role that orchestral musicians in the UK sometimes refer to as a *traffic cop*. While most conservatoires have addressed this problem by engaging professional conductors for their student ensembles, it is still almost invariably the case that the budgets and prominence allotted to symphonic projects are significantly greater than those for new music programmes.

Despite reports of individual instances where ad hoc approaches were perceived positively, my interviewees broadly agreed that composers should not be burdened by default with responsibility for a role that in most cases they never sought, one for which their aptitude has rarely been assessed, and one for which they lack (in many cases) the skills and training to perform with confidence. Given their own standpoints as performers, it is unsurprising that my interviewees generally favoured performers having greater institutional responsibility for curriculum-setting in NMPT. This should not be taken as evidence for a tussle for control; in my experience, composers are generally delighted to have the responsibility for ensuring performing excellence taken off their hands, and strongly welcome the contributions of committed performers. Accordingly, the ad hoc model is in decline, and is even functionally extinct in some regions (the 'NMPT heartland' of 1.2.2 below.)

[31] See John Butt, 'Should there be a twenty-first century "Complete Kapellmeister"? The skills, content and purpose of a university music degree', in *Higher Education in Music in the Twenty-First Century*, ed. Björn Heile, Eva Moreda Rodríguez, and Jane Stanley (Abingdon and New York: Routledge, 2018), 11-12.

[32] I have inadvertently contributed to this imbalance. During my period of study at London's Royal College of Music (2004-2006) I (a hapless student) conducted several concerts with that institution's official New Perspectives Ensemble. In the same period stellar guest conductors including Bernard Haitink conducted programmes with the RCM Symphony Orchestra; it would have been unthinkable to permit a student to conduct a symphonic programme. While this was advantageous to me personally, it was perhaps less so for the students whom I conducted, who might have reasonably expected to work with a more experienced conductor.

What should replace it is currently the subject of debate, and the terminology of this relatively new field is accordingly unresolved. Where institutions have taken a positive decision to provide NMPT, the real responsibilities and practices of course leaders can rarely be guessed from their job titles: a 'Professur Interpretation Neue Musik' might be a conductor who spends their time leading ensembles in a workflow that resembles a traditional orchestral training pathway, or might be an experimental vocalist who combines the realisation of scores for voice with improvisation workshops. There is no international harmonisation of terminology whatsoever. Within institutions, debates about course content and approach are generally of high sensitivity, since they directly relate to the appointment and deployment of individuals. Consequently, they take place mostly in private. This text is a rare public contribution to this field, offered with the hope of providing tools for institutions to develop their own notions about the structure and content of a NMPT programme, rather than heaping responsibility for both conceptual structuring and provision onto a single hired individual. This would not be seen as desirable or even possible in other faculties with longer-established training models (3.1, 3.2). Before offering my own tools, I attempt an overview of how some institutions have sought to replace the ad hoc model with targeted training.

1.2 Beyond the ad hoc model: a brief history of institutional NMPT

1.2.1 Locations, geographic and social: where should a NMPT programme start from, and where should it go?

The majority of institutions which have engaged intensively with NMPT as a distinct field are located in continental Europe; accordingly, the direction of travel of NMP trainees in the first two decades of this century, and of many of their instructors before them, has been overwhelmingly towards that region, and away from the Americas, Asia, Australia, the UK, the post-Soviet states, and (pre-2022) Russia. Consequently, this narrative is not only Eurocentric but centred to a remarkable degree on the snowy-white region of the Alps and their northern basin. It is an uneasy thought that much of the institutional NMPT I will describe, in its tendency to value refinement and control and an attendant whiff of connoisseurship, might itself resemble a precious and delicate Alpine flower — perhaps a descendant of one collected by Webern on one of his botanical expeditions. In recent years there have been tentative signs that more countries are becoming involved in NMPT and that more students are being offered access to it. However, in some countries, including the UK, acute funding pressures have led to a narrowing of access. There is a long way to go before the discipline may be considered as having been successfully brought down from the mountains and established internationally as a flourishing practice.

Viewed in broad social terms, the set of musical practices discussed here is a niche of a niche in some cultural contexts and entirely absent in others.[33] Even the new music performance hotspots of Donaueschingen, Witten, Darmstadt, and Huddersfield — their admirable qualities notwithstanding —

[33] In the UK it has fallen off the cultural radar even of the 'chattering classes' to the extent that not a single composer nor ensemble referred to in this text is commonly invoked in non-specialised cultural discussions. A similar picture is noticeable in other countries; a veteran concert-goer in Paris in 2006 complained to me in an ironic tone that 'in the old days' — we had been discussing the Boulez-programmed *Domaine musical* concert series of 1954-1973, which she had avidly attended — 'if someone hadn't heard of a composer, they would at least *pretend* that they had — now they don't see why they should bother!'

could hardly be described as anywhere's mainstream. The relative confidence of new music discourse in the twentieth century (although frequently embattled and tribal) has been replaced in the twenty-first by a widespread sense of uncertainty and precarity in which the continued existence of even some large institutions could not be taken for granted.[34] The Covid-19 pandemic accelerated, but was not the cause of, this uneasy ambience. Even though to train performers in a specific repertoire is implicitly to champion it, most participants in the new music space with whom I have discussed these matters recognise the picture of a broad diminution of cultural and social authority, and that any marking-off of their repertoire as intrinsically more advanced than other musics has mostly disappeared. The specialised skills that NMP trainees will acquire will likely be regarded as hierarchically equivalent to other performing skillsets. Accordingly, the term 'advanced' and its cognates are noticeably on the retreat in the naming of NMPT courses.

In this new environment, fundamental categories and their expected functions and responsibilities (including *composer* and *interpreter*) have been subject to multiple re-evaluations. (Many individuals made comparable re-evaluations during the twentieth century, of course, but with much less impact on institutional discourse.) Pierre Boulez, speaking in 2012 but remaining a prototypically twentieth-century figure, declared with sublime blandness that the mission of the Lucerne Festival Academy was simply to prepare training performers to meet 'the demands of the music.'[35] 'The' music (not 'my' music, or 'music by composers I admire') made its demands, which self-evidently merited fulfilment. The statement struck me as incomplete at the time; today it would be inconceivable for any leader of a NMPT programme to phrase its goals in such straightforward terms. A new honesty about the artform's precarity is not only detectable in its conditions of production — plenty of composers in the twentieth century had endured personally precarious existences while producing glossily modernist scores demanding exotic percussion setups and lavish use of hi-tech equipment — but increasingly within its outputs. This change has profound implications for the future direction of performer pedagogy. When Boulez characterised the LFA's mission, he was not courting controversy but simply giving voice to the uncontroversial-seeming assumption that a performing student's goal was strive for personal mastery: over their instrument and over the work to be performed. This assumption followed from a wider one about the default relationship between composers and performers — a status quo vividly evoked by the performer and researcher Jennifer Torrence:

[34] In Autumn 2022, Arts Council England cut its funding of London Sinfonietta, Psappha, and the Britten Sinfonia by 41%, 100%, and 100% respectively, while the Sound and Music contemporary music charity lost 30% of its grant. Despite a claimed re-direction of funds towards education, few people connected to new music saw these cuts as anything other than disastrous for the future of new music performance or education in the UK. At the time of writing (October 2023) the future of the 75-year-old Dartington Summer School and Festival — an organisation that offered professional NMPT alongside amateur music-making — appeared uncertain, its leadership team having resigned citing an unsustainable financial situation. The Cheltenham Music Festival, which had commissioned numerous new works since its foundation in 1945, also did not seem likely to continue in its current form.

[35] Pre-concert talk, KKL Lucerne, Switzerland, August 29, 2012. In public, Boulez often couched the composer-performer relationship in ironclad bureaucratic terms, making extensive use of the French third person singular impersonal *il faut*. This imperviousness was not permanent, however, and in private he could be generous in his acknowledgement of how much he had learnt from other performers, and was rarely doctrinaire on matters of interpretation. He also was at pains to point out [personal communication, August 22, 2014] that if he had been at times 'trop exigeant' (too demanding) in his demands on performers, they were nothing compared to his own demands on himself, as Boulez the composer to Boulez the conductor.

I describe it as a very long staircase where the composer works at the top and the performer waits at the bottom. First the composer goes up that staircase to be alone at a writing desk for quite sometime. Then, they descend those stairs (with their hands shaking a little bit from excitement and fear) and give the interpreter the sacred object of the score. The interpreter promptly runs home to practice alone until 'perfection' is sonified.[36]

If, in the development of new performing practices, the linked notions of perfection and mastery themselves are put into question — particularly in an artform that makes heavy use of the latter term in its pedagogical discourse (*masterclass*, *maestra/maestro*, *Master's degree*) — the expected journey of the trainee is less clear, as is the proper role of the instructor.

The 2022 edition of the Eclat new music festival in Stuttgart caught, and helped to set, this mood by presenting the creative initiative Performing Precarity. In its curators' words, this was 'a project about precariousness as a principle of form, and about relinquishing control over the musical situation' that arose from 'a tendency in the arts to bring the notion of mastery into question.'[37] Among its outputs was a performance that I found particularly moving: *UTFLUKT* for two performers and animation film (2021/22), a co-creative project uniting the composer Carola Bauckholt, the animator Elizabeth Hobbs, and the performers Jennifer Torrence and Ellen Ugelvik. I will not attempt to describe this performance, other than to note that it unfolded with care, intimacy, and sensitivity. It exceeded its brief in that it not only put mastery into question, but seemed to enact its own answers to that question, since while its subject matter embraced fragility, tenuity, uncertainty and liminality, all participants were — in my estimation — working at an artistic level that was exhilaratingly high. Consequently, they conveyed an overall impression of assurance, security, and expertise; indeed, I felt that I had attended a masterclass. Despite its superficially undemonstrative quality, the performance reminded me of a term favoured by Derrida — *solliciter*, which combines the meanings 'to seek to inquire' and 'to shake the foundations of.'[38] In that moment, the worth of continuing to plough a large field of musical endeavour — what might be called the virtuoso avant-garde extended-modernist tradition, with its characteristically extreme and athletic gestural vocabulary and its do-si-do (from *dos-á-dos*: 'back to back') dance between demanding composer and supplying/suppliant performer — seemed to tremble. Since I was professionally trained within that world, and since my income depends on a hazy reputation for successfully negotiating (or mastering) such challenges — of the type very much in evidence in the concert I was due to give directly after this performance — I found this disconcerting. At the same time, some new model of mastery seemed to be unfolding, for no serious observer of *UTFLUKT* could describe the performance as incompetent or lacking in substance. This was comforting.

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[36] Jennifer Torrence, 'Rethinking the Performer: Towards a Devising Performance Practice' (multimedia research exposition), *VIS - Nordic Journal for Artistic Research*, 0 (2018), n.p., https://www.researchcatalogue.net/view/391025/391476/25/26.

[37] 'Performing Precarity,' *Eclat*, Theaterhaus Stuttgart, Feb 03, 2022, accessed Jun 20, 2024, https://www.eclat.org/konzert/performing-precarity-i/.

[38] Geoffrey Bennington writes: '"Solliciter" is something of a signature term of Derrida's, and, as the recently-published 1964-5 seminar on Heidegger confirms, is closely related to the thought of deconstruction itself. [...] Derrida himself regularly glosses [it] as a shaking movement (*citare*) of the whole (*sollus*).' Geoffrey Bennington, 'Embarrassing Ourselves,' *Los Angeles Review of Books*, Mar 20, 2016. Bennington notes that the term has also been translated (by Gayatri Chakravorty Spivak, in editions of Derrida's *Of Grammatology* dating from 1976, 1997, and 2016) as 'to put a strain on', 'solicit', 'destroy', 'undo', 'shake up', and 'to be interested in'(!), as well as seen an attempt to capture Heidegger's term *Destruktion*.

While the *UTFLUKT* project seemed to embody the spirit of experimental new music in the early 2020s to a particularly notable degree (and, although its creators may find this an awkward comparison, it felt as 'cutting edge' as I imagine some Darmstadt concerts may have felt in the late 1950s), it may also be seen as a bellwether for a large sector of current activity in this space. From the perspective of the audience, the most obvious features of this sector are that most of its outputs are interdisciplinary, commonly incorporating visual elements and stagework. In these projects it is uncommon to encounter musicians in formal concert dress seated behind music stands and led by a conductor. From the performers' perspective, a more fundamental feature of these projects is that they typically come into being via a more nuanced, or 'problematised,' relationship of composer and performer than the one evoked in Torrence's staircase model. While it is easy to find counter-examples and cite evidence for collaborative practices from at least a thousand years of music history, I agree that Torrence's staircase does indeed describe the default way that composer-performer interactions have been assumed, and still are assumed, to take place, even if in reality they play out in multiple ways. I also think that this assumption underlies the default professional stance of the performer, and, consequently, the basic direction of most professional training. In this text I use the term 'Parnassian' as shorthand for a way of thinking that places the composer — defined here as one who makes musical demands of performers, no matter how these demands may be transmitted — infallibly at the peak of Mount Parnassus, fully-conceived sounds or gestures in mind, looking down on their performers as they attempt with arduous toil to master the summit and reach the ecstatic and BDSM-like moment of union with the composer, 'in whose service is perfect freedom.'[39] This is obviously a caricature; I have never met anyone who thinks in this strictly binary way. However, since Torrence's staircase simile echoes criticisms found in several other assessments of the business-as-usual performance practices of classical music *sensu latissimo*, including influential texts by Christopher Small (*Musicking: The Meanings of Performing and Listening*) and Daniel Leech-Wilkinson (*Challenging Performance: Classical Music Performance Norms and How to Escape Them*),[40] the term 'Parnassian' can stand as a useful conceptual marker: as an end-point from which locations on the spectrum of real practices may be measured. Furthermore, even if individuals do not think in this way, many institutions act as if they do (3.1, 3.2.) The ad hoc NMPT approach, in that it prepares trainees for a future of shuttling between an undirected and uncurated succession of compositional demands, strongly favours Parnassian thinking among trainees and instructors alike. Although it is easy to mock this way of thinking for its seeming naivety, it is much less straightforward to describe where our pedagogical steps should be leading (*gradus ad...?*) in the absence of a visible summit or even a confident sense of what counts as up and what down.

The success of *UTFLUKT*, alongside that of comparable rehearsal processes and performances that I have witnessed or participated in, gave me renewed confidence that it might indeed be possible to have my cake

[39] Morning Prayer, The Second Collect, from *The Book of Common Prayer* (1662). Thomas Cranmer adapted it from the Latin *cui servire regnare est* ('whom to serve is to reign'), attributed to St. Augustine. A marker of Parnassian thinking among performers is the commonly-heard polite formulation: *they* [a composer] *know what they want to hear*. In dry British English usage, this can imply that the performer admires the composer's communicative skills and decisiveness (i.e. their ability to erect clear musical targets) but may be agnostic at best about the value of the results.

[40] Christopher Small, *Musicking: The Meanings of Performing and Listening* (Hanover and London: Wesleyan University Press, 1998); Daniel Leech-Wilkinson, *Challenging Performance: Classical Music Performance Norms and How to Escape Them* (ebook, version 2.04, 2020), accessed Feb 4, 2022, https://challengingperformance.com/the-book/.

and eat it too. A sublated[41] sense of mastery might be a worthy goal for a NMPT course to strive towards: one that embraced the cherishing within sensitive trainees of modes of fragility and even might welcome the local loss of performative control in some contexts, but was not so thoroughly in thrall to these currently-fashionable preoccupations that it excluded conveying other possible modes of performance, whether of older musics or music yet to exist. After all, the aesthetic ecosystem from which *UTFLUKT*-like projects arise is by no means the only one to exist or thrive at present. Despite their relative underrepresentation in the academic literature, working practices in which composers set narrowly defined and sometimes extreme challenges to their performers, conveyed via conventional musical notation, continue to be widespread and active. Only a very rash observer would dismiss ambitious works such as Francesca Verunelli's *Tune and retune II* for orchestra (2020), Unsuk Chin's *Alaraph: Ritual of the Heartbeats* for orchestra (2023), or Enno Poppe's *Prozession* for large ensemble (2015/20), as encoding outmoded practices.[42] (Nor would any knowledgeable participant describe any of these highly practical composers as embodying naively Parnassian attitudes.) We should also resist any assumption that more obviously experimental practices represent an intrinsically newer way of working, since they have their own long histories: one possible line could be drawn from John Cage through Cornelius Cardew, Howard Skempton, and Laurence Crane; many others exist. Performers can and do move between both worlds, and notice the fact. Torrence herself points to a 'vital ambivalence' between the "'quick now" crisis energy' of live creativity that she loves — a performing mode that embraces risk and uncertainty, and deprioritises the control over materials conventionally associated with mastery — and her rigorous process of preparation and memorisation, noting that

> I still want to deliver brilliant performances shaped with care and precision. And I still want to go on stage with a clear musical or performative idea and every intention of delivering it.[43]

A comparable carefully-calibrated tension lies within Jennifer Walshe's much-discussed term *The New Discipline*,[44] which seems at once to be a discipline in the humanities-adjacent sense, and also in a physically strict, almost monastic, sense, and therefore carrying a strong whiff of the conservatoire practice room and dutiful scales-and-arpeggios work.[45] As for the term *mastery* itself, it would seem highly desirable to retire it

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[41] Sublated: a key term of Hegel's, as *aufgehoben*, from *Aufhebung* (sublation). The term combines the senses of a notion being simultaneously cancelled and preserved in a transcended form.

[42] Although some have done exactly that. According to the composer François Sarhan, 'le compositeur n'existe plus. Sauf quelques ringards à foulard et mèche.' ('Composers don't exist any more. Except for a few lame-os with scarfs and quiffs.') In his more charitable moments Sarhan allows that a composer may be permitted to exist within a collaboration, 'comme mal necessaire' ('as a necessary evil'). François Sarhan, interview with Clément Lebrun, Jul 10, 2017, accessed Jun 20, 2023, http://www.cdmc.asso.fr/fr/ressources/compositeurs/entretiens-filmes/compositeur-oeuvre-francois-sarhan.

[43] Jennifer Torrence, 'Quick Now-', *Oblivia*, May 7, 2021, accessed Jul 2, 2023, https://oblivia.fi/quick-now-2/.

[44] Jennifer Walshe, *The New Discipline*, https://www.borealisfestival.no/2016/the-new-discipline-4/, accessed Feb 1, 2020; Monika Voithofer, "'That it's not too late for us to have bodies": notes on extended performance practices in contemporary music', *Music & Practice*, vol. 6, Performative Compositional Practice (Online, 2019), accessed 10 Dec, 2023; Ed Cooper, 'Jennifer's Jokes: Contextualising "The New Discipline"' *Positionen – Texte zur aktuellen Musik*, 138 (Online, n.d.), accessed 30 Dec, 2023, https://www.positionen.berlin/post/charm-offensive-jennifers-jokes.

[45] Music, perhaps thanks to its exceptionally weighty legacy of detailed expertise, is as usual playing catch-up to other performing arts here: a generation of whole-body performance artists including Tehching Hsieh (b. 1950) and Marina Abramović (b. 1946) laid the ground for these approaches in the 1970s. Comparably, John Cage, talking about *4'33"* (1952), admitted that 'what pushed me into it was not guts but the example of Robert Rauschenberg. His white paintings […] When I saw those, I said, "Oh yes, I must. Otherwise I'm lagging, otherwise music is lagging."' Richard Kostelanetz, *Conversing with Cage* (New York: Routledge, 2004), 71.

along with its vile associations, of which sexism is not even the worst — since the counterpart of a master might be an apprentice, but also a slave. However, a curated NMPT programme must aim to inculcate some broader principles, since it is this curated coherence that separates it from the ad hoc approach. In addition, in cases where such training takes place within higher education institutions, its content needs to be potentially assessable.

Tussles between sets of fundamental values and priorities have long played out within composition-teaching circles, but are relatively new considerations for training performers. Within conservatoires and indeed the wider profession it is still usually taken for granted that the task of performance instructors is to help their students eat and thoroughly digest whatever composers place on their plate, whether the dish of the day is the output of Ruth Crawford, Maryanne Amacher, Claudia Molitor, or Liza Lim — to name four composers whose works might potentially appear in a NMPT course, and whose approaches are quite different from each other. The composer's preferred working method may be hands-on or hands-off, their wishes conveyed via detailed conventional notation, hybrid scores (e.g. including audio or video links), structured improvisation, or even transmitted orally (as in the cases of some compositions by Éliane Radigue and Wojtek Blecharz), but as long as that composer is still alive and capable of breathing down performers' necks, it is almost always the composer that establishes the rules of the interactional game — to the extent that in some circles such rule-setting is seen as the very definition of a composer. Our training and professional practice as performers generally (and with many exceptions in mind) primes us to take a more passive role and resist fundamental decision-making. I suspect that this acquired submissive behaviour partially explains the relative absence of explicit curricula and governing concepts in NMPT programmes.

Given the altered place of new music in wider society as compared to its place during the post-war period, it is impossible to conceive a newly-formed NMPT course's approach proceeding along straightforward and unexamined technical lines as a linear progression towards the mastery of content, even if it were to be continually updated to reflect changing compositional practice in an endless addition of 'advanced' modules comprised of new compositions, novel instrumental techniques and technological encounters, new notational features, ever-more irrational tuplets, non-isochronous meters, and elusive microtones, and so on. One interviewee characterised the strongly technical emphasis of their training as 'a whole lot of tuplet-bashing', and although there was some pride in their tone, there was also a clear acknowledgement that this had been a overly narrow approach. At the same time, to discard such technical content in favour of the creation of an open playground with an exclusive emphasis on the development of new performing practices or collaborative models comes with obvious downsides: not only the risk of de-skilling for the individual trainee but a risk of abandoning a duty of care to the wider artform, in that such an approach abandons curatorial responsibility for the 'old new music' as well as much of the 'new new'. It is certainly unhelpful to view the advent of newer working models in terms of a Whiggish progression narrative towards enlightenment. It may even be considered unethical to produce adventurous, open-minded, but technically de-skilled trainees who are less able to compete for a dwindling pool of performance opportunities, since, in the real world, alumni of NMPT programmes do not have the luxury to pick and choose their projects entirely freely unless they enjoy significant external financial support.

This tension is evident in the overview of practice that follows, in which two broad notions of what a NMPT course should be doing may be distinguished. One is evolutionary: it follows a Boulez-like line, retaining the broad structure of a classical music training model while substituting newer repertoire, musical procedures, and techniques. We might designate the early years of the Lucerne Festival Academy as its holotype. The other is revolutionary: its proponents tend to group modernist repertoire with older classical musics, both being deprioritised in favour of the development of experimental performing practices. As a holotype for this approach we could name the current course at the FHNW–Hochschule für Musik Basel. Courses following the former approach tend to train in larger formations (new music ensembles, conducted or otherwise) and retain a clear distinction between the roles of composer and performer, while those following the latter favour projects with fewer members in which these roles are more fluidly conceived. The former approach principally makes use of the vocabulary of *training* while the latter uses the language of *research*. The largest and most active courses, including Frankfurt's IEMA and the PPCM in Graz, attempt to include aspects of both approaches. Wherever a particular course falls on this spectrum, however, the specialisation that enrolment in any NMPT programme confers tends to be professionally decisive. One IEMA graduate, their tone hovering between regret and pride, told me 'I can't really go back and play Brahms any more.' In Part II I suggest some musicianship-focused ways to help heal this perceived rupture.

Appendix B lists 45 NMPT programmes active at the time of its compilation (2023). These include specialised conservatoire courses, residential academies, and side-by-side apprenticeship schemes.[46] Since the period of study they offer ranges from a few days to two-year Master's programmes, it might appear misleading to list them together. My experience indicates otherwise. In performance education, brief epiphanic encounters may be as decisive as long periods of study: variations on the phrase 'I learned more from *x* in an hour than two years of *y*' are commonplace among musicians. Consequently, there seems little value in making much of the distinction. The same may be said about whether a course is accredited or not. There exist several processes intended to harmonise the international recognition of accredited courses,[47] and from a tertiary institution's point of view there is a stark distinction between courses that participate in such processes and those that do not. From the point of view of my interviewees, on the other hand, such formal recognition is generally an incidental consideration, since the gaining of such credits has few direct implications for their employability as performers. NMP trainees are likely to favour institutions such as the Lucerne Festival Academy or the Darmstädter Ferienkurse, even though they offer no ECTS credits, over less professionally prestigious but accredited courses. Accreditation does, of course, have profound implications for trainees who later change or diversify their career path.

[46] A clarification for Anglophone monoglots: the German term *Hochschule* and the French *haute école* do not translate as 'high school' but rather 'conservatoire'. Confusingly, *conservatoire* / *conservatorio,* etc. in many European languages also denote places where young children take music lessons, and accordingly some conservatoires have rebranded in the past few years as universities: the Vienna Conservatoire is now the mdw - University of Music and Performing Arts Vienna. In this text *conservatoire* is used in the usual English sense as a tertiary education provider specialising in music performance (e.g. the Guildhall School of Music & Drama, London, or the Sibelius Academy, Helsinki.)

[47] These include the Bologna Process, the Lisbon Recognition Convention, the Benelux Decision, and their intended successor by 2025, the European Education Area. Their mechanisms include the European Qualifications Framework (EQF) and the European Credit Transfer and Accumulation System (ECTS).

Due to the Covid-19 pandemic, the past four years have been highly abnormal, with all providers forced either to cancel, postpone, or heavily adapt their offerings. In its aftermath, the overall picture is still one of widespread institutional flux. As I write in 2024, some programmes are facing an uncertain future. Many are reviewing their models, while new ones, such as Juliet Fraser's multi-institution VOICEBOX programme, are springing up. The list is therefore a blurred snapshot of a moving target, and I will certainly have overlooked many contributions. (It is, however, more comprehensive than the list offered by the (IRCAM-hosted, EU-funded) Ulysses Network website, the only publicly available directory of such programmes.)[48] Consequently, what follows is not dispassionate history but some early notes from the field, offered due to the scantiness of documentation elsewhere.

1.2.2 The NMPT heartland

Institutional NMPT began in earnest in 2003 with the foundation of the Lucerne Festival Academy (LFA) and the International Ensemble Modern Academy (IEMA). Both were attempts to leverage the expertise of well-established European new music ensembles. As originally conceived, the LFA would be the training academy of Ensemble Intercontemporain (EIC), and the IEMA that of Ensemble Modern (EM). Notably, both initiatives arose outside tertiary institutions. The trainees were generally students on postgraduate conservatoire programmes or early-career professionals, the scheduling permitting some — in particular, long-haul participants from Asia and the Americas — to attend both programmes. In Lucerne, trainees and instructors bathed in the sparkling Vierwaldstättersee between rehearsals at the KKL concert hall, while IEMA's partnership with the Klangspuren festival in Schwaz offered hiking opportunities in Austria's Inn Valley; the opportunity for instructors to escape summers in Paris or Frankfurt was not irrelevant to the choice of venues.

These two pioneering institutions differed in model and ethos, however. The LFA, being affiliated with a prestigious performance festival, emphasised the presentation of whole concerts. Trainees played side-by-side with EIC members, most often in large-ensemble and orchestral repertoire, and received sectional coaching in a model that resembled North American orchestral academies such as Tanglewood and Aspen. The IEMA, while also producing public concerts and at times collaborating with the Ensemble Modern Orchestra, was initially more intimate and experimental in character, favouring small-ensemble work and workshops targeted at the acquisition of transferable skills. While the students of early editions of the LFA mostly sat behind music stands in a concert hall, performing conducted works by Boulez-approved composers including Philippe Manoury, Wolfgang Rihm, and Marc-André Dalbavie, the IEMA's early repertoire included works by John Cage, Mauricio Kagel, and unusual projects such as Benedict Mason's *felt | ebb | thus | brink| here | array | telling* (2001), in which participants processed through a disused locomotive factory in Bolzano playing kutu-wapas, pyrophones, and hurdy-gurdies, playing mostly from memory and orientated by multiple simultaneous clicktracks. This difference reflected the founding conditions of each institution, which might be caricatured as monarchic versus democratic. The IEMA had no single founder; the LFA, however, was the result of an individual's cultural influence. As the last of a

[48] 'Ulysses Platform,' *Ulysses Network*, n.d., accessed Jul 6, 2024, https://www.ulysses-network.eu.

succession of institutions founded by Boulez,[49] its early editions strongly bore his imprint, both in their working methods and choice of repertoire. However, the working culture of the LFA in its first decade was far from being as theocratically centred on the figure of Boulez as was the IRCAM of the 1980s.[50]

The IEMA rapidly expanded its scope and ambition. In 2006 it partnered with the Frankfurt University of Music and Performing Arts to offer a one-year Master's programme. This was the first formal collaboration between a new music ensemble and a tertiary institution, and is the one of this type that has produced the greatest number of alumni: well over 250 at time of writing. IEMA's summer course moved outside the embrace of the Klangspuren festival in 2021 with the launch of a home-grown Hans Zender Academy in Meersburg, targeted at a similar age and level of experience; younger trainees aged 14-20 are offered the epoche-f ten-day course, and specialised conductor training is offered via the International Composer & Conductor Seminars mentoring scheme. Measured by its scale and range of pedagogical targets, IEMA is currently the dominant provider of NMPT, and would merit a full-scale historical study. The LFA remained summer-based (a few isolated projects aside) and formally independent of tertiary institutions, but also operated at scale. Due to its orchestral format, it reported that it had by 2022 produced over 1,200 alumni — a figure that includes a minority of participating composers. Within the small world of new art music, and in particular within mixed-instrument ensembles smaller than symphony orchestras, these two institutions have had impacts through their alumni networks that are detectable well outside the European new music heartlands. For example, on a 2023 visit to Taiwan to conduct concerts with the newly-founded Weiwuying Contemporary Music Ensemble, I discovered that roughly one third of my performing colleagues, all of whom were of Taiwanese origin, were IEMA and/or LFA alumni. Furthermore, those alumni frequently took it upon themselves to transmit certain techniques that they had acquired in Europe to their colleagues. Visiting Seoul and Tongyeong in the same year for concerts with Ensemble TIMF (South Korea's longest-established and most active new music ensemble), I observed a similar tendency for young players with the greatest appetite for new music to gravitate towards the IEMA for postgraduate training, despite the presence of active and competitive conservatoires within that country. One player, who had previously studied at Seoul's prestigious Korea National University of Arts, recalled his European NMPT in terms that, to me, recalled the Swiss finishing schools popular at one time among British aristocrats, in that it had offered them a level of finesse that was (in their view) inaccessible outside the continent of Europe.

The LFA started to engage actively with its legacy in 2013, launching an alumni platform and touring ensemble. In the succeeding years, the previous clear distinction between trainees and instructors was softened, and selected alumni were designated 'Partners' — a mentor status which was not universally well-received (two of my interviewees characterising it as 'unclear' and 'confusing'.) The EIC ceased to be the exclusive teaching provider for the LFA during the mid-2010's, an invited guest faculty taking its place. In

[49] In the aftermath of 9/11, Boulez was briefly interrogated by humourless Swiss police in Basel after a prankster alerted them to some of his early inflammatory rhetoric, including a 1967 *Der Spiegel* interview in which he half-jokingly called for the opera houses of Europe to be blown up. This was particularly ironic since Boulez was one of the principal cultural institution-builders of the twentieth century, his legacy being far more *fixe* than *explosante*.

[50] A culture anatomised in Georgina Born's landmark ethnographic study *Rationalizing Culture: Ircam, Boulez, and the Institutionalization of the Musical Avant-Garde* (Berkeley and Los Angeles: University of California Press, 1995).

March 2022 the EIC announced the formation of an institutional partnership in its home city with the Conservatoire National Supérieur de Musique et de Danse de Paris. Applicants are offered a two-year Artist Diploma in the 'interpretation *and creation* of contemporary repertoire' (my emphasis).[51] There may be a translational slippage between 'creation' in English and *création* in French, since the French term conventionally includes the mere giving of first performances of works without the authorial claim implicit in the English term.[52] If 'creation' in the English sense will truly be included, this promises to be an intriguing development from an ensemble that has historically maintained a stricter composer-performer dualism than many other new music ensembles, and has cherished the distinct role of the heroic virtuoso interpreter as surmounter of the most Eiger-like compositional challenges.

In 2009 a significant new NMPT institution arose with the launch of Klangforum Wien's Performance Practice in Contemporary Music (PPCM) course at the University of Music and Performing Arts, Graz. This was made possible due to an arrangement whereby the ensemble as a whole was granted a formal professorship, as 'Professor Klangforum'. This unusual flexibility on the part of the Graz rectorate permitted a new model of teaching to emerge. Because ensemble members were able to exchange the funded teaching hours flexibly within the group, and because they possessed exceptionally detailed awareness of their colleagues' particular areas of knowledge and expertise, they could move beyond the conservatoire's previous one-on-one teaching model. While students did have a regular point of contact within the ensemble — usually the instructor who played the same instrument — they also received tuition adapted to each performing project or learning objective, offered individually or in groups as appropriate. Thus, one of the ensemble's percussionists could lead workshops on unfamiliar rhythmic procedures, and a violist could lead group sessions focused on intonation and microtonality. This approach avoided treating instrumental families as unconnected siloes — a known problem within legacy structures such as symphony orchestras and their analogues in conservatoires: departments of strings, wind, brass, etc. (see 3.2 below). The budget also permitted external tutors to be invited for specialised modules and the exploration of particular repertoires. Pooling the budget and the teaching responsibilities had the advantage of not forcing individual instructors to sacrifice external performing opportunities overmuch. Hence, in-demand performers who might otherwise be hesitant to take on even a part-time conservatoire position with an expectation of regular presence felt able to make teaching contributions. This arrangement helped alleviate the trade-off familiar to conservatoire hiring panels between opting for 'star hires' who usefully adorn prospectuses but may be rarely available to students, or less glamorous but more reliably present professors. Replication of this model elsewhere would require the simultaneous presence of an ensemble of sufficiently high level whose members possessed profound knowledge of their colleagues' skills, and a tertiary institutional structure sufficiently flexible to permit a group to draw on the funding of one or more

[51] 'Artist Diploma Interprétation – Création: un nouveau cursus unique en Europe en partenariat avec l'Ensemble Intercontemporain,' ['Artistic Diploma in Interpretation – Creation[?]: a new course, unique in Europe, in partnership with the Ensemble Intercontemporain'], *Conservatoire National Supérieur de Musique et de Danse de Paris*, Mar 16, 2022, accessed Jan 03, 2023, https://www.conservatoiredeparis.fr/fr/actualites/artist-diploma-interpretation-creation-un-nouveau-cursus-unique-en-europe-en-partenariat-avec-lensemble-intercontemporain. As this chapter makes clear, the CNSMDP's claim of uniqueness in partnering a tertiary institution with a new music ensemble is — to borrow a phrase from the English legal system — 'mere puff.'

[52] My performing biography in English includes the phrase 'He has given over 200 world premieres'; this was professionally translated into French as 'Il a créé plus de 200 œuvres.'

(sufficiently well-funded) professorial posts. These conditions were so utopian that, despite its prestige within the Austrian cultural landscape, Klangforum Wien was unable to implement the model in its home city of Vienna, instead finding a willing partner organisation in a city 200 kilometres away.

Other NMPT institutions in German-speaking countries expanded in the first two decades of this century. In Austria, Graz was a hotspot for provision; its impuls Academy, founded by Beat Furrer and Ernst Kovacic, having pioneered a short NMPT residential course as long ago as 1998. After a period with breaks of several years between editions, impuls settled into a biennial model in 2007. Expanded to a fortnight, it grew in the 2010s into a major provider of performer training with a surrounding constellation of other initiatives: a festival, a composition competition, musicological lectures and discussion groups, and outreach programmes. Although it has close links with Klangforum Wien and its PPCM programme, it employs a separate invited faculty. In German-speaking Switzerland, the Hochschule Luzern launched a week-long Akademie für zeitgenössische Musik in 2010. This continues to offer performer training alongside composer training. In Germany itself, the storied Darmstädter Ferienkurse (presented by the Internationales Musikinstitut Darmstadt, henceforth IMD), having largely shaken off its twentieth-century reputation for ideological in-fighting between composers, pivoted strongly in the same period towards the 'in-between' territories of creative performance, improvisation, and live composition. The IMD's offering for 2023 included sessions on Embodying Music, Creative Orchestra, Parametric Improvisation, and a Workshop for Creatives. While such descriptions may seem opaque, it is inevitable that where a discipline's fundamental categories are in flux or under intense scrutiny, its terminology will be correspondingly unsettled. The IMD also offers courses whose titles resemble those of conventional performer training (Saxophone, Piano, Voice). However, the selection of tutors will ensure that such training too will be self-consciously creative in some sense, and will not be simply 'Parnassian'. In this respect, Darmstadt appears to be maintaining its reputation as a bellwether for new music practice. 2021 saw the founding of a new NMPT institution, the Grafenegg Academy (Lower Austria), a development of the Grafenegg Festival. All the courses mentioned in this paragraph draw on a shared pool of instructors. Because they are short and do not overlap, an instructor may work in more than one of them in a year. It is also the norm for trainee performers to attend multiple courses.

Parts of Germany offer opportunities for access to NMPT for younger performers. The devolution of a significant portion of the country's culture budget to federal states (*Länder*) encouraged the creation of local programmes that children can access while based at home. Cologne's Ensemble Musikfabrik is a notably international ensemble (over half of its permanent members having originated outside Germany) with an intensive touring schedule. Nevertheless, in its capacity as a local *Landesensemble* of North Rhine-Westphalia, it runs a Studio Musikfabrik training ensemble for secondary school-age players. It offers multiple working phases each year and maintains an exchange partnership with the Princess Galyani Vadhana Institute of Music in Thailand. In Bavaria, the organisation Jugend komponiert Bayern offers a performer training academy (Junge Akademie für Neue Musik) for musicians aged 12-20, while the Landesmusikrat Berlin funds a Landesjugendensemble Neue Musik Berlin. Comparable sustained pedagogical initiatives are exceptionally rare outside Germany. Although most established new music ensembles elsewhere also offer experiences for school-age musicians, these are often in practice little more than attractive 'tasters'. Such

tasters include individual workshops in schools (most often employing minimally-notated or graphic scores, since there is no expectation of even the most basic musical literacy among such participants), open and guided rehearsals, instrumental demonstrations and try-outs, rather than full-scale training programmes like Studio Musikfabrik. It is assumed in Germany that the cost of these opportunities will not be borne by participants but rather by the federal authorities; this is not always the case elsewhere.

1.2.3 Outside the Teutonosphere

Outside the German-speaking world during the same period, institutional NMPT provision also grew, but with less overall vigour. In the late twentieth century, France had pioneered the 'institutionalization of the musical avant-garde' (in Georgina Born's trenchant phrase) as part of a wider expansion of cultural institutions during the presidencies of Pompidou, d'Estaing, and Mitterand (1969–1995). While IRCAM was most prominent among these *grands projets*, other institutions emerged in those years, including the Centre Acanthes. Founded in 1977 by the visionary interdisciplinary journalist Claude Samuel, Acanthes had a peripatetic existence, moving from Aix-en-Provence, to Avignon, and then Metz. Although the headlined invitees in its early years were composers, the influence of the always-practical Péter Eötvös ensured that performer experience was not neglected — the 1984 edition, for example, took the theme 'Percussion'. In the early twenty-first century the mood seemed less certain. In 2012 Acanthes was swallowed by IRCAM and lost its identity,[53] while in the same period IRCAM itself was itself suffering an identity crisis as the democratisation of access to advanced technologies and the spread of open-source know-how via the internet undermined its *raison d'être*.[54] Notwithstanding the variety of voices and viewpoints in French new music culture in those years, the totemic figure of the ageing institution-builder Pierre Boulez (d. 2016) was rarely far from any discussion. (These discussions included lengthy unprompted diatribes about how unnecessary it was to discuss his impact.) As one performer recalled, 'We knew there'd be a post-Napoleon problem — when he's gone, everything might fall apart.' 'Everything' meant the status of new music within broader cultural discourse and its attendant funding implications for institutions. Whether people were broadly pro- or anti-Boulez mattered less in this regard than the gravity well of his mere continuing presence, which ensured that some public attention was attracted to new music. In this faintly eschatological ambience institution-building was not a priority.

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[53] 'Acanthes,' *IRCAM*, online archive, n.d., accessed May 20, 2023, https://acanthes.ircam.fr/historique/historique_2012.html.

[54] And not only IRCAM's. The founding rationale for many comparable institutions for new music, including the CEMAMu (Centre d'Études de Mathématique et Automatique Musicales) and GRAME (Générateur de Ressources et d'Activités Musicales Exploratoires) in France, the Studio für elektronische Musik des Westdeutschen Rundfunks and SWR Experimentalstudio in Germany, and the Center for Computer Research in Music and Acoustics in Stanford University, the Columbia-Princeton Electronic Music Center, and the MIT Media Lab's Experimental Music Studio in the USA, was the need to develop specialised technology and know-how. In many of these institutions, however, the impetus to develop such technology can be seen in retrospect as little more than a feint to attract funding to enable composers to pursue their real creative projects — and also providing opportunities for performers, and (later) performer training. While the MacGuffin *par excellence* was IRCAM's vastly expensive and minimally-exploited 4X synthesiser, comparable projects formed the nucleus of many institutions. Composer-training and NMPT programmes alike moored their boats around these islands of comparative security. In IRCAM's case there would have been no Cursus or Tremplin pedagogical initiatives without the central pillar of technological investment, even if those notionally satellite programmes may be judged in retrospect to have had a significantly greater cultural impact than the 4X synthesiser.

Nevertheless, in 2012 IRCAM initiated the Ulysses Network Project, receiving funding from the Creative Europe programme of the European Union. Not a new pedagogical institution itself, the network attempted to link partner organisations across Europe — a rather inchoate selection of festivals, NMPT summer schools, and one conservatoire — that, in IRCAM's estimation, 'play a fundamental role in the recognizing, accompanying, professionalizing, and developing of the carriers [sic] of young European composers and performers.' The network had no less lofty an ambition than thereby to '[encourage] the emergence of European citizenship.'[55] One of these partner organisations was the Gothic abbey of Royaumont, which, through its Fondation Royaumont, had a tradition of supporting vocal training including new music. Its Académie Voix Nouvelles offers performer training tutored by members of Ensemble Court-Circuit and guest ensembles.[56] Strasbourg's Ensemble Linea ran various pedagogical initiatives during the 2010s, including a short-lived summer performers' academy. In 2019 a European Creative Academy for Music and Musicians was launched in Annecy, offering masterclass-based NMPT alongside discussion groups and lectures.

Many other countries simply lacked notable NMPT structures beyond sporadic individual masterclasses and the ad hoc approach in their conservatoires. Trainees from such countries flocked to the providers described above, often with few good words to say about the state of NMPT in their home country. An exception was found in Hungary, where Péter Eötvös had founded his International Eötvös Institute in 1991. Re-founded in 2004 with a broadened field of activity, the Eötvös Péter Contemporary Music Foundation offers an intensive mentoring programme for a small number of composers and conductors, and also runs NMPT workshops and masterclasses. (Eötvös' death, which was announced during the editing of this text (March 2024), has rendered the future of his eponymic institution unclear.) In the UK, the London Sinfonietta runs a one-week summer academy, while the Birmingham Contemporary Music Group's more ambitious NEXT programme, presented in association with the Royal Birmingham Conservatoire, offers a year-long programme of side-by-side playing and mentoring.

Elsewhere, the composer-led model has created an international profusion of composition courses and competitions of varying reputation, and comparatively few trained performers to perform their outputs. In real ecosystems, herbivores are more numerous than carnivores; in the trophically imbalanced new music world the reverse is the case — no performer has ever complained 'I can't get anyone to compose a piece for me!' A 2024 call for scores by a professional but small and relatively unknown European new music ensemble (not one of those named in this text) attracted 377 applications, of which five were selected; while, admirably, the ensemble did not levy a reading fee in this case, the selected composers also did not receive a fee for their scores being performed. The International Society for Contemporary Music (ISCM), a composer-focused organisation, maintains chapters in fifty countries; most of these countries may be described as net exporters of composers. Composers from these countries are forced to rely heavily on the institutional structures and performance opportunities provided in the NMP heartland — an unhealthily dependent relationship. As one composition professor in a conservatoire in a country in Asia ruefully

[55] 'Ulysses Platform,' *Ulysses Network*, n.d., accessed Feb 20, 2022, https://project.ulysses-network.eu/partners/.
[56] 'Les formations professionnelles,' *Royaumont: abbaye & fondation*, n.d., accessed Mar 13, 2022, https://www.royaumont.com/centre-pour-les-artistes/les-formations-professionnelles/.

observed to me, 'I just don't know how many more composers I can keep on teaching when there's no-one [here] to play their music'; composers being marginally more able to distance-learn their craft (via recordings, YouTube, and online score libraries) than performers. In a different Asian country, there were discussions about launching an 'academy for new music' in 2019. Despite the initiative arising from a new music ensemble and a concert hall management, the initial plan included composer training only; the notion of specialised performer training had simply not arisen. This absence of performer training should not be taken as an inevitable sign that players (or audiences) in these countries are resistant to new music *en masse*, but rather that — due to prejudice on the part of some controllers of their institutions (concert promoters who decide without evidence that their audiences will not respond to a new music programme, and conservatoire instructors who opine that learning newer techniques will harm performer development) — they often are denied the data to make a meaningful assessment.[57] Accordingly — and perhaps surprisingly, given the near-universal accessibility of online content — I can report from personal experience that what currently counts as new music among performers differs dramatically when viewed from Berlin, Almaty, Tallinn, London, or Seoul. The dependency on Germany of much of the new music ecosystem discussed in this text is actually understated by a narrative that highlights the geographical location of providers, since many international programmes rely on German funding, and in particular on the roughly three million euros distributed to new music each year by the Ernst von Siemens Music Foundation.[58]

1.2.4 Founders' motivations

Within the NMP heartland, what prompted this proliferation of training institutions in a mere two decades? The growth should be seen in the context of the contemporaneous expansion of education departments across the performing profession. Many symphony orchestras and opera houses also launched or expanded their training programmes during this period, and some, like the Karajan Academy of the Berlin Philharmonic, or the London Philharmonic Orchestra's Foyle Future Firsts programme, included a significant amount of new music in their programmes. Nevertheless, even within the general context of expansion, the sense of urgency and consequent pace of growth within the specialised new music ensemble world seems exceptional. Some ensemble members told me that the principal initial motivation was simply to train up their own replacements ('we thought — who's going to keep playing this stuff?') Many of these institutions were indeed launched during a period of accelerated personnel replacement as members of the ensemble's founding generation were approaching retirement. One such member joked that 'it seemed time to settle down, buy a house, and have kids.' The metaphorical 'kids' in question were NMP trainees, although the relative financial security that teaching provides, with its real-world domestic implications, was also attractive to these (mostly freelance) musicians. The comment implied a sense of a turning-point in the lifecycle of the ensemble, and indeed a 'pedagogic turn' generally arrived in sufficiently well-established ensembles when they reached child-bearing age: the Ensemble Intercontemporain was founded in 1976 and partnered with the LFA in 2003 at the age of 27, Ensemble Modern (founded in 1980) founded the

[57] Unsuk Chin and Maris Gothoni, 'Contemporary Classical Music: A Komodo Dragon? New Opportunities Exemplified by a Concert Series in South Korea,' in *Classical Music: Contemporary Perspectives and Challenges*, ed. Michael Beckerman and Paul Boghossian (Cambridge: Open Book Publishers, 2021), 157-176.
[58] 'Funding,' *Ernst von Siemens Music Foundation*, n.d., accessed Mar 14, 2022, https://www.evs-musikstiftung.ch/en/evs-funding.html.

IEMA in 2003 aged 23, Klangforum Wien (founded in 1985) launched the PPCM in 2009 aged 24, and Ensemble Musikfabrik (founded in 1990 as Musikfabrik NRW) produced a series of pedagogical initiatives from its late teens onwards (Studio Musikfabrik 2006; SpielBar, Adventure HfMK, SMOL 2021). Ensembles in the UK took longer to catch the baby bug: Birmingham Contemporary Music Group (founded in 1987) launched its NEXT programme in 2018 at the age of 31, while the London Sinfonietta (founded in 1968) was an elderly primigravida, having launched its London Sinfonietta Academy in 2009 at the age of 41.

Having a secure 'house' was highly advantageous in preparing for the advent of 'kids.' This may explain the earlier emergence of NMPT courses in the better-funded environments of Germany, Austria, and Switzerland than in the UK, Spain, or Italy. While it is possible to produce conventional performing projects in the absence of a fixed base (because the instrumental and technical requirements are usually known in advance), it is much more challenging to run education projects in this way, particularly those that embrace devised or open-ended outputs. The studios of Ensemble Modern and Ensemble Musikfabrik offered Aladdin's caves of instruments and accessories that curious trainees could raid at will, as well as reliable technological support (sound diffusion, recording and editing, video capture and projection), on-hand administrative help (organising travel, photocopying and binding scores), and areas to exchange ideas over refreshments — this last being no trivial consideration. Less well-funded peripatetic ensembles had to be content with a training model that copied the conventional rehearsal-concert process: there would be little possibility to break groups out into smaller rooms at will, to browse in a score library for new programming ideas, to linger after official hours with like-minded peers, to pursue and share ongoing side-projects (tinkering with analogue synthesisers or circuit-bending), or to experiment in an unpressured environment with rare and exotic instruments (a Lumatone isomorphic keyboard, a Chromelodeon, a lur, a lupophone…) This restriction severely limited the impact of their offerings since, as participants repeatedly reported to me, many of the most productive and inspiring interactions occurred in the cracks of academy schedules, rather than during the formal sessions. Informal peer interactions could have decisive consequences: the original members of the JACK Quartet, for example, met in this way at the LFA.

If an initial motivation for the founding of NMPT academies was to produce a successor generation for ensembles concerned about their future, the numbers now going through these programmes far exceed the replacement rate: the alumni of IEMA's Master's programme alone could fill Ensemble Modern's chairs ten times over. Many graduates have founded their own ensembles: Schallfeld Ensemble in Graz is a direct spin-off from the PPCM course, while the IEMA has spawned so many successor ensembles (many ephemeral) that current students are offered specific training to construct their own education projects — placing the Ensemble Modern in a grandparental, rather than parental, position. A current focus of concern among participants and some instructors is less on populating a particular ensemble or ensuring the future health of a repertoire, and more on the limited availability of performing work for NMPT graduates. Some of my interviewees shared my concerns about the propriety of producing a large cohort of highly specialised trainees when the precarity of the profession was well-known even before the trauma of Covid-19.

1.2.5 Conservatoire-initiated NMPT programmes

The impulse to create a NMPT programme did not always arise from an ensemble. During the 2000s and 2010s, conservatoires in Germany (and to a lesser extent, elsewhere in Europe) tumbled over each other to launch their own dedicated programmes. This was easy to achieve in theory: where existing *Institut* subdivisions existed (the term has been translated as 'department,' but it usually implies a stronger sense of self-determination and physical presence), a NMPT programme could be added without special conceptual effort on the part of management. The existing departments of historically informed performance (HIP) provided an obvious model; in one large European conservatoire, a catch-all 'Institute for Special Ensembles' gradually splintered into separate Institutes for chamber music, early music, and new music. In some institutions, the effect has been that conservatoire programmes that did not claim a specific repertoire affiliation (and therefore lacked a cheerleading *Institut*), such as 'Master of Performance: Violin,' faced territorial attrition from two fronts: from an energised HIP movement seemingly intent on extending its scope ever forward in time,[59] and from these emerging NMP institutes, some of whom claimed responsibility for a swathe of twentieth-century repertoire as well as newer works. Since a growing consensus exists that all performance practice is, or should be, historically informed (and since the alternative — being uninformed — understandably lacks appeal), the long-term future status of these *Institute* is unclear. Instrumental provision in conservatoires may either start to unite such programmes under a broad umbrella (e.g. 'Violin,' encompassing everything from Isabella Leonarda to Georges Aperghis) or continue to fragment (a newly-founded 'Institute for mid-twentieth-century orchestral practice' might oversee a student performance of a symphony by Grażyna Bacewicz.) A model in which specialist repertoires old and new continue to be institutionally othered from the self of a standard repertoire does not look sustainable. Nevertheless, the current trend seems to be 'splittist' in direction.

No data exist to inform an objective comparison of the success of these programmes. Any future comparison would need to be international or at least Europe-wide to be informative, since this is the nature of the marketplace: performance students do not generally choose a country first, then an institution, but rather select from an international menu of courses. Judged by the unreliable and fickle metric of reputation within the profession as I and my interviewees sensed it, it seems that the courses held in the highest regard are those where the tertiary institution forges close links with a local new music ensemble. Where institutional partnerships are absent — even if individual instructors perform regularly with such an ensemble, as they almost invariably do — the course seems to have less impact in terms of trainee employability. This may be ascribable to the quality of the provision itself, or may simply reflect the fact that trainees on linked courses develop professional networks as they study. Indeed, some trainees openly say that an important motivation for joining a course had been to make such professional connections.

[59] See, for example, recent performances of works by Stravinsky 'on original instruments' by the orchestra Les Siècles: Igor Stravinsky, *Stravinsky: Ballets Russes*, Les Siècles, cond. François-Xavier Roth, harmonia mundi HMX2905342.43, released Jun 25, 2021, CD. Such projects confound the categories of old and new: many string players in 'normal' (non-HIP) orchestras habitually play instruments that are significantly older than the early twentieth century, as did the musicians at that time, of course. On the other hand, technological change in the last few decades has been so rapid that some aspects of quite recent new music performance practices are very hard to reconstruct. See, for example, Georg Hajdu, 'Resurrecting a Dinosaur – the adaptation of Clarence Barlow's legacy software AUTOBUSK', in *Proceedings of the TENOR conference* (Online: International Conference on Technologies for Music Notation and Representation, 2016), 181-186, and the challenges of information loss faced by today's interpreters of those works by Luigi Nono that include live electronics.

Even if most had little hope of becoming permanent members of an established ensemble, they could aim to win a place within the ensemble's gravitational field — each ensemble being surrounded by a little solar system of regular guest and/or trialling performers. While some interviewees reported that they had received good tuition in courses without such official links (the example of the work of Barbara Maurer at the Folkwang University of Arts in Essen was cited — although she would probably be better recognised as the violist of Freiburg's Ensemble Recherche), formal partnerships are, in the view of one instructor on the PPCM course, 'the only way that makes sense.' The current trend is for unlinked conservatoire new music programmes to seek such partnerships: this is already underway in Paris, and seems to be proceeding in Geneva and Zürich. Where no formal partnership is made, students may benefit from initiatives such as an 'ensemble in residence' or similar temporary arrangements.

1.2.6 'Creative performer' programmes

A formal link with a new music ensemble was not the only possible way for tertiary institutions to develop their NMPT programmes. For some institutions, the word 'creative' in 'creative performer' was not merely a buzzword used to decorate marketing materials. The FHNW–Hochschule für Musik Basel, after two decades of offering NMPT in a conductor-led new music ensemble model, re-focused its Master's new music performance course in 2022 to emphasise 'open creation'. This careful formulation was clearly intended to shed not only the baggage of the composer-interpreter dichotomy (along with its conceptual apparatus, such as the work-concept and *Werktreue*) but also that of other genre-marked practices with their own histories, such as 'free improvisation.' Nearby, Bern's University of the Arts offers a 'Creative Practice' Master's programme.[60] The statements of intent of these courses appear similar: their ambitions are self-consciously therapeutic in nature, seemingly motivated by the desire to heal a practice riven by an artificial separation of the identities of composer and performer. However, as of 2024 it is still the case that applicants coming from a performance background will be more attracted to study with instructors such as the soprano Sarah Maria Sun or the guitarist Yaron Deutsch in Basel, and those from a composition background with Simon Steen-Andersen or Cathy van Eck in Bern. A distinguishing feature of these approaches is that, because they stress the desirability of actively re-conceiving the rules of engagement of creative encounters, their outputs deprioritise existing performing structures with a large number of participants (e.g. symphony orchestras, opera companies, and even some new music ensembles) in favour of smaller and more mobile performing groups. It would therefore be inappropriate to measure their success in conservatoires' traditional terms: lists of alumni who have won orchestral positions or prestigious solo competitions. How they might meaningfully be assessed is less clear.

Switzerland — although it is a discreetly radical artistic *entrepôt* — does not have a monopoly on neutrality with respect to such identities. The unusual CoPeCo (Master's in Contemporary Performance & Composition) institutional collaboration, founded in 2018, allowed footloose creative performers /

[60] The following publicly-shared social media post by Simon Steen-Andersen is representative of the targeting of these programmes: 'Just a few more days to apply for the "Creative Practice" master programme at Bern University of the Arts with a fully flexible curriculum, ideal for interdisciplinary work! Very international, open for composers and performers and in-betweens from all backgrounds.' Simon Steen-Andersen, 'Just a few more days,' *Facebook*, Mar 13, 2022, https://www.facebook.com/profile/1063991995/search/?q=just%20a%20few%20more%20days.

performing composers to spend a semester each in the conservatoires of Tallinn, Stockholm, Lyon, and Hamburg — an Erasmus programme *par excellence*. Stuttgart's Staatliche Hochschule für Musik und Darstellende Kunst offers a Master's course in Experimental Performance Practice & Theory via its Campus Gegenwart. In Belgium, the Conservatorium Ghent & KASK, in collaboration with the Ictus and Spectra ensembles, offers the Manama course, focusing on interdisciplinary 'co-creation' via 'project-based education' and including workshops with choreographers, theatre makers and visual artists, and curatorial training. A large number of other programmes initiated by composition departments in conservatoires and universities worldwide might also seem to fall under this heading, since the development of new paradigms for composer-performer relationships is an area of intense current interest.[61] The United Kingdom's University of Oxford — not an institution previously associated with musical experimentation — signalled a change of direction with its 2021 appointment of the interdisciplinary composer, improviser, and vocalist Jennifer Walshe as Professor of Composition.

1.2.7 Musicianship-first approaches

The 'creative performer' model was not the only training approach that questioned or deprioritised the older interpretative training model: that is, the imperative to learn, master, and get to the heart of a succession of pre-existing pieces. 'Musicianship-first' approaches do so in a different way: in these approaches, a musicianship skill is learnt first which may later be applied to multiple instances of practice. The teaching approach may be agnostic as to where this future practice might sit on a composer-performer spectrum. The Advanced Rhythm programme at the Amsterdam Conservatoire, developed by Rafael Reina, is a prominent and intensive example of such an approach. Participants (instrumentalists, composers, or conductors) engage in group workshops to learn Karnatic rhythmic practice (konnakol) via the use of solkkattu (spoken rhythmic syllables). They then receive instruction on how this training may be applied to particular new music projects. Comparable workshops were offered by the percussionist Jarrod Cagwin in early editions of the IEMA. A skill-first approach to pitch is offered by Marc Sabat and others at the Universität der Künste Berlin. As is the case in the Amsterdam course, the materials are conceived as having an existence prior to instances of their pedagogical application — a *takadimi* rhythm and an 11:8 interval exist, then trainees discover them — although, naturally, all participants arrive with extensive training backgrounds in performance or composition and are far from being blank slates. Reflecting the historical primacy given to the musical parameter of pitch, courses and projects specialising in (cerebral, Apollonian) pitch tend to be dignified with terms such as *research*, while those specialising in (bodily, Dionysian) rhythm must be content with the humbler vocational language of *training*.

[61] See, for example, the following press release: 'Der kreative Schaffensprozess in all seinen Facetten steht im Fokus der Darmstädter Ferienkurse vom 5.–19. August 2023. Wie arbeiten Komponierende und Ausführende heute zusammen? Wie sehen die kreativen Dialoge aus, die zu neuen Werken führen? Vor welchen Herausforderungen stehen kollaborative Arbeitsformen, partizipative Projekte und nachhaltige Produktionsweisen?' ('The creative process in all its facets is the focus of the Darmstadt Summer Courses from 5-19 August, 2023. How do composers and performers work together today? What do the creative dialogues that lead to new works look like? What challenges do collaborative working methods, participatory projects and sustainable production methods face?') 'Pressemitteilung,' *Internationales Musikinstitut Darmstadt*, May 16, 2023, accessed Jun 05, 2023, https://internationales-musikinstitut.de/de/ferienkurse/presse/pressemitteilungen/programm2023/.

It is unusual in Western classical music practice for musicians to be invited to leave their identities at the door and participate in an activity on equal terms. This is particularly the case when that activity is challenging and complex — categories usually reserved for virtuoso performances on a principal instrument. Some who cherish status and/or guard a secret sense of personal inadequacy (I am thinking of conductors) are at times reluctant to engage in these revealing, sauna-like, activities. This understandable unwillingness to 'go back to square one' in a musical training journey may account for the relative rarity of such provision within institutions. Since I argue in this text in favour of re-balancing NMPT in favour of musicianship, I reserve further discussion of these approaches for Chapters 3 to 8.

1.2.8 Outliers

Some NMPT programmes did not fit into any obvious mould. One such case was the 2017-2019 Master Specialisation 'aus LICHT' at the Royal Conservatoire The Hague:

> …a degree that has been specifically created to train students in becoming experts in Stockhausen's music. Their final goal: performing the three days with selections from [the opera cycle] LICHT in Amsterdam in June 2019.[62]

The appropriateness of creating an accredited course to enable the production of a single — admittedly ambitious — work has been questioned, albeit not yet in public. In any case, this was likely to remain an isolated example, since of his generation of composers only Stockhausen retained the power (even *post mortem*) to bend institutions to his will in this way: there are no equivalent Master's programmes in Ligeti-ology, Kurtág-ology, etc. The course was notable for its counter-cyclical nature. While the rhetoric surrounding teaching practices elsewhere (including some at The Hague itself) stressed increasing a performer's freedom, this was a large-scale exercise in unapologetic 'transfer pedagogy' (see 3.1 below) and in the self-conscious preservation of a performance practice ('to stage the musical theatre experience as Stockhausen intended.')[63]

Other unusual performer development approaches were found among those who found the inherited Western instrumentarium onerously limiting. Technological advances in the 2010s permitted two areas of practice to begin to converge. One was the dissident anti-tradition of 'philosophic musicians seduced into carpentry' (to paraphrase Harry Partch's self-description): this very loose category included Partch himself and his follower Cris Forster, Walter Smetak, Giorgio Battistelli, Annea Lockwood, Laetitia Sonami, Giovanni Verrando, and many others. The other area comprised the various attempts to extend the

[62] 'About aus Licht,' *aus Licht*, Jun 2019, accessed May 15, 2022, https://auslicht.com/en/aus-licht. The principal tutors were members of Stockhausen's inner circle, including Kathinka Pasveer and Suzanne Stephens. Despite the course including a small research project element, its core output was the performance of *aus LICHT* in front of a paying public, and in collaboration with professional (paid) performers and commercial performing structures (an opera company.) Although this may raise red flags to readers from a humanities perspective, the course may be better understood as arising from pedagogical traditions that embrace direct 'transfer pedagogy,' including some Indian teaching approaches. I personally would have been delighted to attend the *aus LICHT* course as a student, but only at a time where I possessed the ability to contextualise it: that is, not in my early twenties, as were most of the participants.
[63] Ibid.

capacities of acoustic instruments by electronic (and later, digital) means.[64] Rapid improvements in human-machine interfaces in the twenty-first century led to a hybridisation of these areas of practice, while the intensity of creative activity in the field (many participants coming from outside the 'classical music' space entirely) normalised the use of new technologies to the extent that, by 2024, the question of whether a new musical project 'included electronics' or not sounded rather quaint. These activities swiftly found a place in tertiary institutions, in which they continued to develop at pace: the Tangible Music Lab at the University of Art and Design Linz offers a Master's course on Postdigital Lutherie, and the Cyborg Soloists project at Royal Holloway, University of London, promises to '[advance] interdisciplinary music in the post-internet age through new musician-technology interactions.'[65] Such approaches, which took Lachenmann's much-quoted formulation 'to compose is to build an instrument' at face value,[66] offered another way of loosening the composer-performer barrier, the profiles of their participants overlapping with the 'creative performers' of 1.2.6. Where there is no established tradition of playing techniques, a composer is obliged also to be a performer, if only to demonstrate in rehearsals. Although they are presented as research programmes, they also fall on the fringes of NMPT. They are clearly not pure luthiery in the sense of violin-making institutions such as Newark College's School of Musical Instrument Crafts, where the existence of a mature technology and a long performing tradition permits a clear division of roles between maker and performer. Works and projects addressed by and created within these courses receive little attention in the rest of this text, which draws its examples from compositions written for the (slightly extended) Western orchestral instrumentarium. This choice was taken to avoid lengthy descriptions of unfamiliar physical set-ups; no value judgement is implied.

The outputs and preoccupations of these courses may be seen as extreme examples of a much wider current tendency for instrumentalists to wish to, or be professionally expected to, extend their reach via the use of pickups and effects pedals, sensors, auxiliary instruments of all sorts, and any technique that interrupts a performer's conventional connection with their principal instrument, such as singing, whistling, and body percussion. A thoroughly representative work that makes such demands is Malin Bång's *blooming brume* for large ensemble (2020), in which the performers are asked, in addition to playing their principal instruments, to play ocean drums (both conventionally and with electric toothbrushes in a specific jeté technique), to move through the public, to speak and whisper in Swedish *rövarspråket* ('robber language,' a children's language game), and to control portable CD players. (See **Figure 87** for an extract of the score.) For most new music ensembles, the inclusion of such elements is not in the least unexpected or controversial. Even if the particular techniques that a composer requests may be unfamiliar, the expectation that comparable techniques will arise has been thoroughly naturalised and reflected in professional performers' preparatory workflows: rehearsal schedules are adapted to allow familiarisation time, video demonstrations of

[64] Alessio Sabella, 'New lutherie,' in *New Lutherie: Orchestration, Grammar, Aesthetics*, ed. Giovanni Verrando, trans. Laura Davey (Milan: Edizioni Suvini Zerboni, 2014), 143-166. Sabella's extensive history includes the 'hyper'-string instruments of Tod Machover and the MIT (1986–), the MIDI flute developed at IRCAM in the 1980s, Jonathan Impett and Bert Bongers's meta-trumpet (1993), and entirely new instruments, among the most notable of which were the outputs of Amsterdam's STEIM (Studio for Electro-Instrumental Music) including Laetitia Sonami's Lady's Glove series (1991-2014).
[65] Zubin Kanga and Mark Dyer, 'Homepage,' *Cyborg Soloists*, 2021, accessed Nov 10, 2023, https://www.cyborgsoloists.com.
[66] '*Komponieren heißt: ein Instrument bauen.*' (Italics in original.) Helmut Lachenmann, 'Über das Komponieren' ('On composing'), in Helmut Lachenmann, *Musik als existentielle Erfahrung: Schriften 1966-1995*, ed. Josef Häusler (Wiesbaden: Breitkopf & Härtel, 1996), 77.

techniques that need clarification are sought, and so on. Such immediate concerns often take up the lion's share of time and attention in NMPT and professional contexts, since if they are not addressed the project swiftly fails. On first encounters with such concerns, notions of musicianship may seem remote. However, once these concerns have been appropriately met — that is, once the correct varieties of antique phonograph horns, vibrators, squeaky rubber chickens, or dried soybeans[67] have been acquired and through familiarisation have been transformed from objects that are merely 'present-at-hand' to true, 'ready-to-hand', equipment[68] — musicianship re-asserts itself.

[67] All examples of extended instrumentation in this paragraph are, of course, from projects I have conducted.

[68] Terms from Martin Heidegger's famous analysis of tool use, as given in the lectures 'Einblick in das was ist' ('Insight Into What Is') from 1949 and 'The Question Concerning Technology' from 1953. The philosopher Graham Harman explains: 'As Heidegger puts it, "the less we just stare at the hammer-Thing, and the more we seize hold of it and use it, the more primordial does our relationship to it become, and the more unveiledly is it encountered as that which it is—as equipment" […] As opposed to the *Vorhandenheit* (or "presence-at-hand") of phenomena in consciousness, the being of equipment is called *Zuhandenheit* (or "readiness-to-hand"). The latter term … refers to equipment that remains concealed from view insofar as it functions effectively.' Graham Harman, 'Technology, objects and things in Heidegger,' *Cambridge Journal of Economics* 34, no. 1 (2009): 17-25. My language in parts of this text (in particular my leitmotivic use of the word *care*) borrows from a shared lexicon that might be described as Heidegger-lite and Husserl-adjacent. While I find these terms useful, I am not a philosopher, and regret if I have misrepresented their origins and proper uses.

Chapter 2: Existing resources

2.1 Dreary theory

NMPT programmes, unlike comparable performer-training courses in other artforms such as the MA Theatre Lab at London's Royal Academy of Dramatic Art (RADA),[69] are not usually accompanied with a reading list of supporting materials. Instead, instructors tend to plunge trainees directly into primary materials. In most cases this means the realisation of a succession of written scores. This reflects the anti-conceptualising and anti-generalising legacy of the composer-led ad hoc model of NMPT. Many composers are theory-averse in their teaching practices — 'theory' meaning here any discussion that seeks to find explanatory links between individual instances of practice. Daniel Mateos-Moreno asked six composers with senior teaching positions in the United Kingdom some broad questions about their teaching approaches. He noted that

> … they considered the studying of treatises as one of the last things to do in order to become a composer: many of them agreed in declaring it 'useless' or 'entirely dispensable'.[70]

Theory as an endeavour skews general rather than individual; in the language of biological taxonomy, it tends towards 'lumping' rather than 'splitting.'[71] Mateos-Moreno's interviewees felt that teaching should be maximally adapted to the individual needs of the student; consequently, (good) teaching should be splittist, tailored, and resist the formation of rules. With this imperative in mind, general treatments of any musical area will naturally be perceived as less useful. In this respect his interviewed composers differed from even as paradigmatically Romantic and hyper-individual a figure as Robert Schumann, who counselled, in his *Musikalische Haus- und Lebensregeln* ('Musical House- and Life-rules') of 1848:

> Have no fear of the words: theory, figured bass, counterpoint, etc.; they will treat you kindly if you do likewise.[72]

Mateos-Moreno's interviewees were born between 1946 and 1963. As children of the twentieth century, they cleaved reliably to an observation of Nadia Boulanger, which she ascribed to her friend Paul Valéry:

> In the past, people imitated mastery, today we seek out individuality ['la singularité'].[73]

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[69] 'MA Theatre Lab: Methodology and creative practice', *Royal Academy of Dramatic Art*, n.d., accessed Feb 2, 2023, https://www.rada.ac.uk/courses/ma-theatre-lab/.

[70] Daniel Mateos-Moreno, 'Is it possible to teach music composition today? A search for the challenges of teaching music composition to student composers in a tertiary context,' *Music Education Research*, 13, no. 4 (2011), 419.

[71] 'Splitters make very small units–their opponents say that if they can tell two animals apart, they place them in different genera, and if they cannot tell them apart, they place them in different species. Lumpers make large units–their opponents say that if a carnivore is neither a dog nor a bear they call it a cat.' George Gaylord Simpson, 'The principles of classification and a classification of mammals,' *Bulletin of the American Museum of Natural History,* 85 (1945), 23. 'Lumping' is associated with the older biological species context, while 'splitting' is associated with the newer (post-1980s) phylogenetic species context; this text identifies a contemporaneous tendency in the discourse of new music.

[72] 'Fürchte dich nicht vor den Worten: Theorie, Generalbaß, Contrapunct &c.; sie kommen dir freundlich entgegen, wenn du dasselbe thust.' Robert Schumann, *Musikalische Haus- und Lebensregeln*, originally intended to be published as supplementary material to *Album für die Jugend*, op. 68, first printed in *Neue Zeitschrift für Musik*, 32 (1850), 1-4.

[73] 'Jadis on imitait la maîtrise, aujourd'hui on recherche la singularité.' Bruno Monsaingeon, *Mademoiselle: entretiens avec Nadia Boulanger* [Mademoiselle: interviews with Nadia Boulanger] (Paris: Editions Van de Velde, 1980), 59.

Although there is evidence of a recent pushback against this consensus — the title of a 2024 article by the composer Matthew Shlomowitz, *It's not about you: Do we still need an 'artistic voice'?* speaks for itself[74] — the preference identified positively by Boulanger, and critically by Shlomowitz, still largely prevails. Taking a birds-eye view of composers' and theorists' narratives from the late nineteenth century to the present day, we see a steady retreat from attempts at *grands récits* towards documentations of individual practice: while Riemann, Schenker, and Schoenberg felt able to write general *Harmonielehren* (1893, 1906, and 1911, respectively), by 1944 Messiaen restricted himself to a *Technique de mon langage musicale* (emphasis added),[75] setting the model for today's self-descriptive written commentaries in composers' doctoral theses, which are liberally sprinkled with the term 'my practice.' I only touch on this well-trodden ground to draw attention to a less-recognised consequence of the search for 'la singularité'; that performers, in an ad hoc (or ad hoc-influenced) training model, may become accidental hostages to influential composers' distaste for theory in its various guises. Since, even in a creative marketplace that pays lip service to notions of collectives and practically fetishizes the term collaboration, a composer's saleability is still measured by having developed a sufficiently individual 'voice,' we may echo Mandy Rice-Davies at the Profumo trial, and note that, in cases where composers reject the impulse to construct theories that include the practices of other composers, 'they would, wouldn't they?' (Their reticence in this respect may not be as admirably humble as it may first appear!) In any case, what is, or may be, appropriate for training composers should not be assumed to hold for training performers. However, performers — hampered by their historical status as musical servants, with the burden of *Werktreue* having been shaken off in some musicological accounts but still felt weightily in the profession — may have neither the confidence nor the institutional clout to overrule the preferences of composers.

Naturally, a distaste for theory may be shared by performer-instructors. Carl Flesch evokes the familiar figure of

> … the practical musician, filled with living sound, with a ghastly fear of theoretical treatises.[76]

Silke Kruse-Weber has explored the 'tension field between theory and practice' in non-repertoire-specialised conservatoire-level instrumental pedagogy.[77] Within NMPT, 'theoretical treatises' are of course no longer the only alternative to 'living sound.' Supporting materials exist in many formats: texts online and offline, videos, études, software, and gadgets, in various hybridisations. For this reason I prefer the terms 'materials' and 'resources' rather than the 'treatises' in Mateos-Moreno's survey, a formulation which

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[74] Matthew Shlomowitz, 'It's not about you: do we still need an "artistic voice"?', *Tempo* 78, no. 308 (2024): 38-45. Article based on a talk by the composer at the 2023 edition of the Darmstadt Summer School.

[75] Olivier Messiaen, *Technique de mon langage musicale* [Technique of my musical language] (Paris: Alphonse Leduc, 2005). As ever, there are counter-examples to this trend; perhaps most notably James Tenney, 'Meta ≠ Hodos: A Phenomenology of Twentieth-Century Musical Materials and an Approach to the Study of Form (1961), in James Tenney, *From Scratch: Writings in Music Theory*, ed. Larry Polansky, Lauren Pratt, Robert Wannamaker, and Michael Winter (Chicago, University of Illinois Press, 2015): 13-96.

[76] Carl Flesch, *The Art of Violin Playing. Book Two: Artistic realizations & Instruction*, trans. Frederick Martens (New York: Carl Fischer, 1930), 1.

[77] Silke Kruse-Weber, 'Instrumentalpädagogik im Spannungsfeld zwischen Theorie und Praxis' [Instrumental pedagogy in the tension field between theory and practice], in *Instrumentalpädagogik – wie und wozu?: Entwicklungsstand und Perspektiven* [Instrumental pedagogy: how and why?: Its state of development and perspectives], ed. Wolfgang Rüdiger (Mainz: Schott Music, 2018): 117-150.

understandably elicited answers as dusty as the (mostly hypothetical, I suspect) treatises those composers affected to disdain — for had he actually named a particular 'treatise' (Rimsky-Korsakov's evergreen *Principles of Orchestration*, for example) I am confident that he would have received less dismissive responses.

The creation of materials of potential use to a trainee curious about new music long predates the establishment of institutional NMPT. During the second half of the twentieth century,[78] the 'pioneering instructors' referred to in 1.1 produced a large corpus of texts. The main subject matter of these was the documentation of recently-discovered or relatively unfamiliar instrumental and vocal techniques; in this respect they could claim to be closer to 'practice' than 'theory.' Contemporary commentaries sometimes used the term 'extended techniques' to mark off these playing methods.[79] Since this implies the existence of an extra-historical core of un-extended or natural techniques, the term is in decline and is avoided here. (It could still be meaningfully used with reference to a specific historical repertoire, as in the proposition 'for Mahler when writing his Symphony No.7, "snap pizzicato" was an extended technique.') For new music-curious trainees passing through institutions of the ad hoc type, particularly during the pre-internet age, such texts were of crucial importance, since for some they were the only route to access any NMP-focused training beyond a haphazard succession of scores to be negotiated. As one interviewee — a member of that generation — told me, 'You got the score, and the fingerings [for unfamiliar microtones] if you were lucky.' During that period some of these manuals circulated, samizdat-like, in photocopies of dubious legal status.[80] Materials that focus on the techniques and expressive possibilities of particular instruments are referred to here as *instrument-specific materials* (ISMs). An overview of these materials is given in 2.2.

In addition to these, there exist potentially useful NMPT materials which are not focused on a particular instrument nor on a single compositional practice, but which are directly engaged with a performer's practice. Such materials, which are variously referred to as offering ear-training, ear-and-body training, rhythmic training, instruction in music theory, technical ear-training, and timbre-training, are here referred to as *non-instrument-specific materials* (NISMs). In the remainder of this text the less jarring term 'musicianship materials' is used. These materials are addressed in 2.3.

[78] And, in a few cases, much earlier. Ellen Fallowfield points to Carlos Salzedo, *Modern Study of the Harp* (Milwaukee: Schirmer, 1921) as an important precursor of the texts in this section, describing Salzedo's work as 'astounding given the early date of publication.' Ellen Fallowfield, 'Cello Map: a Handbook of Cello Technique for Performers and Composers,' (doctoral thesis, University of Birmingham, 2009), 5. In the same year (1921) the energetic Salzedo founded the International Composers' Guild alongside Edgard and Louise Varèse.

[79] The nomenclature of an action of an instrument, as it becomes integrated into practice, moves from 'special effect', to 'extended technique', to 'technique', and finally dissolves into unlabelled second nature. Few violin manuals remind us which hand holds the bow and which the instrument.

[80] The flautist and new music specialist Helen Bledsoe makes ironic reference to this period of restricted access in her pedagogical blog: 'Back in the USSR, when information was really suppressed, many people were hungry for the truth. Now governments hide the truth from us under a deluge of information. I think composers suffer from this deluge, but it is not a government conspiracy. The true range of the concert C flute is a matter of public domain, published in text books, on the internet, and God knows where else as a cold, hard fact. It is neither a state secret nor rocket science. Yet why is it ignored?' Helen Bledsoe, 'The True Range of the C Flute,' *Advice for Composers*, accessed Feb 15, 2024, https://helenbledsoe.com/the-real-range-of-the-c-flute/.

A great variety of other resources might figure on the reading list of a thoughtfully-constructed NMPT programme, including (in no order of importance): biographies and autobiographies of composers and performers, books and articles of historical musicology, analyses of individual works, resources relating to performer health and professional development, guidance about diversity and inclusion in working environments and repertoire choice, accounts of other performing artforms and approaches to interdisciplinary collaborations, technical support for audio hard- and software, and many more. To avoid what is already a very wide survey becoming unmanageable, this chapter confines itself to ISMs and NISMs. This should not be taken as an implied argument that these should form the core of a NMPT programme's reading list. Other materials may be found equally or more useful; the selection here reflects the focus of this study.

2.2 Instrument-specific materials: fertile lands

2.2.1 The twentieth century: printed materials

The composer Bruno Bartolozzi's *New Sounds for Woodwind* (1967) is frequently cited as a pioneering ISM.[81] Bartolozzi's areas of interest and basic categorisation (microtonal monophonic playing, multiphonics, and timbral variation) set the tone for many successor texts, even as the repertoire he had in mind is by now so historically distant that we might as well name Berlioz, Tartini, or Vincentino as progenitors. Indeed, Bartolozzi's approach has already been re-visited in HIP-like terms.[82] Many of the succeeding ISMs that appeared in the 1970s and 1980s are marked by earnestness and taxonomic zeal. Intrepid performer-prospectors, fired by the spirit of scientific discovery, would mine deeply into their instruments and unearth precious treasure (referred to as 'resources', or 'materials') which were sorted, graded, polished, then offered up to composers for use. In almost all cases this process was accompanied by pleas for validation: of the expressive capacities of the instrument itself (virtually every author arguing that their instrument was an unacknowledged goldmine),[83] and of the techniques they had discovered or invented. The flautist Robert Dick's mission statement, 'I set out to remove the non-traditional aspects [of flute technique] from the category of special effects and into the realm of valid musical materials,' is highly typical of the axiological intent of early (and some current) ISMs.[84] Many could be summarised as 'the sounds you thought were bad are actually good.' Some texts of this period, such as Phillip Rehfeldt's *New Directions for Clarinet* (1976) are still in use,[85] albeit in updated forms with multiple corrections and additions.

As members of the founder generation of specialised new music performers — a generation that included the original line-ups of the new music ensembles referred to in 1.2.4 above — amassed teaching experience

[81] Bruno Bartolozzi, *New Sounds for Woodwind*, trans. Reginald Smith Brindle (Oxford: Oxford University Press, 1967). Bartolozzi's book is cited in many of the successor texts in this section.
[82] Jade Caroline Barker, 'Applying Bartolozzi's theory from *New Sounds for Woodwind* (1967) to a performance of Bartolozzi's *Per Olga* (1976) and Smith Brindle's *Andromeda M31* (1967) mediated through the utilisation of the Bartolozzi-Mencarelli method,' (Master's thesis, Monash University, 2014).
[83] Bertram Turetzky, in *The Contemporary Contrabass* (Berkeley: University of California Press, 1974), 1, describes the development of pizzicato technique as 'until recently a barren wasteland.' Fallowfield, in 'Cello Map,' 11-12, provides further examples.
[84] Robert Dick, *The Other Flute, a Performance Manual of Contemporary Techniques* (London and New York: Oxford University Press, 1975), v.
[85] Phillip Rehfeldt, *New Directions for Clarinet* (Berkeley: University of California Press, 1977).

and seniority, they started to produce texts with an explicitly pedagogical intent. While all ISMs court a dual readership of composers and performers (as well as 'in-betweens'), their authors can partially direct the way their texts are likely to be used. Benny Sluchin's *Practical Introduction to Contemporary Trombone Techniques* (1995),[86] Joseph Marchi's high-clarinet *Études des harmoniques et du suraigu* (1994),[87] and Robert Dick's own extensive pedagogical output,[88] do not simply lay out their sonic-gestural spoils but provide progressive exercises for the acquisition of skills. Their envisaged primary consumers were not composers but the new crop of NMP trainees. Breitkopf und Härtel's Pro Musica Nova series, subtitled '*Studies for Playing Contemporary Music for* [instrument],' assembled eight volumes of such studies under the supervision of a formidable editorial team.[89] More recently, the *Viola Spaces* studies of Garth Knox are true compositions that have received several public performances.[90] A distinct conception of NMPT was coming into being: one which heavily stressed the acquisition of new instrumental techniques.

It was natural that publishers should seek to group texts with the (as yet unfulfilled) ambition of creating a range that covered the Western orchestral instrumentarium, since its families and subfamilies provided an obvious set of headings for a future 'Dewey Decimal Classification' of ISMs. The first such series of handbooks was the *New Instrumentation* series, edited by the contrabassist Bertram Turetzky (originally published by the University of California Press, and later Scarecrow Press.)[91] Bärenreiter, through its series *The Techniques of* [instrument] *playing* (sometimes referred to as the *Spieltechnik* series, with a nod to the multilingual format of some volumes), is currently the most active publisher of ISMs.[92] These books are presented as 'for use' in that they purport to document the state of the art rather than a historical performing practice. Some are co-authored with composers, while others are credited to performers alone. Musicians invariably refer to these texts by the name of the authoritative performer and not the hand-holding composer or technical helpers: 'Veale' not 'Veale, Mahnkopf, Motz, and Hummel,' 'Svoboda' not 'Svoboda and Roth,' etc. Each book stands as a monument of technical expertise, and some of these books are held by performers in high esteem bordering on awe. Since it is not usual for players of one instrument to read manuals relating to one in a different instrumental family — an error, as I argue in 3.2 below — it is worth

[86] Benny Sluchin, *Practical Introduction to Contemporary Trombone Techniques: 20th Century Excerpts* (Paris: Editions Musicales Européennes, 1995).
[87] Joseph Marchi, *Études des harmoniques et du suraigu* [Studies on the harmonics and the super-high register] (Paris: Editions Henry Lemoine, 1994).
[88] E.g. Robert Dick, *Tone Development through Extended Techniques for Flute* (USA: Lauren Keiser, 2008). Originally published by Multiple Breath Music Company, 1986.
[89] Wilhelm Bruck (guitar), Heinz Holliger (oboe), Alfons Kontarsky (piano), Aurèle Nicolet (flute), Igor Ozim (violin), Siegfried Palm (cello), Eckart Schloifer (viola), and David Smeyers and Beate Zelinsky (clarinet).
[90] Garth Knox, *Viola Spaces: Contemporary Viola Studies, Volume I* (Mainz: Schott Music, 2009), and Garth Knox, *Viola Spaces for Two: Contemporary Viola Studies, Volume II – 2 Violas* (Mainz: Schott Music, 2015).
[91] A list of these handbooks is given in Fallowfield, 'Cello Map,' 8.
[92] As of July 2024, the available volumes are (alphabetically by principal author): Jack Adler-McKean, *The Techniques of Tuba Playing* (Kassel: Bärenreiter, 2020); Irvine Arditti and Robert HP Platz, *The Techniques of Violin Playing* (Kassel: Bärenreiter, 2016); Bettina Buchmann, *The Techniques of Accordion Playing* (Kassel: Bärenreiter, 2018); Christian Dierstein, Michel Roth, and Jens Ruland, *The Techniques of Percussion Playing* (Kassel: Bärenreiter, 2018); Pascal Gallois, *The Techniques of Bassoon Playing* (Kassel: Bärenreiter, 2019); Nicholas Isherwood, *The Techniques of Singing* (Kassel: Bärenreiter, 2013); Seth F. Josel and Ming Tsao, *The Techniques of Guitar Playing* (Kassel: Bärenreiter, 2014); Carin Levine and Christina Mitropoulos-Bott, *The Techniques of Flute Playing* (Kassel: Bärenreiter, 2002) and *The Techniques of Flute Playing II* (Kassel: Bärenreiter, 2004); Mike Svoboda and Michel Roth, *The Techniques of Trombone Playing* (Kassel: Bärenreiter, 2017); Peter Veale, Claus-Steffen Mahnkopf, Wolfgang Motz, and Thomas Hummel, *The Techniques of Oboe Playing* (Kassel: Bärenreiter, 2014); Marcus Weiss and Giorgio Netti, *The Techniques of Saxophone Playing* (Kassel: Bärenreiter, 2010).

giving a flavour of this monumentality. Peter Veale's *The Techniques of Oboe Playing* presents 391 oboe multiphonics, ordered by progressively opening the instrument's holes from bottom to top, annotated with the level of air pressure required for their production, their playable dynamic range, their ease of production, their possible legato transitions, and their potential speed of repetition. Each multiphonic's frequency content was analysed with the aid of a computer,[93] the spectrum filtered by ear using insights from psychoacoustics, and the results notated as volume-marked pitches quantised to the nearest eighth-tone. Timbral information (whether the multiphonic sounds unstable, beating, rolling, or noisy) is also supplied. The menu of monophonic timbre fingerings is no less exhaustive: we learn, for example, that a C♯6 has no fewer than 26 possible fingerings.[94] The saxophone equivalent, authored by Marcus Weiss, is equally magisterial, its list of *Schwellentöne* ('threshold tones' — the individual tones that may be isolated from multiphonics) being a particularly novel feature. In addition to its rich taxonomy of techniques and their sounds, Weiss and Netti's text vividly evokes the way gesture and aural memory intimately fuse as a performer gains expertise. Their advice about the production of saxophone multiphonics could be applied (*mutatis mutandis*) to the acquisition of almost every instrumental technique:

> Only a small number of multiphonics are very easy to play. To realise the partials of a single fingering, a very flexible embouchure is necessary as is often the ability to clearly imagine the sound beforehand. This 'pre-hearing' of the sound is the recall of the physical posture that is saved in the lips, jaw, throat and head. […] It is a kind of 'physical motorical remembrance' [original: 'eine Art "physisch-motorisches Erinnern"'] of previous realizations of this sound.[95]

In this virtuous circle, the body leads the ear, which leads the body, and so on, in a spiral pathway up Mount Parnassus. A mark of the impact of these works is how rapidly they have achieved canonical reference status: a score might notate a particular oboe multiphonic as 'Veale 197' and a bassoon one as 'PG [Pascal Gallois] I/21 12'. In the face of such documentations of superabundant expertise it is easy to see how 'advanced' musical thinking has in some quarters become automatically equated with hyper-specialised instrumental expertise — for who would dare to seek to disrupt, or question the value of, such intimate connections of body and ear?

The book format has disadvantages, the most immediate of which is cost, both of production and purchase. Due to Bärenreiter's academic pricing model, purchasing all the available *Spieltechnik* books would cost €777 as of 2024, despite the range so far covering less than half of the orchestral instrumentarium, and despite most books in the series having leveraged external sources of funding for their writing. This severely restricts their impact, for while a bassoon student may well feel that an expenditure of €67 for the purchase of Pascal Gallois' *The Techniques of Bassoon Playing* is justified, the likelihood of that student additionally

[93] An ATARI personal computer running the Composers Desktop Project (CDP) software, as developed principally by Trevor Wishart from 1986 onwards at the University of York, UK. There is no reason to suppose that more recent developments would offer any improvement on the results of this now-vintage technology. Weiss and Netti take a different approach to the presentation of the pitch content of multiphonics. They eschew spectral analysis and notate pitches as the authors hear them, aided by a simple digital tuner. This difference in approach may be partially ascribed to the fact that it is generally easier to recognise the pitch content in saxophone multiphonics than oboe ones: saxophone multiphonics sound relatively 'loose' while oboe ones sound 'tight'.

[94] Veale, *Techniques*, 34-35.

[95] Weiss, *Techniques*, 139.

purchasing the accordion, violin, and tuba books is effectively nil.[96] While this may seem a trivial point, I argue below that this enforced silo-effect reflects and reinforces a distorted view of NMPT's methods and goals.

The performer-authors of these texts rarely foresaw or sought out the anointment of their creations as final works of reference. Such a designation, which is imposed by others, has its drawbacks. In his 1994 preface to the original edition of the oboe volume, Heinz Holliger sternly counsels that such a text '… no longer leaves any room for approximations or superficial knowledge.'[97] This can never be the case. While an assessment of the content of individual ISMs is outside the scope of this text, even the most detailed and rigorous of them certainly do approximate, as do all acts of mapping. Approximation and the filtering of information is indeed a key feature of the way such texts bring meaning to the seemingly infinite variety of ways real instruments can be played. Members of the clarinet family, for example, have been viewed as embodying intrinsic instability; more than one clarinettist has described their instrument to me as being 'out of tune with itself.'[98] Although clarinets have been particularly intensively researched,[99] they are still capable of springing surprises on even their most experienced players. Rather than throwing up their hands in the face of such complexity, the authors of their ISMs have proceeded with care, judging at every stage the appropriate level of granularity for reporting their findings: the appropriate (mapping) scale for each (musical) scale. In every such investigation, granularity could be increased and the taxonomies of reported items allowed to proliferate. The tendency to proliferate is the line of least resistance, both in the sense of the player's relationship with the instrument (which at times approaches obsessional love — a pursuit of knowledge of its most intimate contours) and also with the more prosaic considerations of academic defensibility in mind. However, a permissive attitude to the accretion of instrumentally-specific detail comes at the expense of translatability. Every step further into the 'grain of the voice' of an instrument (this much-cited formulation of Raymond Barthes being a useful shorthand for performative ultra-specificity) is a step away from the ready interchange of musical content with colleagues who play other instruments. While the early ISMs contained features such as fingerings for quarter-tones, which lent themselves relatively easily to translational, cross-instrumental, application ('your trumpet C♯ is my oboe C♯' — or rather, 'they are close enough in the given context'), phenomena like small-interval dyads on the clarinet,[100] 'Fawcett'

[96] Readers who have affiliations with tertiary institutions, and who have become used to their institution subscribing to paid content on their behalf, should recall that this is not the norm among professional performers.
[97] '… für Ungefähres und für Halbwissen kein Raum mehr sein wird.' Veale, *Techniques*, 5.
[98] As reflected in the title of one of its ISMs: Alain Sève, *Le Paradoxe de la Clarinette* [The Paradox of the Clarinet] (Paris: self-published, 1998).
[99] See, for example, Carl Rosman, 'Emergent behaviours in five long-term collaborations for clarinet,' (doctoral thesis, University of Huddersfield, 2021), 39-44; Sarah Watts, *Spectral immersions: a comprehensive guide to the theory and practice of bass clarinet multiphonics*, (Belgium: Metropolis Music Publishers, 2015); the resources by Roche, Alder, and Watts referred to in this section, and recordings by pioneering players including Harry Sparnaay and Alan Hacker.
[100] 'In the last few decades, one particular class of multiphonic has become an increasingly prominent resource in writing for clarinet: 'small-interval' dyads, obtainable only at a relatively quiet dynamic, featuring two clear, dynamically balanced pitches, without a tendency to merge into a sound aggregate, and with an interval between them usually smaller than an octave and sometimes as small as a semitone.' Rosman, 'Emergent behaviours,' 39.

harmonics on bowed string instruments,[101] or speed-controlled muraikis on the shakuhachi[102] are intimately wedded to those instruments, and also very often to the small set of players who have invested the time and energy required to perform them. The ISMs that seem to be most readily accessible to NMP trainees are those which employ judicious approximation and omissions to steer a confident course between the Scylla of what is translatable but abstract and consequently lacking attractive 'grain', and the Charybdis of what is ultra-specific and richly grained, but not translatable. As one ISM author put it to me, 'What's hard is knowing when to stop.'

The way the features of ISMs are syntactically arranged is not inevitable but reflects patterns of practice. Features could be arranged differently to create different knowledge structures: in 2020 the clarinettist Heather Roche and composer Scott McLaughlin conducted a re-categorising review of Rehfeldt's B♭ clarinet multiphonic chart that did just that.[103] Comparable future reviews may not only serve to heap on detail, but may offer the opportunity to take a more robustly selective attitude to the available content. In this respect what Holliger dismissed as undesirable dilettantism ('Halbwissen') may not count as such for others; there may be value in judicious ignorance if it helps a performer free up other aspects of their practice.

Nor are ISMs encyclopaedic in the sense of pointing straightforwardly to existing facts, although some read as if the techniques had always been somehow present, lurking in dark crevices of the instrument and awaiting discovery. Since they straddle the categories of discovery and creation, many may be read as travellers' tales of pioneering voyages, mixing reportage with artful confection. This contrasts with assumptions about the authorship of musical materials in earlier practice. For Mendelssohn, writing in 1834, it was his job as composer to conceive a sound even before a performer had made it available to him, and the performers' job to find a way to realise his demands. Concerning a written C minor chord in *Ouvertüre zum Märchen von der schönen Melusine,* Op. 32 (1833), he wrote:

> The E flat for the horns and trumpets I put down trusting to luck, and hoping that Providence would show the players some way to do it; if they have new contrivances for it, so much the better.[104]

(Mendelssohn may have had the very 'extended technique' of hand-stopped *trumpets* in mind!) However, we might reasonably doubt if a scale in eighth-tones on the oboe d'amore or musette could be said to have had

[101] 'This technique isolates harmonics with bow placement.' Valerie Welbanks, 'Foundations of modern cello technique: creating the basis for a pedagogical method,' (doctoral thesis, Goldsmiths, University of London, 2017), 58. Welbanks notes that nobody seems to have discovered who Fawcett is or was.
[102] Michèle Castellengo, Benoît Fabre, and Catherine Dale, 'The contemporary transverse flute and the shakuhachi: Convergences,' *Contemporary Music Review* 8, no. 2 (1993): 217-37.
[103] This was just one element of a large 'laboratory-style' practice research project: Scott McLaughlin, Heather Roche, and collaborators, *The Garden of Forking Paths* (2019-2021), accessed Jan 05, 2023, https://forkingpaths.leeds.ac.uk/resources/.
[104] *Letters of Felix Mendelssohn to Ignaz and Charlotte Moscheles*, ed. and trans. Felix Moscheles (New York: Books for Libraries Press, 1970), 97. Mendelssohn's casualness here may seem to embody a rather lofty attitude towards the players — a milder echo of Beethoven's legendary dismissal of Schuppanzigh's 'elende Geige' ['miserable fiddle']. However, it actually conforms to the interactional preferences of some experienced performers. In a rehearsal, one woodwind player became tired of the profusion of excerpts of ISMs in their part (fingering charts for microtonal tremolos and multiphonics), as lavishly supplied by a well-intentioned composer, and said 'look, just write what you want to hear, and we'll find a way.' Such an approach, they explained to me later, would have ultimately been more respectful of *their* expertise.

any real existence before Veale's book, let alone some of the more elaborate items in ISMs such as 'teeth on reed + glissando + flutter tongue' on the soprano saxophone,[105] or 'impressionistic polyphony' on the guitar.[106] Each of these musical objects is charged with a such a quantity of expressive content that they resemble phrases or even little pieces more closely than single 'notes'.[107]

Even if they do not directly acknowledge the fact, ISMs are less concerned with directing the production of particular gesture-sound nexuses, and more concerned with those nexuses being made distinct to the body and ear, their stabilisation, and, crucially, their replicability. After all, my six-year-old, whose violin practice could be described as highly experimental, has no trouble producing half-harmonic-pressure string multiphonics and diagonal flautando bowing, but might struggle to reproduce these features on demand. Rather than viewing these texts as final comprehensive reference works (as Holliger implied, and as some admiring reviews quoted in the blurbs of ISMs claim) they are better seen as impressive and detailed codifications of the expressive preferences of a current practice. From the standpoint of 2024, twentieth-century titles like *The Avant-Garde Flute* may seem quaint.[108] With further perspective they may seem to be apt descriptions of a specific historical practice, while today's more putatively general, publisher-mandated, titles ('*Die* Spieltechnik…') may seem like cases of mild overreach.

2.2.2 The twenty-first century: the move online

Online formats, which intrinsically resist claims of finality or completion, mirror the shape of practice more naturally. Because online content may be updated at little cost, error traps may be avoided. In conversations, interviewees noted the presence of various small but vexing errors in some books in the *Spieltechnik* series (not in the Veale or Weiss volumes discussed above), observing that in some cases they knew that the authors were aware of these errors but that funding to produce a new edition was unavailable. An online format offers the additional advantage of allowing audio- or audio-visual content to be integrated with the text, rather than being supplied on an accompanying CD. Unsurprisingly, there has been an explosion of online ISMs in the past two decades, some of which are at least as ambitious as the books in the *Spieltechnik* series, if not more so. Examples include Ellen Fallowfield's *Cello Map* (a project whose format traced a very twenty-first-century path from diagram-laden doctoral thesis to website to mobile app),[109] Heather Roche's

[105] Weiss, *Techniques*, 169.
[106] Josel, *Techniques*, 43.
[107] After writing this paragraph, I discovered a very similar observation in Rosman, 'Emergent behaviours,' 18: 'Adorno polemically notes concerning a child who has found a new harmony on a piano: "[...] But the chord was always already there, the possibility of combinations is limited, actually everything already rests within the keyboard itself". To what extent can multiphonics and other recently-developed resources be said to be "already there" in an instrument [the clarinet] which reached its current key layout around 180 years ago, at a time when even such a repertoire staple as Robert Schumann's 1849 *Fantasiestücke* had yet to be written? One hesitates to imagine an enterprising soloist in the 1840s presenting Schumann with a palette of small-interval dyads – and yet these techniques are perfectly possible on instruments of this vintage. Whether or not (and in what sense) these resources can reasonably be considered as already "resting within" the instrument of Buffet and Klosé's 1844 patent, the instrument is being used to achieve a result that its creator could not conceivably have foreseen. The instrument has barely changed; the performer has constructed new affordances.'
[108] Thomas Howell, *The Avant-Garde Flute: A Handbook for Composers and Flautists* (Berkeley: University of California Press, 1974).
[109] Ellen Fallowfield, 'Download the New App: CellomApp', *Cellomap*, accessed Oct 2, 2023, https://cellomap.com, link to 'Apple App Store Preview', https://apps.apple.com/jp/app/cello-map-app/id1529456113?l=en.

immense and rich clarinet blog,[110] the innovative (but not universally-admired) web project *The Virtual Flute*,[111], Helen Bledsoe's highly practical flute blog,[112] online materials on low clarinets by Jason Alder,[113] and videos by the trumpeter Nathan Plante (*The Modern Trumpet.*)[114] Some content was released under the aegis of established new music ensembles, such as the video series *Studio Musikfabrik Online Learning* of Ensemble Musikfabrik.[115] The informality characteristic of internet style encouraged authors of some online ISMs to adopt a tone less solemn than the encyclopaedic one struck by some of their predecessors. Roche's description of a set of 'fingered multiphonics with spectral aspects […] that can also be ultra-underblown' as sounding 'somewhere between a clarinet and a distressed goose,' is not only entertaining but arguably more descriptive than a chart of the sounding pitches (these are supplied too.)[116]

While earlier texts presented their primary content in the form of annotated musical notation with accompanying audio materials, for some of these newer resources the audio or video itself was the primary content. This permitted not merely the demonstration of a technique in isolation, but an understanding of its environment; specimens were no longer captured and pinned to a card in isolation but allowed to flutter in the leaves a little. Woodwind multiphonics have been the mainstays of ISMs since Bartolozzi; while the attention of readers of printed texts is drawn primarily to their pitch content,[117] viewers of videos are as likely to notice the nature and duration of the performer's preparatory breath, the level of tension in their facial muscles, the level of controllability of internal elements of the sound (which pitches come in first? can they be predicted or delayed?), the overall fragility of the technique (what is its likely failure rate? what does such failure sound and look like?), and how fatiguing it seems to be, or is reported to be, for the performer. Comparable videos of string techniques allowed viewers to witness the patterns of effortful extension in performers' hands and arms, while video demonstrations of inside-piano playing encouraged a better appreciation of the time required for the body extension and accurate hand-positioning of such work (this duration being almost invariably longer than desk-bound composers had tended to allow, routinely occasioning what one of my interviewees called 'the usual mad scramble.')

The implications for composers of being offered a more complete understanding of a technique's environment via video were manifold. On the positive side of the ledger, the opportunity directly to witness

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110 Heather Roche, 'Index – Table of Contents,' *Heather Roche*, accessed Aug 15, 2023, https://heatherroche.net/2014/05/26/index-table-of-contents/.

111 Andrew Botros, 'About The Virtual Flute,' *The Virtual Flute*, accessed Aug 27, 2023, https://flute.fingerings.info/about.html; Andrew Botros, John Smith and Joe Wolfe, 'The Virtual Flute: an advanced fingering guide generated via machine intelligence,' *Journal of New Music Research* 35, no. 3 (2006): 183-196.

112 Bledsoe, 'Advice.'

113 Jason Alder, 'Resources,' *Jason Alder: Bass Clarinetist*, accessed Feb 15, 2024, https://www.jasonalder.com/resources/; Jason Alder, 'Compendium of sonic possibilities of the contrabass clarinet: a study of cross-compatibility and composer collaboration,' (doctoral thesis, The Royal Northern College of Music in collaboration with Manchester Metropolitan University, 2021).

114 Nathan Plante, 'Welcome to The Modern Trumpet!' Aug 9, 2020, *The Modern Trumpet*, accessed Mar 10, 2023, http://themoderntrumpet.com/2020/08/09/welcome-to-the-modern-trumpet/.

115 'SMOL – Studio Musikfabrik Online Learning', *Ensemble Musikfabrik*, accessed Dec 12, 2022, https://www.musikfabrik.eu/en/academy/studio-musikfabrik/smol/.

116 Heather Roche, '"Ultra-Underblown Multiphonics": Part 2 of the recategorisation of Philip Rehfeldt's chart,' *Heather Roche*, accessed Aug 27, 2023, https://heatherroche.net/2020/03/17/ultra-underblow-mutiphonics-part-2-of-the-recategorisation-of-philip-rehfeldts-chart/.

117 For simplicity I elide 'pitch content' and 'frequency content'; elsewhere in this text (2.3.3) I make the distinction clear.

patterns of bodily effort in advance of a rehearsal process helped guard against the tendency (prevalent in the 1990s and 2000s) of treating the *embarras de richesse* of items in an ISM like items on a DAW's piano roll that may be infinitely reproduced and stitched together at will. A composer who has witnessed a demonstration of the physical effort involved in the production of a flute jet whistle is less likely to write a succession of them at the end of a long phrase, particularly if the instructor has explicitly warned that this is a taxing technique. (I recall one exhausted performer of a different instrument spluttering 'Wish I hadn't put *that* one in the book!' while workshopping student compositions in the mid-2000s.) This contributed to a new and welcome atmosphere of openness around matters of performer endurance and consent, albeit one mostly in evidence in self-consciously experimental interactions and much less so within large-ensemble or orchestral contexts (see 5.4 below.) When scrutinised on video, the fragility and riskiness of certain techniques loomed so large that for some composers they took on a fetishistic aspect. This was a seductive but perilous place to hang a practice with hopes of future performances, since the zonal limits of 'core' instrumental technique (the region that such composers found relatively uninteresting) change so rapidly that what is intrinsically fragile (and consequently interesting) today may be routine and effortless tomorrow. The famous bassoon high C that opens *Le Sacre du printemps* has had such a historical trajectory; moving from an place of strain and risk at the time of its composition — Stravinsky talked of evoking 'the violent Russian spring […] that was like the whole earth *cracking*' (my emphasis)[118] — to its usually unproblematic execution by professional bassoonists today. (It would be amusing to witness a player's response to a conductor who asked for the note to sound less secure!) The widespread availability of online 'embodied' content thus presented composers with a host of benefits and a few potential traps.[119] For performers, on the other hand, it was an unmitigated boon, since, as one trainee put it, 'A video is worth a thousand words.' A conductor faced with a player who is struggling to execute a notated technique, or who is unfamiliar with the expected result, can discreetly point them in the direction of an expert video demonstration during a rehearsal break, thus avoiding awkwardness or a didactic atmosphere during the rehearsal, along with any pretence that a conductor is automatically (or perhaps ever) the best person to advise on these questions.

Online formats have their disadvantages, however: the stable availability of content is subject to the vagaries of internet service providers; access, undirected by the authoritative-seeming imprimatur of (for example) a publisher famous for its Urtexts, is subject to opaque search engine algorithms which often point to outdated or actively misleading materials; finally, the non-linear structures that the format favours provide an open invitation for composers in hurried search of content to skip over potentially crucial contextualising

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[118] Stephen Walsh, *The Music of Stravinsky* (Oxford: Oxford University Press, 2001), 41.

[119] Such traps recede if the composer chooses to focus on their present active practice and to deprioritise the projective (future-performance directed) aspect of notation. The varied contributors to the *Fragility of Sounds* artistic research project seemed to be linked by this preference. As the convenor Pia Palme put it, 'Examining the word com-posing, we find the term with [Latin: *com*] right in the prefix. In essence, my practice is an activity: as an artist I do something – often with others.' The project described this working model as being interwoven with feminist practice. It should be noted that there also are many female-identifying composers whose practice retains a 'traditional' working model: the preparation of a detailed notated score 'at the desk,' its publication, and its dissemination to performers present and future, with the composer choosing to intervene minimally or not at all during the rehearsal process. Performers are not obliged to choose their allegiances in this regard; since they may move freely between these worlds, an NMPT programme will need to prepare trainees for encounters with both working methods. Pia Palme et al., *Project AR 537: On the fragility of sounds* (Graz: Centre for Gender Studies and Diversity, KUG University of Music and Performing Arts Graz, 2019-2022), accessed Feb 2, 2023, https://www.fragilityofsounds.org.

material. For these reasons, the question 'book, blog, or app?' is a live one among performer-researchers. The direction of traffic is not one way; contributors such as Barbara Maurer[120] and Mira Benjamin[121] have opted to present their research outputs in long form. Explicitly pedagogical performance material, such as Hans Cafmeyer and Luk Vaes' *Peyotl* — a series of short piano pieces for young learners that appealingly include 'improper' playing methods adapted to children's physical characteristics — naturally continue to be presented in printed form.[122]

2.2.3 The future of ISMs

The overall outlook for the production and support of future ISMs looks positive. Within academia, such projects fit well within the 'embodied turn', or 'corporeal turn':[123] the broad shift of research interest in the past two or three decades towards projects that embrace 'knowing-how' as well as 'knowing-that' (to echo Gilbert Ryle's influential formulation.)[124] Within musicology, this was manifest in the explosion of activity in 'performance studies' in that period.[125] Accordingly, many recent projects have been funded through academic channels, although other funding sources have been used, including the budgets of new music ensembles themselves and online membership platforms such as Patreon. Indeed, 'embodied' approaches, for which the currently favoured language is of 4E cognition ('thinking that does not occur solely in the head, but is Embodied, Embedded, Enacted, or Extended'),[126] are now so dominant in the discourse of the humanities that the interdisciplinary theorist James Carney, in his 2021 review of the field, even referred to 4E as a 'savage god' that required placating, observing that

> To query 4E cognition is to be somehow gauche: bodies are where it's at, and you must surely wear socks with your sandals if you think otherwise.[127]

As a performer, it is hard to avoid the impression that in this respect the academic consensus acidly identified by Carney had laboriously attained territory that performing musicians had never abandoned.[128]

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[120] Barbara Maurer, *Saitenweise: Neue Klangphänomene auf Streichinstrumenten und ihre Notation: Eine Anleitung* [String by string: [the original title includes a word play on 'Seitenweise' ('page by page')+'Saiten' ('strings')]: new sound phenomena on string instruments and their notation: a guide] (Wiesbaden: Breitkopf & Härtel, 2014).

[121] Mira Benjamin, 'Thick Relationality: Microtonality and the Technique of Intonation in 21st Century String Performance,' (doctoral thesis, University of Huddersfield, 2019).

[122] Hans Cafmeyer and Luk Vaes, *Peyotl: volume 1* (Ghent: Orpheus Institute, 2017). This was a successor project to Vaes' monumental study of extended piano techniques: Luk Vaes, 'Extended piano techniques: in theory, history and performance practice,' (doctoral thesis, University of Leiden, 2009).

[123] Maxine Sheets-Johnstone, *The Corporeal Turn: An Interdisciplinary Reader* (UK: Imprint Academic, 2015).

[124] Gilbert Ryle, 'Knowing How and Knowing That: the Presidential Address,' *Proceedings of the Aristotelian Society* 46 (1945): 1-16.

[125] A vast field, including key contributions from John Rink, Nicholas Cook, Jonathan Dunsby, and many others. See John Rink, 'The State of Play in Performance Studies', in *The Music Practitioner: Research for the Music Performer, Teacher and Listener* , ed. Jane W. Davidson (Abingdon: Routledge, 2016): 37-52, and Ian Pace, 'The New State of Play in Performance Studies,' *Music and Letters* 98, no. 2 (2017): 281-92.

[126] Albert Newen, Shaun Gallagher, and Leon de Bruin, '4E Cognition: Historical Roots, Key Concepts, and Central Issues,' in *The Oxford Handbook of 4E Cognition*, ed. Albert Newen, Leon de Bruin and Shaun Gallagher (Oxford: Oxford University Press, 2018), 4.

[127] James Carney, 'Thinking avant la lettre: A Review of 4E Cognition,' *Evolutionary Studies in Imaginative Culture* 4, no. 1 (2020), 79.

[128] Nor, it seems, had experts in other fields. Carney writes: 'So where now for 4E cognition? To start with, it is no longer the future and probably needs to stop saying so. The shambling, wheezing Brezhnev awarding himself the Order of Lenin for zeal in the cause of revolution is not a good look, but that is what 4E resembles when it burnishes its revolutionary credentials thirty years after the revolution has ended.' Ibid., 86.

Our everyday patterns of speech encode what might be called a native '4E-lite' position: pianists routinely say that a tricky phrase is 'in' (or 'not yet in') 'my fingers' or 'my muscle memory', while a singer in a rehearsal might ask for 'time to get it [an interval, or a phrase] into my voice.' The quotation from Weiss and Netti's text (see 2.2.1 above) gives a sense of the way musical performers, octopus-like, experience their cognition to be thoroughly (but not evenly) distributed within their bodies and not solely located in the cranium. Related developments in the wider philosophical and interdisciplinary literature encourage a further expansion of the locus of performer cognition. At the risk of parroting the formulations of another recent vowel-duplicated initialism — OOO (object-oriented ontology) — such thinking might even be understood as taking place within the instrument itself. In this ontologically flat paradigm our main instrument may be conceived not merely as an extension of our body but as an object with its own agency.[129] At the minimum, the question of whether I play the violin or it plays me is non-trivial. The relationships between players and 'their' instruments (or is it the other way around?) have been the subjects of several recent documentations. A representative example is M. Elizabeth Fleming's *The Incorporated Hornist: Instruments, Embodiment, and the Performance of Music*, whose author, a self-described 'assemblage of horn and human operator, a cyborg' describes her relationship with her instrument (deliciously riffing on a formulation by Peter Szendy) as *cor à corps*.[130] Comparably, the performer and researcher Zubin Kanga calls himself a 'cyborg pianist.'[131] While the language is modern, the idea is very old. In *Hamlet*, Claudius admiringly describes a horseman in essentially identical terms:

… he grew unto his seat;
And to such wondrous doing brought his horse,
As he had been incorpsed and demi-natured
With the brave beast:[132]

Skilled instrumentalists generally feel quite at home with their 'incorpsed and demi-natured' status, whether their instrument is digitally-augmented or conventional, and regardless of their degree of awareness of recent developments in philosophy and interdisciplinary thinking. Consequently, I suspect that they have little need of rescuing from perceived errors of Cartesian dualism, despite such straw men being arduously erected and destroyed in the ISMs that work so hard to promote the value of embodied cognition. Fleming finds the following question, posed by the scholar of performance studies Diana Taylor, pertinent:

How would our disciplines and methodologies change if we took seriously the idea that bodies (and not only books and documents) produce, store, and transfer knowledge?[133]

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[129] Graham Harman, 'An outline of object-oriented philosophy,' *Science Progress* 96, no. 2 (2013): 187-199; Levi R. Bryant, *The Democracy of Objects* (Ann Arbor: Open Humanities Press, 2011).
[130] M. Elizabeth Fleming, 'The Incorporated Hornist: Instruments, Embodiment, and the Performance of Music,' (doctoral thesis, City University of New York, 2019), 35. Fleming leads her abstract with the obligatory reference to Barthes' formulation 'the grain of the voice,' and continues, 'Stated simply, this project asks *What is the body in the horn as it sounds?* (ibid., iv). As her text makes amply clear, there is nothing simple about this question.
[131] Kanga, *Cyborg*.
[132] William Shakespeare, *Hamlet: Revised Edition – The Arden Shakespeare*, ed. Ann Thompson and Neil Taylor (London and New York: Bloomsbury, 2016), 4.7.85-88. Reference is to act, scene, and lines.
[133] Diana Taylor, *Performance* (Durham: Duke University Press, 2016), 199.

If the 'our' in Taylor's question were to refer to musical performers rather than academics, I suspect the response would be: hardly at all. (Thankfully, I have never encountered a *disembodied* hornist.) The impact of this change of climate is felt more in academic circles than performing ones. This has concrete implications for the apportionment of funding for future projects. The existence of performers who very obviously embody richly detailed but non-verbal forms of knowledge (and who know it) is now, happily, deemed of interest not only to researchers working in music departments ('performance studies') but potentially also to those from the many faculties that may fall under the very wide 4E umbrella. In a clear signal of the academic respectability that performers now are granted, the 'last word' in *The Oxford Handbook of 4E Cognition* is given to the philosopher and ballet dancer Barbara Gail Montero.[134] I return to Montero's thought in Chapter 4.

Spurred on by this synergy between the newly smiling gatekeepers of academic funding and the real existence of deep and only partially charted pools of performing expertise, it seems likely that investigations of the 'knowing how' of performers, of which the production of ISMs forms a small but significant part, will continue apace. Wherever there is an under-documented instrumental or vocal practice, it seems that an expert will swiftly jump in to fill the gap. Recent and ongoing projects have investigated newer instruments such as the contraforte,[135] new techniques on familiar instruments such as pitch-bent microtones on the piano,[136] multiphonics on the harp,[137] and glissandi on the organ,[138] the re-engineering of familiar instruments such as the Howarth-Redgate oboe[139] and the 'Kingma system' low flutes,[140] the renewal of interest in overlooked instruments such as the musette,[141] the heckelphone,[142] the traverso flute,[143] and the Strohviolin,[144] as well as the (post)digital hybrid creations of 1.2.8 above. Despite some unresolved questions of format and reach, and despite the caveats I have expressed about the claims and internal structures of some ISMs, the broad picture is that today's NMP trainees have access to a corpus of materials that is rich, varied, actively evolving, and marked by significant contributions created by passionate experts.

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134 Barbara Gail Montero, 'Embodied Aesthetics,' in Newen et al. (eds.), *Handbook*, 891-910.
135 Lorelei Dowling, contraforte research project (KUG University of Music and Performing Arts Graz), in progress.
136 Sanae Yoshida, 'The Microtonal Piano and the Tuned-in Interpreter,' *Tempo* 74, no. 291 (2020): 77-84.
137 Gunnhildur Einarsdóttir, 'Multiphonics on the Harp: Initial Observations,' *Tempo* 74, no. 291 (2020): 71-75.
138 Alyssa Aska, Klaus Lang, Pablo Abelardo Mariña Montalvo, and Martin Ritter, 'Extended Techniques,' *Organon*, n.d., accessed Aug 15, 2023, https://institut1.kug.ac.at/projekte/organon.
139 Christopher Redgate, 'Transforming the Oboe: creating an instrument for the 21st century,' (lecture, Goldsmiths, University of London, Jan 23, 2020).
140 Carla Rees, 'Collaboration in practice: developing a repertoire of extended techniques for the Kingma System alto and bass flute,' (doctoral thesis, Royal College of Music, 2014).
141 Veale, *Techniques*, 159-169. Instruments of the oboe family have been added to the volume in successive updates since its first publication in 1994.
142 Ibid., 175-181.
143 Matteo Gemolo, 'Extended techniques on the traverso: The case of the glissando and the flattement,' *IMPAR Online journal for artistic research* 2, no. 2 (2018): 30-47.
144 Max Haft, 'Research,' *Max Haft*, n.d. (in progress), accessed Jan 10, 2024, https://www.maxhaft.com.

2.3 Non-instrument-specific materials: a patchy scrubland

2.3.1 Where musicianship usually stops

An overview of those materials that may be of actual or potential use by NMP trainees but which are not specific to a particular instrument, nor to a particular work or composer's practice — 'NISMs' — produces a very different impression. In contrast to the broad, deep, and active field of ISMs, the provision of NISMs is patchy and hard to navigate. The field is characterised by intense expert activity in some highly specialised areas and significant lacunae in others. Its most striking absence is a lack of bridging materials, both between the actively researched specialised areas, and between these areas and broader 'classical music' training models. In Chapters 3 and 4 below I attempt to explain why creating such bridging materials seems to be so exceptionally challenging. In this section I look at the context and intended readership of some selected NISMs. Where these materials are considered of direct practical relevance to this project — that is, those materials that either are currently in use by NMP trainees, or those that (in my view) could be considered as appropriate for such use — they are noted here and revisited at greater length in Part II. In this section I proceed as if it were unproblematic to separate the musical parameters of pitch, timbre, and rhythm, since a discussion of the challenges that parametric interactions pose to NMPT is the subject matter of 4.1.

The parameter of pitch has historically been given pride of place at the musicianship table.[145] This has sometimes caused frustration for the champions of other musical parameters (see 2.3.4 below.) NISMs focusing on pitch are therefore heavily informed by, and sometimes in thrall to, the categories and procedures of the traditions of 'solfège / solfeggio', 'aural training', 'formation musicale', 'Hörerziehung', and 'Gehörbildung'.[146] Lotta Ilomäki[147] and Monika Andrianopoulou[148] have written detailed histories of this field, documenting the various ways instructors have conceived these overlapping but non-identical areas of activity. These accounts, which are informed and enriched by their authors' own practical teaching experiences, stress the absence of consensus among instructors about how skills of pitch should best be taught, even before other musical parameters are considered. Other studies concur: Violaine de Larminat, for example, compares, contrasts, and attempts to synthesise, French and German methods.[149]

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[145] Lotta Ilomäki, *In Search of Musicianship: A Practitioner-Research Project on Pianists' Aural-Skills Education* (Helsinki: Sibelius Academy, 2011), 20. Ilomäki writes, 'My present formulation of sub-skills gives strong emphasis to musical pitch, while addressing, for example, rhythm and texture only in connection with patterning. I made the choice of these limited sub-skills to map some of the most discussed topics in aural-skills literature, and to provide some background for my practitioner-research project, in which harmonic study was one special topic of interest. I share, however, the viewpoint of those recent authors who have warranted increasing attention in aural-skills education to other musical parameters [a long list of references is provided].'

[146] 'There is some difference between schools and countries in the relative emphasis of performing-related skills and analysis as the ultimate goals of aural-skills education. Traditionally, the *solfège* tradition in Romanic counties has tended to stress sight-reading skills and conceive itself as a support for performing […] The German *Hörerziehung*, on the other hand, has been much more oriented towards aural analysis […] Sometimes institutions have separate lessons for the two types of emphasis.' (Ibid., 13).

[147] Ibid.

[148] Monika Andrianopoulou, 'Aural Education and Its Pedagogical Conceptualisation in Higher Music Education: An investigation through varied perspectives' (doctoral thesis, University College London, 2018).

[149] Violaine de Larminat, 'Gehörbildung zwischen französischer und deutscher Tradition – Versuch einer Synthese,' [Ear-training between French and German traditions – an attempt at a synthesis], *Zeitschrift der Gesellschaft für Musiktheorie* 5, no. 1 (2008): 121-62.

Notwithstanding these documented differences in approach, a common picture that emerges from these accounts of tertiary level provision is the relatively modest status and reach of the conservatoire musicianship instructor when working within that conservatoire's mainstream repertoire. Such an instructor is typically viewed as a supporting player or cicerone, while one-to-one instrumental/singing/conducting instruction, chamber music coaching, and orchestral training are the artistic-pedagogical main events; the appointment of a musicianship teacher is rarely trumpeted in conservatoires' press releases. Musicianship is uneasily confined, Poland-like, by the surrounding territorial claims of instructors in other departments. If musicianship training is conceived as a prop, as the trained performer gains in ability and status the need for such a prop falls away. In this pedagogical pathway the territory of musicianship (broadly driven by an impulse to find and transmit musical commonalities) is gradually eaten up by concert-orientated performance training (broadly driven by an impulse to make differences distinct: 'get to the heart of *this piece*'). Unsurprisingly, some ambitious musicianship instructors chafe at such restriction:

> I felt I had problems confining my interaction with the students to the set of activities which has become normative in aural-skills courses.[150]

The territory of NMPT provision, while not quite virgin, has been far less staked-out. NMPT instructors in tertiary programmes who seek to expand their pedagogical scope are less likely to tread on the toes of colleagues than their non-specialised equivalents, since they are often already subject to institutional separation. (In less culturally sensitive times the phrase 'the new music ghetto' was sometimes used to describe this separation.) Nevertheless, the conceptual legacy of musicianship as a prop, intended to fall away as the student progresses into the more advanced worlds of pure performance, continues to influence the default structure of these programmes. Where musicianship training is conceived in this way we can clearly see why it is not automatically associated with NMPT — a supposedly advanced specialism that is most appropriately offered to postgraduates (3.2, 4.1.)

Ilomäki's astutely diagnosed sense of restriction contrasts to the loftier status granted to 'theory' (meaning here the teaching of any musical feature outside its application in a particular instance of practice, be it in the composition of a work or a performance) in some other performer training models. In Karnatic pedagogy, for example, the musical elements initially presented in theory-like terms are later revealed as intrinsically foundational elements of the final performance rather than post hoc abstractions.[151] Accordingly, they are couched in grander language: konnakol itself has been variously translated as the 'ruler' (or 'prince', or 'sceptre') 'of rhythm.'[152] Early-years musicianship teaching methods, such as Kodály-based approaches, also do not tend to be shy about making 'foundational' claims about their scope and

[150] Ilomäki, *In Search of Musicianship*, 1.
[151] Rafael Reina, *Applying Karnatic Rhythmical Techniques to Western Music* (London: Routledge, 2016): 3-4.
[152] 'Konnakol derives its name from two Tamil words Konnal (or Konnai) and Koal. Konnai literally means to 'stutter' when speaking but here denotes to recite rhythmic musical phrases. Koal is a 'sceptre' […] and also equates to 'rule'. Thus the word 'Konnakol' implies that it is the ruler of rhythmic music, indeed it is the 'King' of all the percussion instruments as it is the essential vocal reference.' 'Konnakol', *Nathalaya Academy of Rhythmic Arts*, n.d., accessed Aug 14, 2023, https://www.nathalaya.co.uk/classical-and-carnatic-instruments/vocals/konnakol. According to the konnakol practitioner Somashakhar Jois, 'undeniably any percussion technique, from any part of the world, can be comprehended and reproduced perfectly with the help of Konnakol.' Sriram Ravishankar, 'Wizardry!', *The Score magazine* 11, no. 3, March 2018, 31.

importance.[153] The more restricted permitted ambitions of musicianship in (Western, and Western-model) tertiary education are reflected in some of the materials addressed here.

The ear-training approaches examined by Ilomäki and Andrianopoulou are almost exclusively concerned with the procedures of pre-war — indeed, overwhelmingly pre-twentieth-century — repertoire.[154] The fact that more recent music is not included does not reflect poorly on these studies. Rather, it reflects a consensus within conservatoire musicianship teaching about the historical-stylistic barrier — which in reality resembles less a sharp barrier than a rapidly-gathering fog — beyond which the guiding Virgils of ear-training can go no further. Music beyond this barrier is deemed to be so stylistically diverse that any musicianship guidance would be impossible. This fog starts to gather somewhere around the inter-war period;[155] the century-old practices of Bartók and Berg are glimpsed in flashes through its haze. No Beatrice conventionally replaces Virgil: after this point the student is left to proceed mapless and alone, groping from work to work.[156] In this model, the training performer of Mozart's music is offered extra repertoire-tailored 'musicianship' guidance while the performer of Lachenmann's music is not — a curious state of affairs given the rhetoric of difficulty that has conventionally accompanied new music. I do not subscribe to the view that it is easier to perform Mozart than Lachenmann, either from the instrumental-technical or the musicianship points of view. However, given the persistence of this perception, it might be thought that institutions would seek to provide extra support to performers of the latter rather than the former.

2.3.2 Pitch NISMs

2.3.2.1 Microtones absent

Some creators of general ear-training (meaning, in most cases, pitch-focused) materials have ventured beyond the historical-stylistic barrier. Ulrich Kaiser, in two volumes of *Gehörbildung*,[157] prioritises extracts of real scores over the often-problematic taxonomies that featured in earlier texts.[158] Although his treatment of twentieth-century music is brief (it concludes with Webern), his lively and undogmatic approach, in tending to undermine assumptions about 'common practice' in pre-twentieth-century repertoires while still offering insights with broad applicability, could prove a useful model for future work in newer music. Through his Open Music Academy website, supported by institutions including the Munich and Düsseldorf

[153] 'Kodály training […] can be applied to all kinds of music from classical to world music and jazz,' 'The Kodály Approach', *British Kodály Academy*, n.d., accessed Aug 10, 2023, https://www.kodaly.org.uk/the-kodaly-approach.
[154] See the list of materials used in Ilomäki, *In Search of Musicianship*, 299-301.
[155] Violaine de Larminat, 'Methodologie und Problematik der Höranalyse des Repertoires des 20. Jahrhunderts am Beispiel der ersten *Offrande* von Edgar Varèse' [Methodology and problems of listening analysis of the 20th century repertoire using the example of the first *Offrande* by Edgar Varèse], in *Musiktheorie – Begriff und Praxis: 2. Jahreskongress der Deutschen Gesellschaft für Musiktheorie München 2002*, ed. Stefan Rohringer, 203–221.
[156] A long complaint to this effect is made by David Doty, in *The Just Intonation Primer* (USA: The Just Intonation Network, 2002), 7.
[157] Ulrich Kaiser, *Gehörbildung: Satzlehre, Improvisation, Höranalyse. Ein Lehrgang mit historischen Beispielen* [Ear-training: 'Satzlehre' [no close English equivalent: the activity of arranging notes harmonically or contrapuntally], Improvisation, Listening analysis. A course with historical examples], vols. 1 and 2 (Kassel: Bärenreiter, 1998).
[158] For example, the naming of Italian, German, and French augmented sixth chords — terms that notoriously bear little connection to musical practice. As a child I wondered if a Neapolitan sixth was a combination of all three flavours of sixth, like a Neapolitan ice-cream.

Hochschulen,[159] Kaiser has also improved the online availability of pedagogic and music theory texts, although it contains few materials focused on new music as yet.

Other publications are less informative. Kent Cleland and Mary Dobrea-Grindahl's *Developing Musicianship through Aural Skills: A Holistic Approach to Sight-Singing and Ear-Training*, for example, claims to be both 'holistic' and 'comprehensive.'[160] Turning to newer music, its authors do not mince their words:

> Few musicians will have the luxury of being able to avoid twentieth-century music altogether throughout their careers. […] In the end, it's OK to dislike this literature.[161]

Since the authors' awareness of 'this literature' in this 2010 (!) work seems to conclude with a brush encounter with pitch-class set theory (most usually associated with Allen Forte's 1973 *The Structure of Atonal Music*), their recommendation to approach it through gritted teeth is perhaps understandable.[162] I do not invoke this book as a cheap target but as evidence for the continued survival of a conception of musicianship that some may have thought extinct. The book is actually relatively unusual among non-specialised accounts in supplying some guidance, however misconceived and grudgingly offered, directed at 'non-tonal' music (as they call it.)[163]

Cleland and Dobrea-Grindahl's lack of acknowledgement of Michael Friedmann's *Ear Training for Twentieth-Century Music* (1990) is regrettable, since their treatment is essentially a hostile précis of Friedmann's method.[164] Friedmann's work is a distillation of his long-running ear-training course at the Yale School of Music (1985-2020) which was attended by a significant number of today's composers and performers; consequently, the impact of the approach has been greater than the readership of the text alone would suggest. Friedmann's painstaking approach systematically attempts to bring the insights of pitch-class set theory into ear-training, leveraging terms and concepts not only from Forte but also John Rahn, David Lewin, and Christopher Hasty. This intricate *Glasperlenspiel* plays out on a grid of strictly twelve tones; microtones are not admitted. Pitch — specifically, intervals and contour but not register — is king; rhythm and timbre are placed even further below the salt than in many older accounts of solfège. Much is made of 'the integration of horizontal and vertical space so important to … Schoenberg and Stravinsky [!]'.[165] This

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[159] Ulrich Kaiser, 'What is OMA?', *Open Music Academy*, 2024, accessed Feb 10, 2024, https://openmusic.academy.
[160] Kent D. Cleland and Mary Dobrea-Grindahl, *Developing Musicianship through Aural Skills: A Holistic Approach to Sight Singing and Ear Training* (New York and Abingdon: Routledge, 2010), xi.
[161] Ibid., 473.
[162] The authors offer a patient justification for the ghastliness of such music: '[In the twentieth century] the notion of music … as being representative of beauty was replaced in the minds of many composers by the idea that music and art should represent "truth", whether beautiful or not.' (Ibid.) Keats might have raised his eyebrows at this formulation.
[163] Ibid., 522-558. Among pedagogical institutions in the USA, in particular those outside the 'classical music' space, the tone and values of this text are not an outlier. See, for example, the reading list of the movable-Do solfège ear-training course at Berklee College of Music ('the world's preeminent college for the study of music,' according to their website in 2024): 'Recommended Reading List,' *Berklee College of Music*, n.d., accessed Jan 10, 2024, https://college.berklee.edu/core/readlist.html. The approach is summarised in a course manual: Steve Prosser, *Essential Ear Training for Today's Musician* (Boston: Berklee Press Publications, 2000). Curiously, in the 2016 merger of Berklee College and the Boston Conservatory, Berklee accidentally inherited staff associated with the very different ear-training emphases of the Boston Microtonal Society (see 6.3.2 below).
[164] Michael Friedmann, *Ear Training for Twentieth-Century Music* (New Haven: Yale University Press, 1990).
[165] Ibid., 21.

integration is inculcated in the student through the heavy use of exercises including melodic retrogrades — features of scores now usually viewed as amusing quirks or rebuses.[166]

The intervening decades since the book's publication have not been kind to this type of approach. It is hard to imagine a 2024 reader dutifully singing chromatic lines in numbered pitch classes (we are reminded to sing 'sev' and 'el' for 7 and 11), let alone earnestly engaging with 'distinguishing [tetrachordal] Z-related set classes' by ear,[167] since the more general problem of recognising where, in a pitch landscape where the horizontal and vertical axes are considered to be integrated, our attention to a musical object should start and when it should stop (i.e. the problem of segmentation) goes largely unaddressed.[168] The reader is unlikely to share a view of tonality as 'a special filter' applied to 'the twelve pitch classes', nor accept that Friedmann's 'more basic' theory 'precedes', rather than extends, tonal theory.[169] The book's massing of numerals, while elegantly organised, irresistibly recalls a waspish remark by Boulez in 1963 that certain analyses resembled 'fictitious timetables of trains that will never depart.'[170] Indeed, the high-water mark of the vogue for pitch-class set theory among analysts had already passed before the publication of this text.[171] Friedmann's approach is not entirely cerebral and disembodied, however. While he valiantly attempts to raise rationally-ordered 'theory' above mere 'calisthenics' ('exercises for facility and memorization that lack the benefit of any linguistic structure'[172] — the then-fashionable equation of music with language marking Friedmann as an heir of the semiotician Nicolas Ruwet and contemporary of Jean-Jacques Nattiez), his practical experience leads him to acknowledge the usefulness of 'calisthenics' as foundations of a method. In this respect his approach resembles many older diatonic ear-training methods: the reader is deemed to already have 'calisthenically' mastered simple intervals (and if the rules of the game only permit moves in 12-EDO,[173] there are not so many); the text will then help the reader to join them into patterns.

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166 This may reflect the influence of technology. For example, Berg's palindromes (as found in *Lulu*, the *Lyrische Suite*, and the *Kammerkonzert*) once attracted earnest analytical attention, perhaps because they encoded intricate labour; the fact that the same procedure may now be achieved with a single keystroke in notation software has rather 'deauraticised' them (to borrow a term from Walter Benjamin.) The same might be said for a host of generative procedures that used to be spoken of with awe but now seem naif in their assumption that procedures in one area retain their interest when brought wholesale into another: examples include Xenakis' use of sieve theory or Bartók's interest in Fibonacci sequences and the golden section. In the era of Big Data any fool can translate any dataset (say, the radio signature of a distant galaxy, or the underground electrical signals of fungi) into sound. A prescient discussion of this subject is found in Douglas Adams, *Dirk Gently's Holistic Detective Agency* (1987), chapter 12.

167 Friedmann, *Ear Training*, 75.

168 This problem bedevilled pitch-class set thinking from the outset; Friedmann's attempt to apply it to ear-training exposes it cruelly: 'Like Contour Class, Contour Interval is a concept that has real meaning only after the listener has determined what the musical unit is; it therefore depends on a complete, crystallized picture of that unit in musical space.' (Ibid., 35.) Consider how many aural passes from past to moving present, and back again, would be necessary to achieve such a crystallization — by which time the music would be 'all over before it starts' (as Anton Webern's father was reported to have lamented after hearing his son's *Vier Stücke für Violine und Klavier*, op. 7.)

169 Ibid., xxi.

170 '…horaires fictifs de trains qui ne partiront point!' Pierre Boulez, *Penser la musique aujourd'hui* (Paris and Geneva: Gonthier / Denöel, 1963), 12.

171 Michiel Schuijer, *Analyzing Atonal Music: Pitch-Class Set Theory and its Contexts* (Rochester: University of Rochester Press, 2008).

172 Friedmann, *Ear Training*, xxi.

173 '12-EDO' — twelve equal divisions of the octave, also known as '12-tone' or 'chromatic' equal temperament, or simply 'equal temperament', is the familiar tuning system that divides the octave into twelve equal parts (semitones), each of 100 cents. The term is used here as a compromise between the older 12-TET and the newer, but rarely-encountered, 12-ED2.

Almost all NISMs contain selections of musical extracts. These selections illuminate the musical dataset that their author has drawn on; in many cases they predate, usually by roughly a generation, the repertoire to which the NISM may be most germanely applied. In Friedmann's case, while his examples are taken from Debussy, Bartók, Stravinsky, and Schoenberg, his method fits most naturally with the music of his uptown[174] contemporaries including Charles Wuorinen and Elliott Carter. In the Apollonian world he evokes, any interest in the 'grain of the voice' is at its lowest imaginable point. The pitch-class is the object of interest — the rest is packaging. Whether theory preceded practice or vice versa, this way of thinking had very real implications for performers, who were expected to be ready to produce on demand any permutation of: any (tempered chromatic) pitch, at any rhythmic point and with any duration, at any dynamic, and with any articulation. Squeaks, scratches, scrunches, or sighs were implicitly undesirable. This conception of what constitutes performing professionalism is still highly influential in orchestral and some new music ensemble practice; it was piquantly described by one of my interviewees as being 'the ultimate extended technique.' Friedmann is (of course) a pianist.

Despite, or perhaps alongside, his uptown allegiances, Friedmann's text embodies a characteristically North American nostalgia for old Vienna. His touching goal is to help his reader realise 'Schoenberg's ambition […] that musicians and audiences would whistle his melodies as they did those of Tchaikovsky.'[175] Reading his text evokes a frisson of nostalgia for a musical world that has largely vanished as a direct point of reference, but some of whose underlying paradigms remain influential.

An earlier volume, Lars Edlund's *Modus Novus: Studies in reading atonal melodies* (1963) presents a 'new way' on an equal footing with the 'old way' (the author's diatonic *Modus Vetus* appearing, curiously, a decade later.)[176] Edlund's 'preparatory exercises', humbly placed before his choice of extracts from the works of starrier composers, meander peaceably around the chromatic intervals he intends his reader to learn. In their organ improvisation-like neutrality they prefigure the fractal *Uendelighedsrækken* ('infinity series') that generates the melodic lines in Per Nørgård's proto-spectralist *Voyage into the Golden Screen* for chamber orchestra (1968-69). The work is presented with an impressive absence of didacticism or rhetorical overreach. I was told in 2019 that Edlund's work had recently been used in ear-training classes in Helsinki's Sibelius Academy.

Two principal limitations effectively rule out extensive use of the manuals of Edlund and Friedmann for current training purposes. The first is their failure to engage with the interaction of musical parameters, which was a defining aspect of new music even at the dates of their publication; the challenges such interactions pose to NMPT musicianship are addressed in 4.1 below. The second is that they are limited to the twelve tones of equal temperament. The meta-skill both attempt to convey is a sense of ease when

[174] 'Uptown': a New York term commonly used in the 1970s to refer to academically-connected composers 'of whom the public has rarely heard … but who win the Pulitzer prize every year.' Samuel Gilmore, 'Coordination and Convention: The Organization of the Concert World,' *Symbolic Interaction* 10, no. 2 (1987), 213. According to Ellen Taaffe Zwilich, John Cage's response to the uptown/downtown distinction was to declare that he would 'only be discussed by his zip code.' Ellen Taaffe Zwilich, interviewed by Frank J. Oteri, 'Goose Bumps in the Candy Shop,' *New Music USA*, Apr 29, 2011, accessed Mar 21, 2023, https://newmusicusa.org/nmbx/ellen-taaffe-zwilich-goose-bumps-in-the-candy-shop/.
[175] Friedmann, *Ear Training*, xiv.
[176] Lars Edlund, *Modus Novus: Studies in reading atonal melodies* (Stockholm: Wilhelm Hansen, 1963).

negotiating any given combination of these tones. In the service of that ease, they see value in hierarchically flattening these pitches, their examples arduously avoiding the appearance of the gravity wells of tonics or quasi-tonics. These putatively anti-gravitational acts of flattening are also anti-orientational and rob their texts of value as guidance. Trainees who wish to improve their skills in these contexts may, in preference to reading these volumes, prefer to reach for a score by (for example) Ruth Crawford Seeger or Harrison Birtwistle, make a random selection of passages that look chromatic and angular, and sing through them, self-correcting as necessary on the piano. (No dismissive tone is intended here — see 6.3 below.)

Moving even further back in time, Paul Hindemith's 1946 *Elementary training for musicians* — impressively still in print in 2024 — stretches the word 'elementary' to destruction.[177] The reader is faced with a rich broth of polemic ('[existing musicianship training] methods are … deplorable', offering 'no solid foundation', consequently, 'save in a few exceptional cases', skills are picked up 'at random',[178] combined with questionable assertions of musical phenomenology ('the most primitive form of temporal action in music is the use of tones of different lengths'),[179] some baffling accounts of acoustics (e.g. the 'explanation' of the tuning of the tritone),[180] and a feast of insightful titbits ('$\frac{9}{8}$ is generally felt as a slower tempo than $\frac{3}{4}$ —without any obvious reason!')[181] Interleaved with all this are the pedagogical exercises, which alternate between, then combine, 'action in space' (pitch skills) and 'action in time' (rhythmic skills). The exercises are imbued with such a strong compositional flavour that the work as a whole might better be described as 'essence of Hindemith' than musicianship manual; many closely resemble phrases in his earlier *Ludus Tonalis* for piano (1942). Nadia Boulanger, while praising this book as a 'chef-d'œuvre de pédagogie,' observed that

> Hindemith understood music in such an astounding [*stupéfiante*] way that it is sometimes difficult to distinguish the composer from the pedagogue.[182]

Indeed, in Boulanger's view, it was this very strength of compositional identity detectable in his pedagogic materials that had led many young composers, and Hindemith himself, to write so much 'mauvais Hindemith.' The specific musical challenges and aesthetic preoccupations addressed in the exercises are naturally very distant from those negotiated by today's trainees. The pedagogical approach, however, is not. The multi-instrumentalist Hindemith takes a thoroughly embodied approach throughout, continually directing the reader to sing, play, tap, and clap (we are reminded to swap the roles of right and left hands.) Most strikingly, much of the learning takes place via 'coordinated action' — not to be undertaken solo but in small groups. Group members exchange the roles of player of a melody, clapper of a counter-rhythm, and conductor. Behind the peppery prose style is an undogmatic acceptance of porosity between the roles

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[177] Paul Hindemith, *Elementary Training for Musicians* (London and Mainz: Schott, 1949).
[178] Ibid., vii. Instrumentalists are let off relatively lightly: 'As for singers […] a singer is usually excused from any but the most primitive musical knowledge—knowledge such as could be acquired by any normal mind in a few weeks of intelligent effort. Rare indeed is the singer nowadays who can do what you would expect to be the most normal of all the activities of a singing musician…' (Ibid., ix.)
[179] Ibid., 3.
[180] Ibid., 144.
[181] Ibid., 118.
[182] 'Hindemith connaissait la musique de manière si stupéfiante qu'il est parfois difficile de distinguer le compositeur du pedagogue.' Monsaingeon, *Mademoiselle*, 60.

of instructor and trainee ('one of your fellow students (or the teacher) may…')[183] Hindemith's collaborative and identity-fluid approach, if not his musical content, seems — perhaps surprisingly — thoroughly applicable to current NMPT practice.

2.3.2.2 Microtones present

None of the materials listed so far could be considered as appropriate for direct, textbook-like, use by current NMPT trainees without heavy contextualisation, nor do they find such use. The NISMs relating to pitch that are in use in NMPT contexts relate to areas of practice that could be described as specialised even within the new music space. The largest and most active of these areas is (Extended) Just Intonation (henceforth JI). No definition or history of this field is attempted here, since the account given by Thomas Nicholson and Marc Sabat in 'Fundamental Principles of Just Intonation and Microtonal Composition' is definitive, readable, and freely available online via the Plainsound Music Edition website.[184] (Other general accounts, including Kyle Gann's vigorous *The Arithmetic of Listening: Tuning Theory and History for the Impractical Musician* are also available.)[185] The generosity of the Plainsound collaborators — including Sabat, Nicholson, Wolfgang von Schweinitz, and Catherine Lamb — in making their scrupulously-edited materials available for online open access, including the influential HEJI specification for microtonal accidentals, stands in contrast to the restrictive publishing model of some ISMs.

Tuning theory is an intrinsically infinite subject. Among its devotees, the development of tuning systems has often been seen as a creative act. Behind many compositions is a new system or subsystem, and very often a new accompanying documentation; in some cases the system is regarded as the work. In the view of Marc Sabat, 'intonation is composition.'[186] Kyle Gann has even proposed that 'music is a footnote to the history of tuning,'[187] although presumably as a provocation and call for action rather than a serious proposition. Consequently, this is a lavishly-documented field.[188] A reader would need several lifetimes to engage in detail with the available materials. It is no simple matter to attempt to skip over the frequently-cited lists of historical precursors (Pythagoras, Claudius Ptolemy, Joseph Sauveur, Helmholtz…) and move directly to the luminaries of the twentieth century (Harry Partch, Erv Wilson, James Tenney, Ben Johnston, Clarence Barlow…) let alone those of the twenty-first, since in this strikingly non-Hegelian field insights expressed by Gioseffo Zarlino or Nicola Vicentino in the 1550s may still be as actively engaged with, in contexts both theoretical and practical, as ones made yesterday.

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183 Hindemith, *Elementary Training*, 127.

184 Thomas Nicholson and Marc Sabat, 'Fundamental Principles of Just Intonation and Microtonal Composition' (Online: Plainsound, 2018), accessed Jul 10, 2023, https://masa.plainsound.org/pdfs/JI.pdf. The paper is a course text for students at the Universität der Künste Berlin (Studio für Intonationsforschung und mikrotonale Komposition.)

185 Kyle Gann, *The Arithmetic of Listening: Tuning Theory and History for the Impractical Musician* (Chicago: University of Illinois Press, 2019.

186 Marc Sabat, interviewed by Thomas Groetz, *Bayerischer Rundfunk* (radio), Feb 20, 2012. Available at 'Intonation ist Komposition (2012),' YouTube, accessed 15 Apr 2024, https://www.youtube.com/watch?v=O-SQd3OFwgg.

187 In Bob Gilmore, 'Microtonality: my part in its downfall,' (keynote address, London Microfest 1, Walton-on-Thames, Oct 15 2005). Text available at 'Bob Gilmore,' *University of Edinburgh* (website host), accessed Jul 10, 2024, https://homepages.inf.ed.ac.uk/stg/Bob_Gilmore/BGMicrofest05.pdf.

188 An extensive reading list is available at 'Intonation: Theorie,' *Studio für Intonationsforschung und mikrotonale Komposition*, accessed Aug 10, 2023, https://www.udk-berlin.de/studium/komposition/intonationsforschung/studio-fuer-intonationsforschung-und-mikrotonale-komposition/intonation-theorie/.

As in the case of the ISMs of 2.2 above, in this area the path of least resistance leads towards ramification; it is much easier to add detail than to prune branches, particularly since this detail may be conveyed in seductively visual and scientistic language: 'pitch-space', 'lattices', 'diamonds', 'spirals', and 'crystallisation'. It is not a criticism to point out that not all of these texts take account of how their discoveries actually sound, or how they might admit of performance by instruments conceived with other tuning frameworks and tolerances in mind. Where the ear is admitted, aural refinement is a key goal: a 2002 symposium of microtonal music at the Amsterdam Conservatoire was aptly named *Het Verfijnde Oor (*The Refined Ear.)[189] Unlike refined sugar, however, the end product of such refinement tends to contain more, not fewer, ingredients. The following description of 53-EDO from the Xenharmonic Wiki gives a flavour of the taxonomic prolixity that a microtonally-curious NMPT trainee might stumble across online:

> 53edo is notable as a 5-limit system, a fact apparently first noted by Isaac Newton, notably tempering out the schisma (32805/32768), the kleisma (15625/15552), the amity comma (1600000/1594323), the semicomma (2109375/2097152), and the vulture comma (10485760000/10460353203). In the 7-limit it tempers out 225/224, 1728/1715 and 3125/3087, the marvel comma, the gariboh, and the orwell comma. In the 11-limit, it tempers out 99/98 and 121/120 (in addition to their difference, 540/539), and is the optimal patent val for Big Brother temperament, which tempers out both, as well as 11-limit orwell temperament, which also tempers out the 11-limit commas 176/175 and 385/384. In the 13-limit, it tempers out 169/168, 275/273, 325/324, 625/624, 676/675, 1001/1000, and 2080/2079, and gives the optimal patent val for athene temperament. It is the seventh strict zeta edo. It can also be treated as a no-elevens, no-seventeens tuning, on which it is consistent all the way up to the 23-odd-limit.[190]

These whimsical names, which combine Ancient Greek terms as adopted by Renaissance theorists with geeky Usenet-style humour, are self-consciously part of a harmless collaborative game conducted mostly online. Their numerical pile-ups, unlike the twentieth-century 'fictitious timetables' of pitch-class set theory, are much less likely to be accompanied by claims of universal applicability. Remarkably for such an ancient subject, tuning theory also still offers sufficient room for new insights to be a *violon d'Ingres* for serious mathematicians.[191]

The level of detail that a musical area has been mapped in does not automatically correspond to its potential significance for the training performer, of course. Very little content from the most detailed materials finds its way even into most of the specialised programmes described in 1.2; if these materials have any application to sound it is overwhelmingly in music made on, and played back by, computers. While the metaphor of the 'rabbit hole' is overused, it is hard to avoid here since it is even used jocularly by some musicians working with JI materials themselves. Indeed, what emerges from the writings of the most strident advocates of JI performing approaches — in particular those approaching the subject from the direction of HIP, such as Ross Duffin's *How Equal Temperament Ruined Harmony (and Why You Should Care)*,[192]

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[189] André Douw (convenor), 'Het Verfijnde Oor,' *Stichting Huygens-Fokker*, accessed Mar 10, 2023, https://www.huygens-fokker.org/activiteiten/verfijndeoor.html. Events took place between Sep 2002-Feb 2003.
[190] *Xenharmonic Wiki*, '53edo,' accessed Jul 3, 2023, https://en.xen.wiki/w/53edo.
[191] E.g. Rafael Cubarsi, 'An Algebra of Chords for a Non-Degenerate Tonnetz,' *Journal of Mathematics and Music* (2024): 1-37.
[192] Ross Duffin, *How Equal Temperament Ruined Harmony (and Why You Should Care)* (New York: W.W. Norton, 2006).

but also from Partch's *Genesis of a Music*[193] — are the authors' willing self-identifications as members of a underground network, working to undermine the Enlightenment-modernist artificial city grids and tower blocks of 12-EDO with a view to collapsing them and liberating the good earth beneath; such collapse, like the advent of the Messiah, being always just around the corner.[194] More recent accounts written from a new music perspective tend to be far less ideologically-driven, although they are certainly emic and 'dug in' to varying degrees, being authored by practitioners with long-term creative investments in the field. The most sensitive commentators, such as the late Bob Gilmore, have been correspondingly generous in their tendency to allow composers' claims about their microtonal practices to go largely unchallenged (claims like 'this piece *is* in *x* system, or *does y*'); understandably so, since it is perilously easy to move from a productively critical stance to an unhelpfully dismissive one. (In German, the term *Vierteltonmusik* – 'quarter-tone music' – is still occasionally encountered as a catch-all term for microtonal practices.)

An awareness of what might be called microtonal music's replicability problem — the vast gaps between (some) tuning theories and (some) performance practices — has itself had a long history; we could point to James Murray Barbour's 1951 observation that 'the complicated tables [of eighteenth-century "mathematically minded" theorists seeking ways to derive equal temperament] could well have had half their digits chopped off before using.'[195] Previous attempts to bridge these gaps usually took the approach of offering linear teaching tools to performers to help them reach the Parnassian heights on which composers erected their pitch-targets. A representative attempt of this type was documented by Graham Hair et al.[196] The intention was to aid a solo singer in the learning and rehearsal of a piece intended to sound in 19-EDO. The singer was furnished with three didactic audio aids, each providing progressively less 'spoon-feeding': a sing-along recording supporting every note and a slowed-down version for private study, a specially programmed 'scordatura keyboard' to check intonation when desired, and automated-listening pitch-tracker software which was intended to give the singer feedback during the rehearsal process. While such elaborate scaffolds have not been adopted widely, singers do sometimes make use of synthesised mock-ups — the first of Hair's stages — in their preparation. More recent accounts have emphasised the interplay between musical supply and demand (performer and composer) in this area, rather than viewing it as a one-way street. The performance of microtonal music is no longer understood solely in terms of performers meeting, or falling short of, the demands of composers. A 2011 Stuttgart conference was aptly named *Mikrotonalität — Praxis und Utopie*.[197] In the careful formulation of the convenor Cordula Pätzold, 'practice' was given precedence over 'utopia' rather than the conventional reverse.

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[193] Harry Partch, *Genesis of a Music: an account of a creative work, its roots and its fulfillments* (New York: Da Capo Press, 1974).
[194] Temperamental eschatology has a long history. Alexander Ellis, writing in 1874, felt that 'the discoveries of Helmholtz have sounded the knell of equal temperament, which must henceforth be recognised as a theoretical mistake and a practical makeshift; as a good servant dismissed for becoming a bad master, and now merely retaining office till his successor is installed.' Quoted in Cathy van Eck, 'A good servant dismissed for becoming a bad master – Zur Geschichte der gleichstufigen Temperatur,' [– on the history of equal temperament], *Dissonance* 110 (2010), 38. Partch called for musical systems to be built 'from Archaean granite, and not … from the frame of an inherited keyboard.' (Partch, *Genesis*, xvii). At the end of *The Incredibles* (Pixar, 2004), the mole-man The Underminer appears and proclaims: 'Behold the Underminer! I am always beneath you, but nothing is beneath me! … Soon, all will tremble before me!' I have tried hard to avoid the pun *fundamentalism.*
[195] James Murray Barbour, *Tuning and temperament: a historical survey* (East Lansing: Michigan State College Press, 1951), 87.
[196] Graham Hair, Ingrid Pearson, Amanda Morrison, Nicholas Bailey, Douglas McGilvray, and Richard Parncutt, 'The Rosegarden Codicil: Rehearsing Music in Nineteen-Tone Equal Temperament,' *Scottish Music Review* 1, no. 1 (2007): 99-126.
[197] Cordula Pätzold and Caspar Johannes Walter, ed., *Mikrotonalität - Praxis und Utopie* (Mainz: Schott Music, 2014).

Most general conservatoire programmes, and even some NMPT courses, have responded to this profusion of activity (which is admittedly expressed in unsettled and alien terminology, and whose significance is contested) by pretending that it does not exist. While microtones and alternative tuning systems proliferate in new music practice (6.1), the practice of microtonal aural training is exceptionally rare. I argue in Chapter 6 that this is a serious lacuna and offer some materials to contribute to addressing this gap. There are precedents for this ambition. Some pitch-focused NISMs are positioned sufficiently close to the rabbit hole's exit to be of direct practical use to players of the Western instrumentarium and singers who wish for a musically varied diet. Since the history of JI within compositional practice is longest and most developed in the United States, many of these texts originated in that country. Among these the best-known is David Doty's *The Just Intonation Primer*,[198] which found institutional use in university courses in California and has seen a renewed surge of international interest in recent years. A related but not identical approach is offered by Julia Werntz in *Steps to the Sea: Ear Training and Composing in a Minute Equal Temperament*, a text distilling her teaching approach in her Microtonal Composition and Performance class at the New England Conservatory.[199] Alongside these manuals, Marc Sabat's notion and lists of empirically 'tuneable intervals' — intervals which, he proposes, may be tuned precisely by ear — have been highly influential, not least via Sabat's own teaching practice.[200] Various software tools also exist to help musicians bridge theory and practice, including Robin Hayward's *Tuning Vine*,[201] and a great number of microtunable plugins for DAWs. The support for native microtonal playback in the notation software Dorico has, thanks to the input of Thomas Nicholson, significantly lowered the bar for musicians with minimal computer experience to experiment with microtonal playback. (In earlier software, such as Sibelius and Finale, microtonal playback was possible but much more arduous to achieve.) Richly valuable also as aural guides are recordings by groups including the choirs Ekmeles and Exaudi, the Kepler String Quartet, and the Harmonic Space Orchestra. Most used of all by performers are electronic tuners: either in the form of stand-alone devices or (increasingly) as software on smart devices. A wide variety of inexpensive tuning apps are now available, many of which offer multiple historical temperaments, readouts with deflections to the fraction of a cent, and even spectrograms. These, and related resources, are returned to in Chapter 6.

Researcher-performers, including the violinists Mieko Kanno,[202] Sara Cubarsi,[203] and Mira Benjamin,[204] have written detailed and searching documentations of their own practices. In their different ways these documentations, which productively apply the insights of historical violin performance manuals that earlier readers might not have immediately grasped as relevant to microtonal thinking, reformulate the language of the field in a refreshingly performer-first fashion. In these accounts, the opposition — widespread and sometimes even axiomatic within twentieth-century discourse — between 'microtones' as compositional

198 Doty, *Just Intonation*.
199 Julia Werntz, *Steps to the Sea: Ear Training and Composing in a Minute Equal Temperament* (USA: Frog Peak Music, 2014).
200 See 6.3.2 below.
201 Robin Hayward, 'Unlock the rich microtonal universe of Just Intonation,' *Tuning Vine*, accessed Mar 10, 2024, https://www.tuningvine.com/
202 Mieko Kanno, 'Thoughts on How to Play in Tune: Pitch and Intonation,' *Contemporary Music Review* 22, nos. 1/2 (2003): 35-52.
203 Sara Cubarsi, 'Unfretting the violin: Theory, composition and practice of microtonal string music,' (Master's thesis, Royal Academy of Music, London, 2014).
204 Benjamin, 'Thick Relationality'.

material and 'intonation' as a performer's concern is thoroughly thrown into question. Benjamin records her student's journey to the following epiphany:

'So, all this microtonal stuff is just more tuning?'[205]

As the authors of these accounts make clear, the elision of microtonality with intonation was not a new insight. The long tradition of building enharmonic and split-key instruments — instruments previously regarded by some as mere historical curios, but (following the work of Patrizio Barbieri)[206] increasingly seen as encoding a dynamic tension between the poles of microtonality and intonation, and 'fretting' and 'de-fretting' (5.8) — helped provide the conceptual apparatus to make this leap. The specific conceptual leap in relation to the understanding of sixteenth and seventeenth century tuning theory and practice seems to have been made by Martin Kirnbauer, working in collaboration with the harpsichordist Johannes Keller, who proposed the elegant and untranslatable replacement term *Vieltönigkeit* (roughly, 'multi-tuning/tonality-ness.')[207] What was new was the confidence with which these performer-authors proceeded to occupy terrain that previously would have fallen to composers by right. As in the case of the ISMs in 2.2 above, the authors were emboldened and enabled by the 'embodied turn' within academia; their texts are pervaded with legitimising terms borrowed from 'theorists of embodied practice.' These texts sit between the categories of ISMs and NISMs: they are texts about violin playing but also have extensive cross-instrumental (musicianship) relevance, rather as the *clavemusicum omnitonum* of the Studio31 collaboration is both an instrument for performance and a demonstration of tuning theory.[208]

Clearly, the NMPT trainee in search of NISMs relating to pitch will encounter no shortage of available content. Virtually absent within the literature, however, are pedagogical bridging materials between pitch as treated in the conservatoire musicianship sense (before the 'barrier') and the thickets of recent microtonal/intonational thinking. This can be ascribed to resistance on both sides; not only from those institutional attitudes of wilful ignorance for which I have used Cleland and Dobrea-Grindahl's text as a shorthand, but also from those who consider themselves to possess microtonally 'refined ears', since few would actively seek aural coarsening. From his firm position on the latter side, Harry Partch was strongly hostile to any attempts to bridge the gap, since

… the virtue of music schools, as presently constituted, can lie only in the possible rebellion against them.[209]

Music schools' greatest sin, of course, was their promotion of the reviled twelve-tone equal temperament ('…the ramification of evil complications in this one little act of perverting nature is actually endless')[210] which was irreconcilable with just intonation ('it can be stated unequivocally that they cannot coexist in the

[205] Ibid., 209.
[206] Patrizio Barbieri, *Enharmonic Instruments and Music, 1470-1900: Revised and Translated Studies* (Latina: Il Levante Libreria Editrice, 2008).
[207] Martin Kirnbauer, '"Vieltönigkeit" Instead of Microtonality: the Theory and Practice of Sixteenth- and Seventeenth-Century "Microtonal" Music,' in *Experimental Affinities in Music*, ed. Paulo de Assis (Leuven: Leuven University Press, 2015): 64-90.
[208] 'The Studio31 Instruments,' *Studio31*, accessed Jul 2, 2023, https://www.projektstudio31.com/instruments.
[209] Partch, *Genesis*, xii.
[210] Ibid., 136.

same musical system … Such xenogamy is conceivable but not yet practical.')[211] While more circumspect twenty-first century commentators would not echo Partch's vehemence, his prohibitions have cast a long shadow. In his programme notes to *Il Clima dopo Harry Partch* for piano and orchestra (2000), Salvatore Sciarrino described the influence of Partch as a 'butterfly effect': a once-marginal figure whose impact was unforeseeably immense. This convincing description was developed by Bob Gilmore, who noted that 'Partch's impact and influence, even during his lifetime, was less due to his actual work than to the *idea* of his work.'[212] Partch's uncompromising attitude, standing in such stark contrast to today's uncertain world, has lent him (or rather, the idea of him) an iconic status that less dogmatic and more pluralistic pioneers of tuning systems, such as Lou Harrison, have not attained. While the theoretical ban on EDO-JI 'xenogamy' was overcome long ago by James Tenney and others,[213] who linked JI to equal temperaments via the psychoacoustically-derived notion of tolerances (various equal temperaments — most notably 31-EDO, 53-EDO, and 72-EDO — having been cited for centuries as theoretical bridges towards, or proxies for, the ratios of JI),[214] a cultural one remains in the form of their siloed pedagogical traditions.

A feature of the writings of many enthusiasts for 'alternative' tunings is that, while their own territories of interest are often mapped on a painstakingly large scale, they do not exhibit a commensurate sensitivity for the complexity and richness of tuning practice outside these areas. We repeatedly encounter the assertion or casual assumption that the pitches of 12-EDO are the default tuning targets in great swathes of performance practice, including for opera singers, church choirs, wind or brass bands, and symphony orchestras. These last are almost invariably considered *en masse*, and very rarely (as I have perceived them in my professional interactions) as loose constellations of four tightly-knit instrumental-family groups, each family — rather like the mafia Families of New York — possessing its own internal codes for intonational practice and compliance, and at times only cooperating with neighbouring families for reasons of expedience. Even a musician as sensitive to pitch as Jeffrey Gavett, director of the tuning-virtuoso choir Ekmeles, could declare in a 2021 interview that 'the default background radiation of classical music is twelve tone, equal temperament.'[215] I do not think this reflects actual practice at all. Moreover, I feel that the burden of evidence for defending such a proposition should fall on the proposer rather than the sceptic. If the proposition were applied to popular music, for example, a more secure case might be made by pointing to a vast number of equally-tempered sample libraries, MIDI instruments, and pitch correction technologies such as Melodyne and Auto-Tune. MIDI — the technical standard that serves as a lingua franca for almost all technological interactions in popular music — although microtonally capable from its conception, really is 12-EDO by default.[216] As I explore in 6.2 below, this cannot be assumed to hold in orchestral practice.

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[211] Ibid., 158.
[212] Bob Gilmore, 'The climate since Harry Partch,' *Contemporary Music Review* 22, nos. 1/2 (2003), 31.
[213] Robert Hasegawa, 'Tone Representation and Just Intervals in Contemporary Music,' *Contemporary Music Review* 25, no. 3 (2006): 263-81.
[214] 53-EDO was recognised as offering close approximations of 5-limit just ratios in antiquity (by Jing Fang) and again in the seventeenth century (by Nicholas Mercator, William Holder, and Isaac Newton). 31-EDO is a good approximation for 7-limit JI (as noticed and exploited by Christiaan Huygens and Adriaan Fokker). 72-EDO (i.e. a division of the octave into tempered twelfth-tones, thus including tempered semitones, third-tones, quarter-tones, and sixth-tones) can approximate 11-limit ratios; it was discussed and experimented with by Ivan Wyschnegradsky and Alois Hába among others.
[215] Jeff Gavett, 'S02 E06: Notes that shouldn't be sung,' *In Unison* podcast, Mar 20, 2021, accessed Jun 4, 2023, https://www.inunisonpodcast.com/episodes/s02e06.
[216] The production of microtonal pitches via MIDI has been possible for decades, of course. The MIDI Tuning Standard (MTS) of 1992 allows pitch-bend alterations to an resolution of 0.0061 of a cent (100 cents / 2^{14}) which is effectively infinite.

The detailed discussions of historical violin performance manuals in Kanno, Cubarsi, and Benjamin serve as vital reminders that, in many contexts — including within nineteenth-century practice — not only is 12-EDO not the norm in performance but may require special and intensive effort to achieve in those contexts where it is deemed desirable. To extend the application of my interviewee's observation about the production of sonically-consistent chromatic tones (i.e. 'normal notes', unlarded on the page by explicitly-marked 'extended techniques') across the range of the clarinet in 2.1 above, working in 12-EDO may sometimes even feel like 'the ultimate extended technique.' I build on the insights of these musicians in Chapter 6.

2.3.3 Timbre NISMs

Before turning to rhythm — the rival contender for pitch's musical-parametric crown — I attempt an overview of those NISMs that focus on the parameter of timbre, and on sound considered in a broad sense. If texts relating to pitch have tended towards scholastic over-precision, here the opposite is the case. As Emily Dolan and Alexander Rehding point out,[217] timbre has suffered the ignominy of negative definition: it is defined by what it is not. The Acoustical Society of America defines timbre as:

> […] that attribute of auditory sensation in terms of which a listener can judge that two sounds similarly presented and having the same loudness and pitch are dissimilar.[218]

Dolan and Rehding aptly call this a 'wastebasket category', and note that musicologists, too, have historically given timbre short shrift:

> For the longest time, musicology treated timbre as an afterthought. In his neat systematic taxonomy of the discipline, Guido Adler assigned the last column of his chart for the 'history of musical instruments,' while making it otherwise clear that music and musicology was about notes, not tones: indeed, musicology begins at the moment when tones are measured and analyzed for their pitch. The trembling air columns that our ears perceive as musical sounds, in specific timbres, were merely a material means serving a loftier goal: the disciplinary gaze was firmly locked on *geistfähiges Material*, as Adler's predecessor Eduard Hanslick called it, that is, material suitable for cogitation. In this system, sound appears as little more than a necessary evil, a messy complication for an otherwise pristine structure.[219]

Additionally, much effort has been expended in recent years by the creators of commercial 'virtual instruments' (large sample banks) to incorporate intonational 'expressivity' in their products in various forms. Nevertheless, the reference pitches, or pitch-targets, for individually-sampled pitches for orchestral libraries are those of 12-EDO, achieved during the recording process through the use of electronic tuners (on the player's side) and post-processing (on the engineer's). This is due to the commercial imperative to maximise the potential use of the sample banks. As one developer noted [personal communication, 2021]: 'if we put out an orchestral set that only sounded good in certain keys, it wouldn't sell. Anyway, most of our customers don't really care about that side of things.' By contrast, most virtual keyboard instruments, from Spectrasonic Keyworks to Hauptwerk, now offer a plethora of temperament options. For a powerful critique of the way technology has integrated 'ethnic' microtonality in a tokenistic way, see Khyam Allami, 'Microtonality and the Struggle for Fretlessness in the Digital Age', *CTM Festival Magazine*, Jan 2019, accessed Aug 19, 2023, https://www.ctm-festival.de/magazine/microtonality-and-the-struggle-for-fretlessness-in-the-digital-age.

[217] Emily Dolan and Alexander Rehding, 'Timbre: Alternative Histories and Possible Futures for the Study of Music', in *The Oxford Handbook of Timbre*, ed. Emily Dolan and Alexander Rehding (Online edition: Oxford Academic, 2021), 9.

[218] 'Psychoacoustical Terminology', American National Standards Institute S.3.20-1973 (New York: American National Standards Institute, 1973).

[219] Dolan, 'Timbre: Alternative Histories', 1.

Timbre appears so plasmic and ambiguous in the academic gaze (at least, by comparison with the minutely-mapped pitch landscape) that many studies have a preliminary and exploratory quality, being attempts to find a meaningful basic descriptive vocabulary. A future 'cognitive linguistics of timbre'[220] might help us refine our language and understanding beyond metaphors such as 'brightness, warmth, roundness, [and] roughness.'[221] The 'paradox of timbre'[222] has been probed from various angles, including the psychoacoustic,[223] aesthetic,[224] philosophical,[225] ethnomusicological,[226] historical-genealogical,[227] and many more. The studies most likely to be of direct interest to a NMP trainee are those that address the interactions of pitch and timbre,[228] and harmony and timbre.[229] However, trainees may be more likely to reach for scores by those composers who found such interactions a particularly fruitful source of materials: scores by Gérard Grisey (who talked of *accords-timbres* — 'chord-timbres', or 'timbre-chords'), by the original 'spectralist' Hugues Dufourt, by Tristan Murail, Hans Zender, Horaţiu Rădulescu, and many more recent figures (see 4.1.) Almost all publications emanating from IRCAM address this subject, such as the documentation of the landmark 1985 colloquium *Séminaire sur le Timbre* (convened by Jean-Baptiste Barrière) which includes contributions from Kaija Saariaho, Philippe Hurel, James Dillon, Philippe Manoury, Marc-André Dalbavie, George Benjamin, Mesias Maiguashca, Roger Reynolds, and Marco Stroppa.[230] These precious texts document the creative approaches and priorities of their authors. Consequently, within the ad hoc model of NMPT, most are likely to be consumed by performers on a project-by-project basis only. A trainee faced with a score by Saariaho may seek out her writings in search of interpretative insights, but has no clear route to any more general treatments of the musical challenges they will face. When reading many composer-authored documents, a trainee may even gain the impression that the composer-author is the first person to have identified and developed the musical area under discussion.

A particularly influential — or at least, frequently name-checked — composer-authored document in this area is Pauline Oliveros, *Deep Listening: A Composer's Sound Practice*.[231] This handbook gathers together a lifetime of 'sonic meditations' that Oliveros and others used as materials for 'Deep Listening Workshops.' Although Oliveros' later approach tended to discourage the isolation of musical parameters in favour of a holistic conception of sound as energy, the book does contain exercises intended to aid aural discrimination and the development of personal sonic taxonomies. Some of Oliveros' earlier (pre-*Deep Listening*)

[220] Zachary Wallmark and Roger A. Kendall, 'Describing Sound: The Cognitive Linguistics of Timbre,' in *Oxford Handbook of Timbre*, 578-608.
[221] Victor Rosi, 'The Metaphors of Sound: From Semantics to Acoustics - a Study of Brightness, Warmth, Roundness, and Roughness,' (doctoral thesis, Sorbonne Université, 2022).
[222] Cornelia Fales, 'The Paradox of Timbre' *Ethnomusicology* 46, no. 1 (2002): 56-95.
[223] Through the extensive output of Stephen McAdams, including the ongoing multi-institutional ACTOR collaboration (Analysis, Creation, And Teaching of Orchestration, https://www.actorproject.org/about-actor, accessed Jun 2, 2024).
[224] Isabella van Elferen, 'The Paradoxes of Timbre: Musical Epistemology between Idealism and Materialism,' in *MPSG 2017 : 6th Conference of the Royal Musical Association Music and Philosophy Study Group* (unpublished, 2017).
[225] Naomi R. Waltham-Smith, 'Deconstruction and timbre,' in *Oxford Handbook of Timbre*, 51-67.
[226] Fales, 'Paradox.'
[227] Daniel Muzzulini, 'Genealogie der Klangfarbe' [Genealogy of Sound-colour] (doctoral thesis, University of Zurich, 2004).
[228] William Sethares, *Tuning, Timbre, Spectrum, Scale* (USA: Springer, 2005). This is a theme throughout, and particularly in chapters 1 and 13; see also Emily J. Allen and Andrew J. Oxenham, 'Symmetric Interactions and Interference between Pitch and Timbre,' *The Journal of the Acoustical Society of America* 135, no. 3 (2014): 1371-1379.
[229] Robert Hasegawa, 'Timbre as Harmony—Harmony as Timbre,' in *Oxford Handbook of Timbre*, 525-551.
[230] Multiple authors, *Le Timbre: Métaphore pour la Composition* [Timbre: Metaphor for Composition], ed. Jean-Baptiste Barrière (Paris: IRCAM / Christian Bourgois, Collection Musique / Passé / Présent, 1991).
[231] Pauline Oliveros, *Deep Listening: A Composer's Sound Practice* (Lincoln: Deep Listening Publications / iUniverse, 2005).

documentations of listening have a hyper-precise, analytical, quality that prefigure the preoccupations of spectralism, in particular the teasing-out of the area where individual pitches emerge from, or disappear into, complex sounds:

> I have listened to many refrigerators. There is often a flickering between the sixth and seventh harmonic. Once, while in the process of drinking ouzo ... a refrigerator sent its harmonics out to surround my head with circles, ellipses and figure-eights.[232]

The hallucinatory, ouzo-fuelled language should not mislead us: Oliveros' 1960s-1970s conception of 'basic musicianship' is highly rigorous and demanding, and I return to it in 3.2 and 7.2.2 below. I note only here that my experience, like that recorded by the younger Oliveros, of attentive listening to complex sounds tends to push in the direction of pitch-finding; of teasing out and sorting available pitches, of consciously deflecting my attention away from the most dominant ones in favour of the most evanescent ones, and even sometimes of the feeling of being able to slow down what would normally be described as transients (as one might select and zoom into a particularly chaotic portion of a spectrogram) to render them perceivable as pitches. Once such an inner process of 'pitch-ification' has been started — for example, when I am carefully listening to the sound of a cracked bell or the glissando of a gong being lowered into water — it cannot (for me) be reversed, and with no obvious loss to my simultaneous ability to recognise a sound in timbral-taxonomic terms (e.g. 'that is some kind of silk-stringed zither.')

The picture of timbre that emerges from the writings of musicologists and composers alike is something enthrallingly protean and labile, almost too hot to handle, its final characterisation being continually deferred ('To talk about timbre means to constantly define and redefine it.')[233] This unresolved status is amply appealing to academic enquiry and creative play, but does not lend itself to the construction of pedagogical methods. Materials dealing with 'technical ear training,'[234] addressed to an audience of audio professionals (sound engineers, producers, and tonmeisters), offer a starkly contrasting approach. Written with commercial imperatives in mind (studio time is expensive!), these manuals are much less hesitant to propose clear terminology and develop structured pedagogies in which there are right and wrong answers. Stephane Elmosnino provides a review of this literature,[235] tracing the discipline's emergence through Andrzej Rakowski's innovative 'timbre solfège' course at the Chopin University of Music, Warsaw (from 1977),[236] to its recognition as a confident and well-resourced field in textbooks such as Jason Corey, *Audio production and critical listening: technical ear training*.[237] Companies have invested significant capital in this area: Harman International R&D trains members of its 'expert listener' panels with a programme called *Harman*

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[232] Pauline Oliveros, 'Some Sound Observations,' *UCLA Committee on Fine Arts Productions*, 5. In Pauline Oliveros Papers, UC San Diego Library (Box 10, Folder 5), digital copy accessed Jun 10, 2023, https://library.ucsd.edu/dc/object/bb0176941r.

[233] Dolan, 'Timbre: Alternative Histories', 4.

[234] 'Broadly defined, technical ear training seeks to make associations between aural impressions of sound quality and quantifiable characteristics of audio signal processing and acoustical measurements.' Jason Corey, 'Technical Ear Training: Tools and Practical Methods,' *Proceedings of Meetings on Acoustics* 19, no. 1 (2013), 1.

[235] Stephane Elmosnino, 'A Review of Literature in Critical Listening Education,' *Journal of the Audio Engineering Society* 70, no. 5 (2022): 328-39.

[236] Tomasz Letowski and Andrzej Miśkiewicz, 'Timbre Solfege: A Course in Perceptual Analysis of Sound,' in *Signal Processing in Sound Engineering*, ed., J. Adamczyk (Warsaw: IPPT-PAN, 2013) 83-96.

[237] Jason Corey, *Audio Production and Critical Listening: Technical Ear Training* (New York: Routledge, 2017).

How to Listen,[238] while Yamaha Corporation, in collaboration with Kyushu University, has developed ear training curricula and in-house software. Elmosnino provides a list of 22 technical ear training software products,[239] none seemingly troubled by terminological self-doubt. That the recent *Oxford Handbook of Timbre* finds no room for these approaches within its 723 pages is a notable omission, given the intensity of real-world activity in this field. Town and gown have gone their separate ways.

The accounts of technical ear training evoke a world whose points of reference seem to be quite distant from new music in the sense of this text. Not only are composers and works mostly absent, their authors make no reference to the work of their expert counterparts in sound design and sound direction that have extensive experience within new music performance, such as Paul Jeukendrup (Department of Sonology at the Royal Conservatoire The Hague) and Gilbert Nouno (IRCAM and elsewhere). Despite their focus on commercial studio workflows, these texts contain insights of significant potential utility to NMP trainees, in addition to their direct applicability as audio production training materials for the many trainees who will pursue portfolio careers. In my interviews, instructors stressed the value of leveraging insights of this type not only in expected contexts (such as when a performing project explicitly 'includes electronics,' or when auditing recorded materials) but also when electronics are absent and where no recording is made. The benefits may be highly specific. After hearing demonstrations of the effects of different filters on a sample, a brass player may improve their selection and understanding of mutes and their interactions with other timbrally-filtering techniques such as non-standard embouchure positions ('vowel positions.') Familiarity with the sounds of different colours of electronically-produced noise may help a player gain attentiveness to, and refine their control of, noise-yielding instrumental techniques. (These may be very precisely specified by some composers: one score called on a violist to play '35% *écrasé*.') Temporarily channelling a sound engineer's ear for frequency rather than pitch can help loosen a performer's over-literal relationship with musical notation and instrumental orthodoxy: having noticed that that certain bars on a particular xylophone produced stronger-than-usual frequencies an octave lower than their 'official' pitch, I saved a performance of Stockhausen's *Gruppen* from breaking the fabled Darmstadt ban on doubled octaves by asking the player to play these pitches 'an octave higher.' (While this example is trivial, the wider point is that certain instruments, including the celesta, need careful case-by-case attention to determine which perceptual octave is actually dominant.) Since performers are rarely in a position to reach for calculators, approximations and memorable rules of thumb are most valuable. Corey, who strives to achieve an 'isomorphic mapping of technical and engineering parameters to perceptual attributes,'[240] notes that

> … matching frequency resonances to specific vowel sounds can help with learning and memory of these particular frequencies. Instead of trying to think of a frequency number, some readers will find it useful to match the sound they are hearing with a vowel sound. The vowel sound can then be linked to a specific octave frequency.[241]

[238] Sungyoung Kim and Jacob Cozzarin, 'A New Technical Ear Training Game and its Effect on Critical Listening Skills,' *Applied Sciences* 13, no. 9 (2023): 53-57.
[239] Elmosnino, 'Review,' 333.
[240] Corey, *Audio Production*, 8.
[241] Ibid., 48.

He offers the following Hz-vowel rough equivalences: 250 Hz ≈ [u] as in boot; 500 Hz ≈ [o] as in tow; 1000 Hz ≈ [a] as in father; 2000 Hz ≈ [e] as in bet; 4000 Hz ≈ [i] as in beet; a 'technical listening-aware' performer may readily translate these into pitch-regions as desired: circa B♮3, B♮4, B♮5, etc. Although frequency is a measure of a physical phenomenon while pitch is a perceptual one, they are strongly correlated. It is possible to 'listen for frequency' as well as to 'listen for pitch'; these activities are non-identical but overlapping.[242] Tristan Murail has promoted listening to 'frequential harmony',[243] as has — in quite a different way — Catherine Lamb.[244] In Chapter 6 I suggest reasons why this notion has found limited resonance among musicians.

In addition to the context-specific benefits I have pointed to, encouraging a NMP trainee temporarily to adopt a 'technical listening' attitude may yield more general — even moral — benefits. The objective listening stance promoted in these texts encourages an open-eared perception of the whole wavefield (this is not necessarily accompanied by an *acceptance* of that whole, as in many moralistic readings of 'the message' of John Cage's *4'33"*.) Rather as the acoustic response of an ideal studio speaker is flat — meaning equal across the frequency range — adopting such a stance tends to flatten hierarchies of status. If it has been demonstrated in the pitilessly exposed environment of the recording booth that a hard-won moment of performing magic may be wiped out by a colleague's momentary inattention to dynamic balance or even by an over-enthusiastic page-turn, this lesson may be applied in many performing contexts to emphasise that on stage, the contributions of all participants should be considered on equal terms: in this respect it is a musicianship (cross-project) matter.

The applicability of most technical listening texts to NMPT is finally limited by their lack of direct engagement with the characteristic gestational processes of new music performances. In viewing their raw materials as audio signals that pass in one direction only from performer to engineer, they show little awareness that sensitive and 'technically'-informed performers frequently adjust aspects of their performance in collaborative dialogue with (artistically informed) audio professionals. Such mutual adjustments are common within new music practice but not reflected in these technical manuals, which are focused on the more linear process of recording and editing commercial music.

The contributors to a documentation of a French conference, *Innovative Tools and Methods for Teaching Music and Signal Processing*, write from a position that is far more 'new music-aware.'[245] Despite this awareness, and despite the ambitions of the convenors of the conference ('another remarkable feature of this book is the inclusion of the performance dimension…', as Jean-Baptiste Barrière writes, quite incorrectly, in the

[242] Corey gives a sense of how frequency — not pitch — may be brought to bear in perceptual terms: 'When you are auditioning a sound file, start to make note of what instruments or components of instrument sounds are affected by each particular octave frequency. For instance, 125 Hz may bring out the low harmonics in a snare drum or bass. On the upper end of the spectrum, 8 kHz may bring out crisp cymbal harmonics. If you are auditioning a Baroque ensemble recording, you may find that a boost at 8 kHz makes a harpsichord more prominent.' Ibid., 47.
[243] Gilmore, 'Downfall', 4.
[244] See footnote 600 below and its context.
[245] Multiple authors, *Innovative Tools and Methods for Teaching Music and Signal Processing*, ed. Laurent Pottier (Paris: Presses des Mines, 2017).

preface),[246] the pedagogical 'tools and methods' documented, including the software projects EarSketch, TaCEM, The Peano Machine, HOA, and FAUST, are directed squarely at creators of various types — or musicians whose principal instrument is the laptop. Apart from Jean Geoffroy's brief documentation of some works for percussion and electronics, the only content relating to instrumentalists (singers are absent) is an account of the TanaCello, a re-imagining of Tod Machover's venerable Hypercello (1993) that offers its player pedagogic feedback and playback of a pre-recorded accompaniment. In this fairly recent text, a wider conception of musicianship as conceived by live performers in an ensemble is notable by its absence.

I am aware of only one general resource that might be described as a 'solfège for timbre' (or 'for sound') written from a new music-aware perspective that might be offered without qualification to a NMP trainee: Michèle Castellengo's *Écoute musicale et acoustique*.[247] Happily, that resource is richly detailed and written with clarity and sensitivity. It documents the author's lifetime of engagement with sound, as successor to Émile Leipp in leading the LAM (formerly the Laboratoire d'Acoustique Musicale, now Lutheries - Acoustique - Musique) of the Institut Jean Le Rond d'Alembert, as teacher at the Paris Conservatoire, as harpsichordist, and as a key link between the worlds of acoustics and new music via her close collaboration with Gérard Grisey from 1977 onwards.[248] In her *livre à écouter* ('listening book')[249] Castellengo proves a worthy Virgil, guiding the reader from vibration, to sound, to music in always-poetic language that eschews jargon. Taking as its motto a phrase adapted from Saint-Exupéry, *S'il vous plaît… dessine-moi un son!*,[250] the chosen sounds are presented alongside their rainbow-coloured spectrograms. Her vivid examples highlight the interactions between musical parameters.[251] The book, in offering what is effectively a detailed and undogmatic course in sonic basic training in a single volume, is highly appropriate for direct use in a NMPT course — even though (or perhaps because) it offers no direct advice to the performer. A successor could leverage more recent visualisation technologies to unify sound and image even more closely, and could incorporate more recent and diverse examples of compositions than those from the era of IRCAM in its pomp — but first, Castellengo's work awaits translation.

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[246] Ibid., 10.

[247] Michèle Castellengo, *Écoute musicale et acoustique (avec 420 sons et leurs sonogrammes décryptés)* [Musical and acoustic listening (with 420 sounds and their decrypted sonograms)] (Paris: Eyrolles, 2015).

[248] François-Xavier Féron, 'Spectra as Theoretical and Practical Models in Gérard Grisey's Creative Process,' in *The Oxford Handbook of Spectral Music*, ed. Amy Bauer, Liam Cagney, and William Mason (Online: Oxford Academic, 2021-(in progress)).

[249] The book is presented as a (vast) PDF file with embedded sounds; a physical book with accompanying DVD-ROM is also available.

[250] 'Please… draw me a sound!' The reference, familiar to Francophone readers, is to *Le Petit Prince* (1943). The Little Prince repeatedly demands that the author draw him a sheep ('S'il vous plaît… dessine-moi un mouton!'). Unsatisfied by the author's attempts, the Little Prince is finally pacified when presented with a drawing of a crate and told that the sheep is inside it. Castellengo is delicately pointing to the impossibility, and the attendant desirability, of the project she has set herself. As she is careful to acknowledge, a spectrogram/sonogram is not a picture of a sound in the sense that a photograph is a picture of a landscape, but rather one translational tool among many for deepening and refining one's sonic understanding.

[251] In the absence of an English translation of this work, I list a few of its highlights: the sound and spectrogram of a man's voice after inhaling helium, then air (325), a complete chromatic scale on the *jeu de tierce* of the Great Organ of Poitiers Cathedral (324), an overtone melody played on a *chang qobuz* (a jaw harp from Kazakhstan) whose player expressively points out the points of greatest intonational divergence from equal temperament via changes in the breathiness of the timbre (400), 'God save the Queen' played by a flute duo producing a virtual bassline of difference tones (416), an example by Jean-Claude Risset of a melody that becomes harmony and then timbre (420) as well as the better-known Shepard-Risset aural illusions (243), the *Pasi but but* millet-growing song performed by Bunun indigenous people in Taiwan, which demonstrates the phenomenon of 'formant-tuning' (460), alongside less-familiar tricks on older instruments (a 'crescendo-decrescendo by registration' on the *clavecin à genouillères* (harpsichord with knee levers) (216)), and visualisations of many of the 'extended' techniques relating to Western orchestral instruments mentioned in 2.2 above (flute whistle tones, tongue rams, key clicks, etc. (337)) — techniques that sound decidedly pedestrian in this vivid context.

Insights from electroacoustic ear-training may also be useful to NMP trainees in offering an alternative conceptual vocabulary to the ones conventionally encountered in instrumental teaching and rehearsals; again, not only when performing works that 'include electronics.' Eldad Tsabary documents the approach he takes in an electroacoustic ear-training course in Concordia University, Montreal.[252] His method, rooted in auditory scene analysis (ASA),[253] is to encourage students to segment aural stimuli into 'aural atoms' — a truly analytical (Ancient Greek *ἀνάλυσις* — 'breaking up', or 'untying') approach. These atoms are the smallest possible perceptual units, smaller than the perceptual *objets sonores* of Pierre Schaeffer,[254] whose work underpins all such attempts to make sense of complex sounds.[255] While Tsabary's atoms are defined with reference to the familiar limens of just-noticeable differences (JNDs), he innovates by proposing techniques for increasing what he calls 'aural resolution': first developing skills of streaming, then microtemporal segmentation (breaking a stream into smaller units), and finally 'atomic' JND discrimination. (His subsequent stages, which seek to build up these atoms into 'higher-level synergetic structures', are more specifically related to the challenge of making sense of electroacoustic music, and are therefore less relevant for our purposes.) Many psychoacoustic studies treat JNDs as empirical findings and hence endpoints by definition. In contrast, Tsabary sees them as challenges that an ear-trainer should seek to reduce in the pursuit of finer resolutions; we might compare the ambitions of the ISMs in 2.1 to map their instruments in ever-larger scales. As he notes,

> … once training allows us to perceive minute microtonal variations (say, 3 cents), we may be able to identify a subtle vibrato in what we previously heard as a stable tone. We may, then, define a single up-and-down pitch motion (an inverted parabola) as an aural atom and recognize vibrato patterns based on variations in rate and intensity. We could, hypothetically, recognize that the vibrato rate increases and decreases slowly at a larger-scale parabolic motion, and so on.[256]

In my experience, this evocation of careful listening corresponds to the ambitions of many fine musicians; I have observed similar tendencies in musicians inspired by 'Deep Listening,' in those who have passed through courses at IRCAM, and (no less frequently) among musicians who claim no specialism in new music.

In my own performing practice, insights from the overlapping domains of acoustics, technical ear training, and electroacoustic ear-training help me improve my response to the complex and dynamic cross-parametric problems that arise in rehearsal situations. They also help me plan my workflow in advance. For example, by predicting that a particular size of thundersheet, when played tremolo in ***mf*** with bass drum beaters, will yield a (roughly) known range of frequencies, after converting that into a rough pitch-range, I can also predict that it will tend to mask detail within a simultaneous, precisely notated, passage in *divisi*

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[252] Eldad Tsabary, 'Aural Atoms and Structures: from Electroacoustic Ear Training to Analysis and Back Again,' (conference paper, *Proceedings of the Electroacoustic Music Studies Network Conference 'The Art of Electroacoustic Music'*, Sheffield, June, 2015).
[253] Albert S. Bregman, *Auditory scene analysis: The Perceptual Organization of Sound* (Cambridge, MA: MIT Press, 1990); Albert S. Bregman, 'Progress in Understanding Auditory Scene Analysis,' *Music Perception: An Interdisciplinary Journal* 33, no. 1 (2015): 12-19.
[254] Pierre Schaeffer, *Traité des Objets Musicaux* [Treatise on musical objects] (Paris: Éditions du Seuil, 1966).
[255] As developed by figures including François Delalande. See Nicolas Marty, 'The Study of Acousmatic Listening Behaviours,' *Organised Sound* 24, no. 1 (2019): 8-19.
[256] Tsabary, 'Aural Atoms,' 5.

cellos and low brass. (In the language of ASA, I predict that all this will be perceived as a single stream.) Consequently, I can either decide to allot less rehearsal time and attention to ensuring the precise execution of the rhythms and pitches in this passage (such conscious deprioritisation is referred to here as *triage* (5.1)), or alternatively suggest to the composer, in advance of costly rehearsal time, that the writing for cellos and brass may be simplified, or the thundersheet played differently or removed.[257] Although this might be seen as a conductor-specific example, this is not the case: in the conception of musicianship as ensemble practice proposed here, comparable acts of 'interventionist audiation' should be undertaken by all participants in a performance, and consequently should be inculcated by NMP instructors. A familiarity with the acoustic literature may also yield simple fixes to vexing problems: I have learned that a horn player should not be placed within three metres of the timpani, because the horn behaves as an impedance matching device in both directions, transmitting sound waves not only outwards but back towards the mouthpiece; consequently a loud timpani stroke can cause a similarly-tuned horn note to crack.[258] Once again, the responsibility for putting such cross-instrumental insights into action need not be left to a conductor. Confident and acoustically aware NMP trainees, when empowered through the acquisition of detailed expertise, acquired in part through such texts that they have encountered and in part through practical experience, already take such matters into their own hands.

2.3.4 Rhythm NISMs

In 2.2.1 I noted that authors of ISMs frequently argue that their instrument had historically been the victim of neglect. Many authors of NISMs argue similarly with respect to the musical parameter they champion. In the case of the status of rhythm within Western and broadly 'classical' approaches to performer training and music theory, the case has been made forcefully and convincingly. The musicologist and new music festival director Mark Delaere writes:

> One of the many paradoxes in the life of a music scholar is that music is said to be the quintessential *temporal* art form, whereas the far greater portion of the theoretical and analytical literature on art music deals with *pitch* independently of temporal factors. Curricula in conservatories of music and university music departments have subjects such as harmony, counterpoint and ear training, with a focus on pitch intervals and chords, but it is hard to find a course on tempo, metre and rhythm.[259]

Russell Hartenberger, the long-term percussionist of the Steve Reich Ensemble, pedagogue, and co-editor of the *Cambridge Companion to Rhythm*,[260] made a similar observation in a recent colloquium:

> A number of years ago, I asked music theory professor at the University of Toronto Mark Sallmen what percentage of the theory curriculum in our Faculty of Music dealt with rhythm, and without hesitation Professor Sallmen said

[257] This example is taken from a real interaction. In all such cases where a composer may be perceived as having made a poor choice I do not identify the composer or work.
[258] Jer-Ming Chen, John Smith, and Joe Wolfe, 'The Effect of Nearby Timpani Strokes on Horn Playing,' *The Journal of the Acoustical Society of America* 135, no. 1 (2014): 472-78.
[259] Mark Delaere, 'Tempo, Metre, Rhythm. Time In Twentieth-Century Music,' in *Unfolding Time: Studies in Temporality in Twentieth-Century Music*, ed. Darla Crispin (Leuven: Leuven University Press, 2009), 13.
[260] Russell Hartenberger and Ryan McClelland, ed., *The Cambridge Companion to Rhythm* (Cambridge: Cambridge University Press, 2020).

'5%'. Just for the record, my experiences with rhythmic training in my music theory classes when I was a student leads me to believe that Professor Sallmen's estimate of 5% was actually high.[261]

Judging from Ilomäki's and Adrianopoulous' surveys of musicianship training, and also from my own experience within institutions, 5% is indeed too high a figure. Hartenberger, citing the work of scholars including Kristina F. Nielsen,[262] convincingly argues that this historically inherited neglect is closely connected to a structurally racist conception of rhythm as a relatively 'primitive' musical parameter. In Hartenberger's view, the increased prominence and higher status of percussion within new music practices is part of a long-overdue parametric re-balancing whose political implications he explores (the principal concern of his colloquium was cultural appropriation *within* the percussion world). Hartenberger approvingly quotes a *New York Times* article by Allan Kozinn that proposed that, in new music contexts, 'drums are the new violins.'[263] Kozinn points to an emerging generation of conductors whose principal instrument had been percussion, viewing this as evidence of an upgrade in the social status of percussion and hence the parameter of rhythm itself. (It might equally be seen as a downgrade in the social status of conductors!)

This parametric re-balancing in creative and professional performance contexts has not been mirrored within training institutions. One of my interviewees (not a percussionist) abandoned their usually mild language to call rhythmic teaching in conservatoires 'generally catastrophic, both then [i.e. during the interviewee's formal training in the early 1990s] and now.' 'Catastrophic,' on further enquiry, meant entirely absent as a distinct training strand. Ensuring that their students received targeted rhythmic training was 'the most important thing I've tried to change here [in the European conservatoire in which they were employed as a full-time professor.]' A very minor upside of this historical absence of scrutiny is that it simplifies an overview of the available pedagogical materials: almost all serious treatments of the subject are relatively recent and may be viewed as offering at least the potential for direct use. In stark contrast to the historical treatment of pitch, we are not faced with millennia of (Western) theoretical authorities to negotiate. In-action engagement with these materials may therefore be reserved for Chapter 7 below. What follows is a probing of some unresolved tensions in the conceptualisation and practice of rhythmic training in new music contexts.

2.3.4.1 What rhythms deserve help?

Since NMPT programmes are often perceived as offering advanced training — a 'Further Maths' A-level to a conservatoire's regular 'Maths' — any rhythmic training they offer might also be thought to help performers negotiate advanced or difficult rhythms. However, there is no consensus on what a difficult

[261] Russell Hartenberger, 'The 5% Quandary: Rhythm in Music Theory,' online seminar hosted by University of Toronto Percussion, YouTube, Dec 9, 2020, accessed Jan 13, 2022, https://www.youtube.com/watch?v=vGBIZy6qP3c. Quotation at 17'05".

[262] 'Applying racist evolutionary theories […], Eurocentric researchers placed Western European art music at the top of their supposed evolutionary chain because of its use of harmony, melody, and rhythm. At the bottom, European and colonialist researchers put African music and Indigenous music of the Americas, alleging that it was 'primitive' in its supposed lack of harmony and melody.' Kristina F. Nielsen, 'Indigenous Rhythm and Dance in North and South America,' in *The Cambridge Companion to Rhythm*, 299.

[263] Allan Kozinn, 'Percussionists Go From Background to Podium,' *New York Times*, Dec 27, 2009.

rhythm might be. Any attempt to evaluate those materials that offer assistance must first take some initial steps in investigating this question; a much fuller discussion is given in Chapter 7.

When rhythmic difficulty is discussed in NMP contexts, we usually 'round up the usual suspects' — scores by the so-called New Complexity composers including Brian Ferneyhough, James Dillon, and Michael Finnissy — and assemble the usual items of evidence: high-ratio and nested tuplets, usually combined with small rhythmic values. Such notational practices lead to blackness on the page; rhythmic difficulty is conventionally associated with, or even equated with, the degree of such blackness. Blackness in rhythmic notation has been often feared and spurned, and also sometimes celebrated. Frank Zappa's iconic 1976 work *The Black Page #1* (also known as *The Hard Version*, in contrast to *The Black Page #2, The Easy Teen-age New York Version*),[264] due to what Zappa called its high 'statistical density,'[265] has become something of a fetish object for devotees of rhythmic blackness. It lent its name to the Viennese new music ensemble Black Page Orchestra, founded in 2014 and devoted to 'radical and uncompromising music of our times.'[266] Finding ways to negotiate black-looking rhythmic notation has occupied a significant part of my own performing practice:

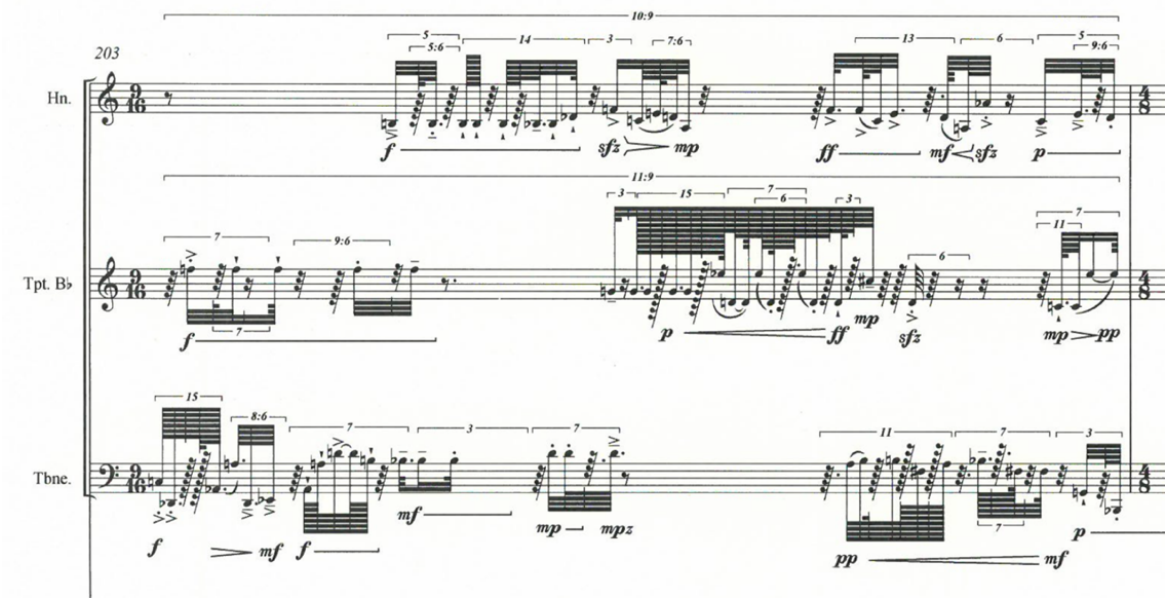

Figure 1: Brian Ferneyhough, *Inconjunctions* for twenty instrumentalists (2014), bar 203, brass parts only, tempo: ♪=47. A conventionally 'difficult' rhythmic passage, featuring my first sighting of a 4096th-note in the wild (the first written E♭ in the trumpet part.) A planned performance of this work with Ensemble Contrechamps at the 2020 Archipel Festival in Geneva, conducted by me, was cancelled due to Covid-19 after the rehearsal phase.

[264] In reality *#2* is not rhythmically simpler than *#1*. However, it does add a disco beat.
[265] Frank Zappa, narration, in 'Black Page #2,' *Frank Zappa in New York*, DiscReet, 1978, 2 LPs.
[266] '…radikale und kompromisslose Musik unserer Zeit,' 'About us,' *Black Page Orchestra*, accessed Jun 2, 2023, https://www.blackpageorchestra.org/about-us. Zappa's short piece, which was originally conceived as a test for a drummer, looks tame by comparison to many transcriptions of musics which are not conventionally staff-notated, including the outputs of bands including King Crimson, The Dillinger Escape Plan, Meshuggah and the 'djent' subgenre of metal spawned by that band, or the highly irregular drum programming of the hip hop producer J Dilla. Each of these practices is surrounded by a circle of celebrants attracted at least partly by the extreme, hardcore, status of the rhythmic material. See, for example, a book by the former drummer of The Dillinger Escape Plan: Chris Pennie with Joe Bergamini, *Polyrhythmic Potential: Creating a Polyrhythmic Vocabulary* (New York: Carl Fischer Music, 2008).

Snapshots of notation of this type occasionally circulate in new music's social media circles, eliciting a range of responses from wary admiration to eye-rolling. It might seem straightforward to identify such a passage as rhythmically difficult. However, performing experience reveals a veritable Mohs scale of degrees of 'hardness' even between instances of black-looking rhythmic notation that superficially resemble each other. The difficulties some pose are merely those that arise from the imperative to decode and manage a large quantity of information: these are referred to in this text as 'workflow' or 'administrative' difficulties. Others prove less tractable. Rhythms that respond less readily to the various strategies for information management examined here are referred to as 'intrinsically' difficult rhythms. Such a designation raises some obvious red flags, since, naturally, what is difficult for me may not be for you. Indeed, the Overton window of what constitutes an acceptable rhythmic challenge to put to a performer has shifted greatly over time, and varies even between the sub-communities of performers specialised in new music. 'Intrinsic' is used as a term of convenience to avoid the repetition of caveats such as 'seemingly intrinsic for a certain subset of musicians, round about now, as I have observed it'; it should in every case be read as 'quasi-intrinsic.' An attempt to explain away intrinsic difficulty as mere unfamiliarity does not make the problems go away, since there is nothing simple about the processes of familiarisation that lead to successful performing outcomes of such rhythms. In 7.1 I defend the meaningful existence of such intrinsic rhythmic difficulties, and propose ways that difficulties may be discovered, isolated, and met head-on in NMPT. Intrinsic rhythmic difficulties sometimes arise from black-looking notation, but very often they do not. Some of the most challenging rhythmic examples I discuss look quite white on the page, while others (the 'fundamentally non-isochronous' rhythms of 7.2) are poorly represented by divisional Western notation and may call for different communicative strategies.

Difficulty implies the existence of metrics of success or failure, as does a notion of progressive rhythmic training. In the ensemble conception of musicianship proposed here, one very obvious metric of success is the degree of perceptible unanimity performers achieve. What performers find especially hard about Zappa's *The Black Page*, for example, is that it is intended to be played by a large group, mostly in unison. On that metric, the following white-looking rhythm is harder than the Ferneyhough passage:

Example 1

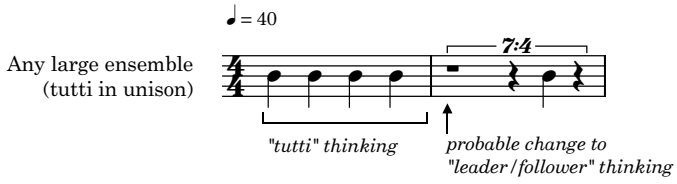

Figure 2: Ensemble rhythmic difficulty, example 1.

The difficulty may trivially be resolved by a single dominant musician (a conductor, a concertmaster, a first violinist of a string quartet, etc.) leading the entry in the second bar. Due to the time-limited pressures of rehearsal processes, which tend to privilege playing together as the key determinant of professional standards, this is the most likely strategy that performers will employ in the majority of contexts. However, 'getting it together' is by no means the only metric that matters. Other ensembles are in play, including the ensembles of trust between a composer's expectations and the output of the performers, and the mobile

constellations of consensus elicited by the subtle phenomenon of rhythmic entrainment between participants in a performance: *participants* encompassing those designated as performers and those called listeners; performers obviously also being listeners, and listening being increasingly understood as a performative act.[267] To put it simply: even in a case where the ensemble plays perfectly together, if the attack in the second bar of **Example 1** sounds like it falls on the third of a minim triplet (as it well might, even though it notionally falls 286 milliseconds, or one beat at c.210 bpm, later), then in many contexts we may say that something has gone wrong. Cases of intrinsic rhythmic difficulty arise where there are unresolved conflicts between these ensembles. In the case of **Example 1**, pursuing the conventional solution may violate the ensemble of trust between performers and composer and also that of the rhythmically-entrained participants, since it involves a shift in rhythmic initiative between the readily-entrainable bar 1 and a leader-follower paradigm in bar 2. It might be thought that such a shift is unnecessary, and that the note in bar 2 might sound in place '*felt* together, with eyes closed' — at least when offered to ensembles with extensive experience of rhythms that are far more visually complex than this mere septuplet. My experience of working with such ensembles leads me to state with confidence that this is vanishingly unlikely. At this slow tempo, the note under the septuplet is hard to place for veteran Ferneyhough interpreters and less specialised performers alike. I therefore predict with confidence that some kind of transfer of rhythmic initiative within the ensemble will occur between bars 1 and 2. Indeed, I suspect that in many contexts a similar transfer will occur, although to a lesser extent, in an even simpler-looking rhythm:

Example 2

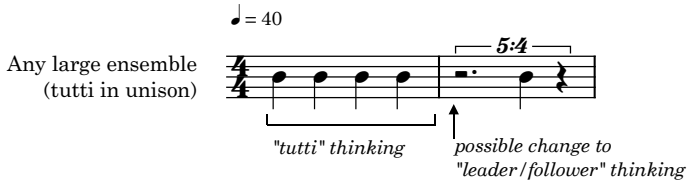

Figure 3: Ensemble rhythmic difficulty, example 2.

The likelihood of a transfer of responsibility for rhythmic initiative taking place between the bars can be greatly increased by making a small notational adjustment:

Example 3

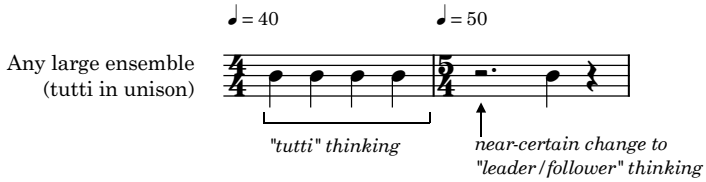

Figure 4: Ensemble rhythmic difficulty, example 3.

The appearance of a 'new tempo' is likely to be decisive, despite the arithmetic involved in recognising the identity (on one reading) of **Example 2** and **Example 3** being elementary (40 ÷ 4 = 50 ÷ 5.) That little extra load on the performers' workflow, combined with the weight of a historically-derived convention that deems

[267] David Helbich, 'Hören ist ein performativer Akt,' [Listening is a performative act] *MusikTexte: Zeitschrift für Neue Musik* 149 (May 2016).

tuplets to be features worth striving for (since they fall unambiguously within the composer's demesne) while tempo changes traditionally admit of greater interpretative latitude — an attitude still widespread even in specialised new music contexts despite sustained historical criticism from figures including Stockhausen and Carter — will tip bar 2 of **Example 3** into 'follower' territory in all but those exceptionally rare ensemble contexts in which all participants take responsibility for the active negotiation of metric modulations: the Arditti Quartet, for example. The consequent loss of successful sustained metric entrainment within the group across the two bars carries the attendant risk of breaking the ensemble of expectation and trust between composer and performers, and also, in contexts where the surrounding music has included sufficient repetition of the whole musical unit to create a sense of expectation, between performers and non-performing listeners. The case is clearer still if we re-notate the septuplet of **Example 1**:

Example 4

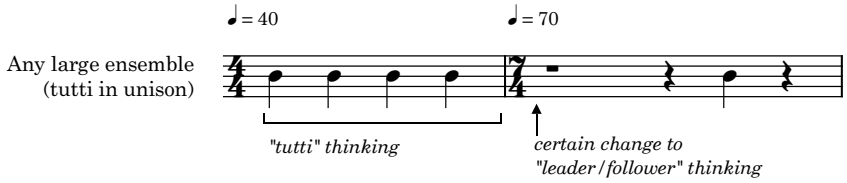

Figure 5: Ensemble rhythmic difficulty, example 4.

In this case, a complete reset of tempo feeling in the second bar and transfer to a leader-follower mode can be virtually guaranteed.[268] These examples, and many other slippages between such 'ensembles' — some prompted by notation, others not — are discussed further in Chapter 7. Such **ensemble intrinsic difficulties** may be likened to the fumbled handover of a baton between members of a relay team.

2.3.4.2 What help is available?

In my experience, almost all specialised new music performers are intensely aware of the gap between what looks difficult *prima vista* and what remains difficult (meaning that it resists naturalisation) even after careful preparation. However, this awareness is poorly documented. Even some of the few NISMs that relate to rhythm skirt the matter. Ine Vanoeveren's *Tomorrow's music in practice today: a practical guide towards deciphering contemporary music* rehearses the conventional equation of blackness with difficulty.[269] Although her text, which breezily dispenses advice to performers and composers alike,[270] does not always make this clear, the key word in Vanoeveren's title is *deciphering*, since in her account the rhythmic targets set by composers are infallibly Parnassian. Vanoeveren patiently guides the reader through her preparatory workflow for a work by (who else?) Brian Ferneyhough, *Sisyphus Redux* for solo alto flute (2010), demonstrating the application of 'lollipop notation,' a rhythmic nesting system developed by the trumpeter and pedagogue Edwin Harkins. The text contains a valuable documentation of how performers mark up the beat and subdivisional

[268] A halfway-house version exists: to retain the tempo change while spelling out the metric modulation [←♩⁷⁻ = ♩→]. In my experience this usually provokes a degree of transfer of rhythmic initiative effect roughly halfway between those of **Example 1** and **Example 4**.

[269] Ine Vanoeveren, *Tomorrow's music in practice today: a practical guide towards deciphering contemporary music* (Antwerp: University Press Antwerp, 2019).

[270] I only refer here to the section of the book devoted to rhythm; Vanoeveren also provides advice on many other aspects of new music performance practice.

structures of 'complex' rhythms with pencil lines above the stave — a practice that is universally done but rarely deemed worthy of comment, and which, as I suggest below, has profound implications for how performers think about and embody such rhythms in their preparation and, consequently, what an audience member will perceive.

In the discourse of pitch, the historical authorities most frequently cited, and the majority of today's dominant explanatory voices, are Western (European and North American) and White. When turning to the discourse of rhythm, it is refreshing to encounter a competing master narrative from elsewhere, and one which has been presented as no less confident about its explanatory power and practical usefulness than any Western *grand récit* from Schenker to Forte. This is the view that the highly-developed rhythmic procedures of Karnatic (South Indian) music, and its theory and pedagogy, can provide the key to unlock and facilitate the 'difficult' rhythms of new music. I have already noted konnakol's etymological status as the 'prince' or 'sceptre' of rhythm. Rafael Reina, in his mighty volume *Applying Karnatic Rhythmical Techniques to Western Music* — a distillation of his teaching practice at the Amsterdam Conservatoire — presents this case explicitly.[271] Not only is it necessary to undertake 'an ample revision of how rhythm is taught (and I would daresay conceived) in the West,'[272] other non-Western rhythmical practices simply do not have comparable explanatory power:

> The reader may wonder why karnatic rhythmical structures, rather than any other non-western culture, can have this enormous potential (or not to the same extent). Reflecting on my previous studies of Flamenco, Berber, African, Turkish, and Maghreb music cultures in the light of my knowledge of karnatic music, I have come to the conclusion that any rhythmical technique in these cultures can be studied using names and applications within karnatic music.[273]

Reina vigorously defends his estimation of Karnatic procedures as offering a rhythmical Universal Solvent across his 460 pages. Understandably, given the low level of understanding of Karnatic terms and procedures in Western training environments, he finds it necessary to start with a (lucid and very detailed) exposition of Karnatic theory and practice, and we must wait until page 322 for our first engagement with any actual new music — a frustration with which the reader of this text may be starting to sympathise. Reina credits an interview given by Pierre Boulez in 2000 as having, in part, provided the motivation and justification for his work:

> For me, what still has to be acquired is [the] degree of precision you need from an orchestra. This is not only because I am obsessed by precision, but also because the orchestral sonority changes completely. The clarity is suddenly there. You can really hear the score as it is written. Sometimes with a piece of Stockhausen, Berio, or myself, the precision is not in the [performers'] head[s] before looking at the score. You [meaning: the conductor] have to be demanding. If you have sixteen violins playing a quintuplet, they have to really be thinking a quintuplet. The kind of tempo modulation you have in Elliott Carter's music, well, it has to be very precise otherwise it's not effective. This type of precision is still not really in the habits, shall we say.[274]

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[271] Reina, *Karnatic*.
[272] Ibid., 449.
[273] Ibid., 3.
[274] Pierre Boulez, interviewed by Jed Distler for Andante.com, Aug 2000. Transcribed and republished as Jed Distler, 'An interview with Pierre Boulez,' *All over the keyboard*, accessed Nov 10, 2023, https://jdistlerblog.wordpress.com/2016/01/06/an-interview-with-pierre-boulez-1925-2016/.

Boulez was thinking on the hoof, and so some initial objections spring to mind: 'really thinking' and producing maximally even quintuplets is appropriate when performing Carter and Stockhausen, but would be actively wrong in many other contexts, so it is not so clear what 'habits' an orchestra should aim to develop (see 3.2 below.) The notated quintuplets in orchestral works by Vaughan Williams, for example, call for a range of subtle durational weightings to yield sub-groups of 2+3, 3+2, and sometimes even 1+4. Janáček's quintuplets are deceptively simple notational headwords for little expressive worlds, ranging from insistent jabbings (to be performed with mathematical rigidity) to cues to reproduce the exceptionally intricate[275] micro-timings of a Czech word. (I could equally have chosen numerous examples from more recent music; I named these composers due to their familiarity.) Discussing triplets, Ian Pace goes so far as to suggest that

> … a metrically regular approach to triplets may be the exception rather than the rule in terms of historical (and even to some extent contemporary) practices.[276]

However, applying such repertoire-specific caveats does not make the problem Boulez identified go away, because we surely would wish to have the ability to produce even (or even-enough) quintuplets in our expressive arsenal, so that we may deploy that ability as we see fit. I cannot think of a reason why we would wish to *reduce* our expressive stocks.

The problem is deeper and less tractable. Neither Boulez (in this quotation) nor Reina (in his book) take account of what I have called ensemble intrinsic difficulties — the difficulties that arise from a slippage of rhythmical responsibility between ensembles: ensembles of performers, and also the ensemble composer+performer(s). Their view of rhythm — to invert Ravel's motto — is *compliqué, mais pas complexe* (complicated, but not complex): that is, they imply that all rhythmic problems would be resolved if only everyone would accept the identity and interchangeability of musical materials. In this view, a quintuplet — or a *ta-di-ki-na-thom* — is presented as a phenomenon with a single reference, like the kilogram cylinder of platinum-iridium in a vault in Saint-Cloud that until 2019 served as the reference by which all other kilograms were measured. It should not, in principle, make a difference if one or a thousand performers were involved, since a quintuplet is a quintuplet; furthermore, my **Example 1** and **Example 4** (likewise **2** and **3**) are identical, just as they would be from the perspective of the 'piano roll' of a DAW. It might be thought that this conception of rhythmic accuracy is essentially notational in nature: first the quintuplet is written, then performers try to do justice to it, inevitably deviating from it but in a measurable way. However, the conception does not depend on the existence of a score. Producing maximally mathematically-even quintuplets would be desirable when performing: Clarence Barlow's *Çoğluotobüsişletmesi* (a highly detailed score exists), Frank Zappa's *Zomby Woof* (the score situation is complicated, sketchy, and partially retrospective), and when attempting a cover version of Meshuggah's *I* (no written score exists). The 'ideal

[275] Jana Dankovicová and Volker Dellwo, 'Czech speech rhythm and the rhythm class hypothesis,' (conference paper, International Congress of Phonetic Sciences, Saarbrücken, Aug 6-10, 2007). Accessed online, Jun 3, 2023, https://www.researchgate.net/publication/228850367_Czech_speech_rhythm_and_the_rhythm_class_hypothesis.

[276] Ian Pace, 'Notation, Time and the Performer's Relationship to the Score in Contemporary Music,' in Crispin (ed.), *Unfolding Time*, 153. Pace notes an observation by Sir Charles Hallé on Chopin's performances of his Mazurkas, which 'appeared to be written, not in $\frac{3}{4}$, but in $\frac{4}{4}$ time, the result of his dwelling so much longer on the first note in the bar.' (Ibid., 156, footnote 11.)

kilogram' conception of rhythm might also inform activity outside a specific performing context: a trainee might sit alone in a room and try to tap or sing even quintuplets with reference to a metronome. This is not a matter of decoding alone.

Reina's failure to situate his notion of rhythmic accuracy adequately sometimes leads to what can only be described as misunderstandings. In his discussion of how performers should approach Franco Donatoni's *Movimento* for ensemble (1959),[277] he intriguingly recasts that composer's conventional Western notation in Karnatic terms (Flute 1 plays *tisra jathi 4*, Flute 2 plays *khanda jathi 3*, and so on.) However, this is all done 'in order to perform this fragment without making it sound chaotic' — an ambition which is not only impossible, but fails even a naive *Werktreue* test, since the passage is obviously intended to sound rhythmically chaotic, being an early example of what later became a standard new music trope: a texture of scintillating rhythmic chaos within tightly-controlled boundaries that contrasts with a static pitch-field, as found at the beginning of Anders Hillborg's *Vaporised Tivoli* for ensemble (2010), and in numerous other works. This conception of rhythmic training omits a vital 'triage stage' (5.1.) The appropriate priority for the performers in the Donatoni example is not to concentrate on the little inner rhythmic cycles of each individual player, but rather to ensure the whole texture is entered and quitted nimbly and cleanly, and maintained with consistency. It is no calamity if a player falls internally out of synchronisation. A comparable limitation applies to many of Reina's examples of new music. Indeed, for a practical educator who proposes a 'revision' of the way rhythm is 'taught and conceived in the West,'[278] he is surprisingly willing to bow to the authority of Western notational procedures and assumptions about music's structural hierarchies. For example, he takes for granted that a composer's preparatory material and sketch-work will retain a meaningful presence in a final score and its sounding result, and that a performer's learning journey should replicate the composer's creative pathway. In his discussion of (of course!) Ferneyhough's little *Mort Subite* for mixed quartet (1990),[279] Reina investigates the rhythmic grid supplied by that composer to the Nieuw Ensemble, rather than the published score or the sounds it provokes — both of which are sufficiently distant from the supposed inner rhythmic scaffold to render the exercise of questionable usefulness.

Reina is not the only educator to have attempted to apply Karnatic practice to the rhythms of new music. The percussionist Jarrod Cagwin has produced a more portable text with accompanying DVD: *One by One: Exercises for Rhythmic Development*.[280] Cagwin jumps straight into practical solkattu, giving the hand positions for the four basic sounds (*ta*, *din*, *thom*, *num*), the familiar cycling phrases *takadimi* / *takajuna*, strategies for counting cycles with the fingers and feet, and so on. His visual presentation usefully associates each syllable with a degree of a fictitious white-note scale, greatly speeding readability for Western-trained musicians. Rapidly and logically we find ourselves in the territory of rapid quintuplets and septuplets, then a highly athletic group syncopation exercise.[281] Although Cagwin has given courses at the IEMA, his resource is

[277] Reina, *Karnatic*, 322-325.
[278] Ibid., 4.
[279] Ibid., 340-345.
[280] Jarrod Cagwin, *One by One: Exercises for Rhythmic Development* (Frankfurt: Ensemble Modern Media, 2009).
[281] Ibid., 43.

limited to core rhythmic training and does not address its direct application to the rhythms of new music. In this way he skirts the pitfalls of rhythmic literalism but limits the scope of his insights.

Perhaps the greatest barrier to the inclusion of Karnatic-informed training in a NMPT programme is its uncompromising nature; the method is presented as needing to be 'swallowed whole.' Reina proposes a five-year weekly training schedule, and prefaces his text with a glossary of 58 South Indian terms; Cagwin, too, accepts without resistance the inherited konnakol syllabary, seemingly without asking whether these are necessarily the best choices for native speakers of other languages (for example, a rapidly-repeated *ta* is awkward for a British English native speaker who habitually aspirates their plosive consonants) or the implications of the inner rhythmic hierarchies they encode, which may not serve new music as well as they do Karnatic music: a septuplet being vocalised as *ta-ka-di-mi-ta-ki-ta* certainly conveys a feeling of 4+3,[282] and so may not be appropriate when applied to contexts where a septuplet without inner accentuation is desired (see 7.2.1.1.) Since I have not undergone the kind of training odyssey Reina recommends, it does not feel appropriate for me to attempt an evaluation of its wider potential usefulness in NMPT contexts. However, if the only person qualified to do so is an initiate — so to speak — there is an obvious problem here, and one that also bedevils the proper evaluation of other training approaches that demand an immersive long-term commitment, such as the Suzuki violin method. Unlike researchers conducting clinical trials, those in search of good practice models for NMPT cannot run long-term identical twin studies. Nevertheless, course leaders such as myself must, somehow, decide to prioritise some approaches over others.

Other training resources exist. In most cases their language is less sophisticated, and their ambitions and frames of reference seem much more limited, than those with Karnatic allegiances. Nevertheless, they cover some of the same ground. Ari Hoenig and Johannes Weidenmueller, from a background in jazz, offer an *Intro to Polyrhythms: Contracting and Expanding Time within Form.*[283] Despite its grandiose title, this is a simple and approachable set of exercises. More challenging exercises are offered by the drummer Peter Magadini in *Polyrhythms: The Musician's Guide*;[284] these are presented in Western notation but arose from collaborations with Hindustani classical musicians, including the sarod player Ali Akbar Khan. I have found some of these helpful in my own practice, less to tackle specific problems arising from an instance of notation, and more as targeted rhythmic therapy to smooth out certain known personal tics and quirks (for example, I know I tend to rush groups of 11 pulses in the time of 8, since I worry about getting through the whole group in time.)

The truth is that although many of the examples in such texts look intimidating on the page, it is often elementary to devise one's own solutions to such problems, and in many cases they hardly seem worth writing down, let alone publishing. In these very limited self-training contexts, a metronome, some privacy, and a good deal of patience, is all that is necessary to gain confidence when dealing with the old rhythmic

[282] Ibid., 31.
[283] Ari Hoenig and Johannes Weidenmueller, *Intro to Polyrhythms: Contracting and Expanding Time within Form* (Pacific, Missouri: Mel Bay Publications, 2009).
[284] Peter Magadini, *Polyrhythms: The Musician's Guide* (Milwaukee: Hal Leonard, 2001). The named editor is Wanda Sykes, who briefly worked in publishing prior to her break in comedy.

chestnuts of '*x* against *y*.' Sometimes a piece of paper, a pencil, and basic arithmetic helps: converting a bpm/ppm[285] value to milliseconds (often useful when working out the time-gap between two events or the equivalence of tempi and tuplet lengths) is simply a matter of dividing 60,000 (the number of milliseconds in a minute) by the bpm/ppm value.[286] We might draw an analogy with the questionable utility of the chromatic pitch-training manuals of Friedmann and Edlund in 2.3.2.1 above. While these tasks seem quite amenable to a low-tech DIY approach, if further assistance is needed, assorted metronomes and metronome apps exist, both aural and haptic, many with training functions. (These mostly seem to be aimed at student drummers, but there is no reason that other performers should not use them.) Software also exists to help naturalise the execution of specific awkward rhythms. Probably the most widely used in new music contexts at time of writing is João Pais' Click-Tracker,[287] an intuitive and feature-rich patch that enables musicians easily to create clicktracks tailored to most of the familiar features of new music's rhythms. (That project is developing rapidly at time of writing; I had noted some missing functions, only to discover that they had been included in recent updates.) One innovative and pleasing feature of Pais' project is his website's nascent library of clicktrack files, programmed by previous performers who found a particular work challenging and shared in the spirit of open knowledge exchange.[288]

Unsurprisingly, the texts in this area most relevant for our purposes are those authored by expert new music performers: these include the percussionist and conductor Steven Schick and the pianist Imri Talgam. Because I view their contributions as 'for use', I reserve discussion of their contributions for Chapters 4 and 7. Comparably, in Chapter 7 I make use of the research of Rainer Polak on non-isochronous rhythms,[289] and so do not discuss it here.

2.3.4.3 Insights from researchers of rhythmic perception: why bother teaching the rhythms of new music?

In contrast to the relative paucity of pedagogical materials in this area outside Karnatic-based approaches, there exists a vast academic literature on rhythm. Much of this literature might be thought to be of direct relevance to new music performance and its teaching, since it includes studies of sensorimotor synchronization,[290] the perception of polyrhythms,[291] the benefits or otherwise of subdivision,[292] the

[285] The abbreviation ppm (pulses per minute) is employed in favour of bpm (beats per minute) in contexts where I wish to be agnostic about where (and if) a perceived beat falls; ppm is simply the number of isochronous 'somethings' that would take up a minute.
[286] So, for example, one crotchet in ♩=96 lasts 625ms (60,000 ÷ 96 = 625).
[287] João Pais, 'Click Tracker Mobile App,' *Click Tracker*, Apr 20, 2021, accessed Jul 2, 2024, http://jmmmp.github.io/clicktracker/index-mob.html.
[288] Although such wiki-like initiatives are surely reasons to be optimistic, shared files do not solve all rhythmic problems for the preparing performer, since the process of inputting a metric structure is both a valuable learning experience itself, and also involves making artistic decisions that may well affect the final performance: do I want a feeling of subdivision here, and how much? how should I grade this accelerando?, etc. Additionally, no responsible performer would rely entirely on the work of others in contexts where input errors are highly probable.
[289] The definition of this key term is unsettled; see 7.2 below.
[290] Bruno H. Repp and Yi-Huang Su, 'Sensorimotor Synchronization: A Review of Recent Research (2006–2012),' *Psychonomic Bulletin & Review* 20, no. 3 (2013): 403-452.
[291] Cecilie Møller, Jan Stupacher, Alexandre Celma-Miralles, Peter Vuust, 'Beat perception in polyrhythms: Time is structured in binary units,' *PLoS ONE* 16, no. 8 (2021), n.p.
[292] Peter A. Martens, 'The Ambiguous Tactus: Tempo, Subdivision Benefit, and Three Listener Strategies,' *Music Perception* 28, no. 5 (2011): 433-48.

categorisation of non-isochronous versus isochronous rhythms,[293] the perceptual separation of rhythmic streams and chunks,[294] the management of progressive tempo changes,[295] and rhythm's interactions with other musical parameters.[296] Despite the breadth and conceptual richness of this literature, and despite the care researchers have taken to develop internally robust empirical research methods, its applicability to NMPT is severely hampered by the absence of studies of performers with deep experience and acknowledged expertise in that field. The experimental subjects of many empirical studies are those students who made themselves available to the researchers. For this reason, enticing-sounding studies such as 'Can Musicians Track Two Different Beats Simultaneously?'[297] (the authors' answer is, essentially, 'no') might more accurately be titled 'Can A Few Classically-Trained Yale School of Music Graduate Students…?' More drastically, Bouwer et al.,[298] in attempting to answer by online experiment the tantalising question 'What makes a rhythm complex? The influence of musical training and accent type on beat perception' (a highly NMPT-relevant concern), employed a distinction between 'musical experts' and 'novices', defined as those who reported receiving more or fewer than two years' musical training![299] Our fields of enquiry, although asking similar-sounding questions, appear to be separated by an unbridgeable distance; it is as if the field of sports studies focused on amateur and student-level sport while neglecting to examine the performance of elite athletes. (Although some may wince at my use of the word 'elite' here, I invite them to attend a concert of new music given by the new music ensembles referred to in Chapter 1, and to ask themselves afterwards if they still have such qualms.)

Recent and ongoing studies have investigated the rhythmic practices of expert performers of West African percussion music, jazz, electronic dance music, R&B/hip-hop and Scandinavian fiddle music.[300] However, comparable studies of performers with extensive experience in new music are far rarer: I could find no such examinations of the practices of established new music ensembles, nor of the many newer and smaller

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[293] Andrea Ravignani, Bill Thompson, Massimo Lumaca, and Manon Grube, 'Why Do Durations in Musical Rhythms Conform to Small Integer Ratios?' *Frontiers in computational neuroscience* 12 (2018): 86-86; Andrea Ravignani and Guy Madison, 'The Paradox of Isochrony in the Evolution of Human Rhythm,' *Frontiers in Psychology* 8 (2017): 18-20.

[294] Eric F. Clark and Carol L. Krumhansl, 'Perceiving Musical Time.' *Music Perception: An Interdisciplinary Journal* 7, no. 3 (1990): 213-251; Jonathan D. Kramer, *The Time of Music: New Meanings, New Temporalities, New Listening Strategies* (New York: Schirmer, 1988); Roger T. Dean, Andrew J. Milne, and Freya Bailes, 'Spectral pitch similarity is a predictor of perceived change in sound- as well as note-based music', *Music & Science* 2 (2019): 1–14.

[295] Hans-Henning Schulze, Andreas Cordes, and Dirk Vorberg, 'Keeping Synchrony While Tempo Changes: Accelerando and Ritardando,' *Music Perception* 22, no. 3 (2005): 461-477.

[296] Vincenzo Santarcangelo and Riccardo Wanke, 'The Early Stage of Perception of Contemporary Art Music: A Matter of Time,' *Organised Sound* 25, no. 2 (2020): 130-141; David A. Dahlbom and Jonas Braasch, 'How to Pick a Peak: Pitch and Peak Shifting in Temporal Models of Pitch Perception,' *The Journal of the Acoustical Society of America* 147, no. 4 (2020): 2713-2727.

[297] Ève Poudrier and Bruno H. Repp, 'Can Musicians Track Two Different Beats Simultaneously?', *Music Perception: An Interdisciplinary Journal* 30, no. 4 (2013): 369-390.

[298] Fleur L. Bouwer, J. Ashley Burgoyne, Daan Odijk, Henkjan Honing, and Jessica A. Grahn, 'What Makes a Rhythm Complex? The Influence of Musical Training and Accent Type on Beat Perception,' *PLOS ONE* 13, no. 1 (2018): 1-26.

[299] The authors point out the lack of prior work in this area. For example, they note that '… no one has examined whether intensity accents influence beat perception more or less strongly than temporal accents, nor how musical expertise affects sensitivity to each type of accent.' Ibid., 1.

[300] Since many of these studies are ongoing at the time of writing, I give the names of two collaborative research projects rather than their findings: Justin London: "Microtiming, Meter, and Ensemble Coordination in West African Percussion Music.' Ongoing collaborative research with Rainer Polak (RITMO Centre, Oslo) and Nori Jacoby (Max Planck Institute for Empirical Aesthetics, Frankfurt),' and 'Time: Timing and Sound in Musical Microrhythm: Collaborative research project with Anne Danielsen (PI) at the University of Oslo.' Justin London, 'Research,' *Carleton University*, accessed Jul 2, 2024, https://www.carleton.edu/people/jlondon/research/.

ensembles whose members have passed through the NMPT courses in 1.2 and who might be seen as promising candidates for experimental investigation. On the rare occasions where an experienced performer of new music is included in the literature, researchers will treat them with so much deference that any notion of putting their abilities to the test is out of the question.[301] When evaluating the applicability of the literature to NMPT contexts — contexts where we are focusing on improving skills, not just characterising them — these severe limitations must be taken into account.

Some very recent listener-focused investigations of individual performances aside,[302] researchers of rhythmic perception have rarely engaged in detail with the characteristic rhythmic procedures of new music. An exception is Justin London, author of the much-cited *Hearing in Time*.[303] In a 2009 article, 'Temporal Complexity in Modern and Post-Modern Music: a Critique from Cognitive Aesthetics,' London applies his considerable expertise to offer a broadly sceptical view of 'complex' musical materials.[304] This is an exceptionally rare attempt at a serious examination of new music's rhythmic practices from an out-of-group perspective. London's intention is to investigate the cognitive

> … 'constraints on underlying materials' in the temporal domain. For here is precisely where the limits on our perception and cognition of number and duration come into play.[305]

This is my area of interest too; I think that a NMPT programme worthy of the name should seek to train performers to probe these limits directly and honestly. Those that fail to enter this territory and simply omit dedicated rhythmic training (as, recalling the complaint of my interviewee above, many NMPT courses do) may reasonably be deemed to lack the right to claim expert specialisation, at least with respect to this musical parameter. For this reason, London's argument merits careful attention, since it provokes some taboo-breaking questions: what is the ultimate goal of such training, and can it be justified? With the example of *Inconjunctions* in mind (**Figure 1**) it does not seem unreasonable to question the appropriateness of expending a training organisation's finite resources on the placement of a 4096th-note within a nested tuplet.

London starts by skewering the rhythmic theories of the mid-twentieth-century luminaries Messiaen and Babbitt as offering 'distinctions or configurations which we cannot perceive,' noting that their 'careful and systematic rhythmic designs are in large part, for naught.'[306] This corresponds to the experience of performers as I have observed it — I have never met a practical musician who set any store by Messiaen's notion of the recognisability of rhythmic retrogrades, nor by Babbitt's attempt to treat rhythm as parametrically 'on all fours' with pitch, whether for serial purposes or any other. Here, London is pushing

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[301] Kent Nagano in conversation with Clemens Wöllner, 'Music Is a Unique Artform Because of the Temporal Aspect,' in Clemens Wöllner and Justin London, ed., *Performing Time: Synchrony and Temporal Flow in Music and Dance* (Oxford: Oxford University Press, 2023): 369-377.
[302] Jason Noble, Tanor Bonin, Roger Dean, and Stephen McAdams, 'Evaluating the Psychological Reality of Alternate Temporalities in Contemporary Music: Empirical Case Studies of Gérard Grisey's *Vortex Temporum*,' in Wöllner and London (eds.), *Performing Time*, 305-312. Participants listened to the recording of the work by Ensemble Recherche and responded with a joystick; I could not find comparable studies of listeners in live performances.
[303] Justin London, *Hearing in Time: Psychological Aspects of Musical Meter* (New York: Oxford University Press, 2004).
[304] Justin London, 'Temporal Complexity in Modern and Post-Modern Music: A Critique from Cognitive Aesthetics,' in Crispin (ed.) *Unfolding Time*, 45-68.
[305] Ibid., 50.
[306] Ibid., 57.

at a wide-open door, since these decades-old generative processes are recognised by sympathetic musical collaborators as merely having played the part of grist to their respective creative mills; the incoherence of the theories does not invalidate the music. They are no more perceptually present in the resulting compositions than are the star charts that John Cage — in full awareness and celebration of the arbitrariness of the act — traced to provide the pitches and durations for pieces including the *Etudes Australes* for piano (1974-75), nor does any informed participant seriously imagine that they might be or that this absence matters. In almost all cases where generative compositional processes have been employed, the success or otherwise of the resulting compositions depends on other factors.

London's extended argument is stimulating and provocative. He offers a compositional thought experiment in the form of a *Subtle Etude #1* — a piece consisting of a series of long repeated tones with minute differences in duration and dynamics. For simplicity, I do not discuss the dynamics in what follows.

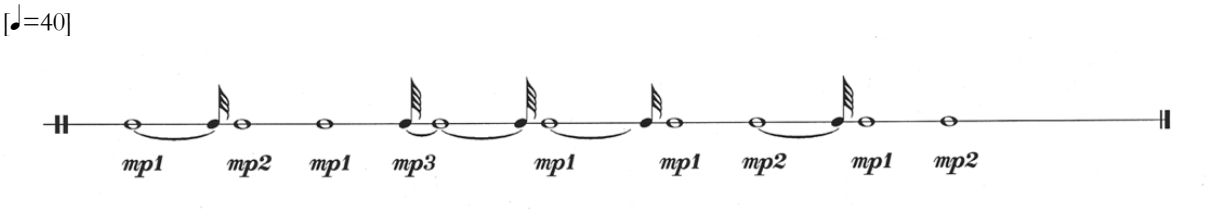

Figure 6: Justin London, *Subtle Etude #1*. Reproduced with kind permission of the author.

Each 𝅝 is six seconds long, and each additional tied 𝅘𝅥𝅯 adds approximately 23 milliseconds each. These differences are chosen to fall well below our empirically determined perceptual thresholds:

… the JND […] for unmetred duration [is] roughly 5% of the inter-onset interval—here about 300ms—though durational discrimination is very poor for intervals greater than about 2 seconds.[307]

London proposes that this étude, in being 'too subtle and too simple to be heard,' can serve as an analogue to what he calls 'hyper-complex works,'[308] which, he implies, should be treated with similar caution.

London's approach has the great value of looking past the notational details of rhythmic complexity (the features that I, with my focus on the training performer, call 'workflow difficulties') and directly at what might be considered intrinsic points of difficulty — at internal human speed limits of various sorts. As an obligate negotiator of musical notation in many varieties, with a pile of scores on my desk awaiting marking-up and learning, I find this external perspective refreshing. It is also of especial potential pedagogic value to today's NMP trainees, given the current broad compositional tendency to retire black-looking notational practices with their heavy decoding burdens (characteristic of the 'British Darmstadt' period in the 1980s,[309]

[307] Ibid., 63. Inter-onset interval ('IOI') is the durational interval 'between the attack-points of successive events' (London, *Hearing and Time*, 4.) This useful term helps distinguish performed attacks from actual heard durations, since rhythms may be played legato or staccato, and will have different decay times in different acoustic environments. Although they do not usually use the term, performers and pedagogues routinely make use of the IOI concept. When a violin teacher asks a student to 'clap the rhythm' of a sight-reading passage, the teacher is asking the student to mark its IOIs.
[308] London, 'Temporal Complexity,' 64.
[309] 'British Darmstadt': the period of the IMD under the Anglophilic directorship of Friedrich Hommel (1982-94), in which composers including Brian Ferneyhough (as co-ordinator of the composition courses), James Dillon, Chris Dench, Roger

and also of the mass of post-spectralist scores produced by composers in IRCAM's orbit in the 1990s and 2000s) in favour of whiter-looking scores which seem intended to offer clearer windows for performers to manifest their agency.[310] As one composer put it to me in 2022, 'all that fussy nested tuplet shit is over.' A perception-led, rather than notation-led, treatment of the temporal aspects of new music that does not emanate from a single composer with a strong authorial voice — the endlessly-cited Gérard Grisey, for example — is surely to be welcomed as practice evolves away from a target-based model in which composers throw down the gauntlet to performers, and towards a collaborative one that demands honesty from its participants both about the degree of precision to which the intended pre-planned content of a performance may be imagined in advance, and the degrees of divergence from that intention that are considered acceptable (see 5.2 below). Such collaborations require the designation of shared working spaces. In 5.4 I refer to these as musical workzones: the overlapping areas towards the centres of our shared experiential fields in which musical materials may be most readily worked on and exchanged. Insights from specialists in musical cognition would be warmly welcomed in helping locate, delimit, and furnish this space.

Unfortunately, London's argument does not offer the help we might wish for in this regard. Firstly and most obviously, it deals with only a single category of potential obstacles to rhythmic comprehensibility, and so can hardly stand as a critique of rhythm in 'modern and post-modern' music as a whole. London's broad-brush dismissal here has a precedent: in his (2004) *Hearing in Time* London used Milton Babbitt's *Composition for Twelve Instruments* (1948, rev. 1954) as a proxy for 'music that is not metric at all, as it does not afford the listener any possible pattern of temporal invariance.'[311] London does not seem willing to entertain the idea that a composer or performer may wish to suspend a feeling of metre temporarily or permanently, nor to be curious about why notated metres may still be employed on these occasions: all these fall under the category of 'effects without causes.'[312] Richer compositional engagements with temporality are not mentioned. Since even twentieth-century icons such as Nancarrow, Lutosławski, Feldman, Ligeti, Grisey, or Stockhausen go unremarked, we may wonder what London would make of the wilder and weirder rhythmic adventures that the scores of Nicole Lizée, Anthony Braxton, Michael Wertmüller, Robin Hoffmann, or Stefan Keller provoke (see Chapter 7 below.) However, since in this text I repeatedly defend the value of making generalisations about new music practice and stress the trivial ease of finding counter-examples to every rule of thumb, such heaping-up of alternatives would constitute neither a fair nor a final criticism.

A more serious problem with London's critique is his narrow conception of the way performers work:

Redgate, Christopher Fox, Richard Barrett, and Michael Finnissy, were invited to Darmstadt. As Fox writes, 'by 1992, even those composers associated with the tendency were in retreat from the term [complex].' Christopher Fox, 'British Music at Darmstadt 1982-92,' *Tempo* 186 (1993), 24.

[310] Multiple exceptions to this tendency may be easily found: in the intricate scores of Turgut Erçetin, for example. However, in my experience as an occasional member of reading panels for calls for scores — an activity which exposes participants to seemingly-astronomical quantities of notation — there has been a noticeable decrease in the average surface rhythmic notational complexity (blackness) of scores over the past two decades.

[311] London, *Hearing and Time*, 24.

[312] London, 'Temporal Complexity,' 65.

The human performer faithfully tries to realize the score, with the paradoxical constraint that if she should make any note audibly longer or louder, it would be a mistake.[313]

Such faithful decoding is certainly not a human performer's only lot in life. However, even if we adopt this stance temporarily, and attempt to convert the *Etude*'s notation into sound dutifully and dumbly, as notation software would, the passage is far from being the 'impossible performance task' London claims. If I run my internal clock in his 𝅘𝅥𝅯s at a leisurely 320 ppm — which, although it may seem alarmingly fast as a tempo indication, is slower than the 𝅘𝅥𝅮s in almost all performances of that hobby horse of metric researchers, Beethoven's *Symphony No. 5, I* — I can perform the passage reliably and without stress, as could almost all professional performers I have encountered, regardless of their degree of new music specialism.[314] In this case a specialism in new music serves less to aid accurate execution *per se*, and more to reduce the taboo around re-notation, since a familiarity with the scrappily contingent way many scores come into being thoroughly eliminates any assumptions that scores arrive immaculate or remain untouchable. A quick re-notation helps to avoid the destabilising 𝅘𝅥𝅯 'hiccups' by surrounding odd groups with even ones. Asymmetries are moved away from the edges and towards the middles, and groupings are arranged so that each attack is followed by a 𝄽 bar to aid re-stabilisation. The rhythmic values are doubled for ease of reading:

[313] Ibid., 64.

[314] 'Perform': on a violin, piano, ukulele, kazoo, a tapped knee, etc. This is an example of instrumentally-independent musicianship; while performers may prefer to use their main instrument, the passage is simple enough to be performed in multiple ways. Players of instruments with characteristically soft or less-predictable attacks and/or who would need to find breathing solutions, such as hornists or tubists, might find clapping or tapping more secure.

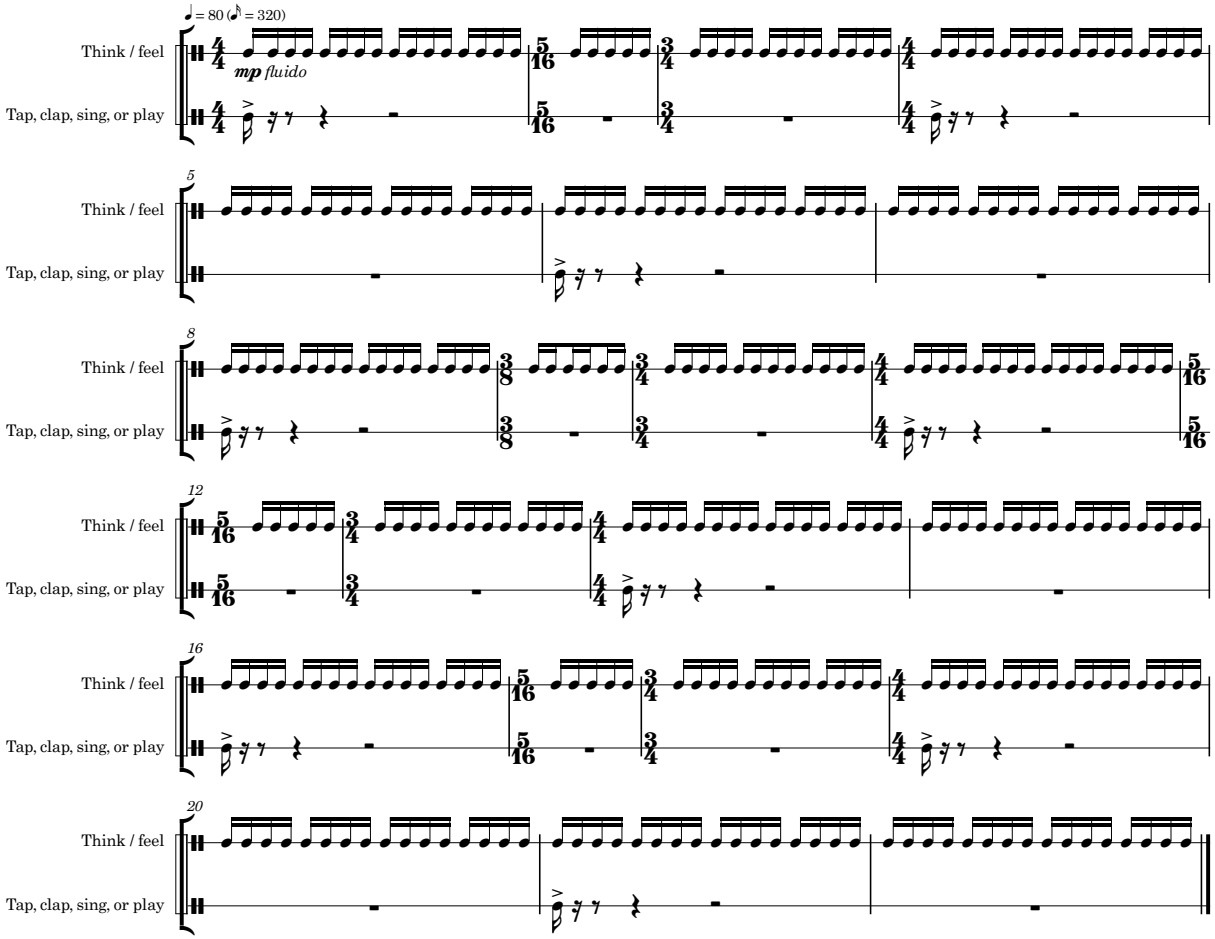

Figure 7: *Subtle Etude*, re-notated.

This re-notation (we might call it an 'Unsubtle Etude') actually conforms to one of London's own principles — his '[metric] well-formedness constraint 6 (version 1)' on non-isochronous rhythmic subcycles, which states that 'all subcycles must be maximally even.'[315] Contrary to his tendency to favour a decomposition of 5 into 3+2 or 2+3, here I feel the groups of 5𝅘𝅥𝅯s as indissoluble units. (A flow of 320 pulses per minute is close to my lowest working speed for reliable grouping in 5s;[316] if it were even a little slower I would favour decomposition.) In practice such explicit re-notation would be unnecessary; it may be performed mentally and on the fly as long as a quick tally has been made of the number of London's 𝅘𝅥𝅰s (my 𝅘𝅥𝅯s) per attack (33, 32, 32, 34…) Despite queasiness on the part of some performers about the propriety of such acts of re-notation (qualms virtuosically annihilated by the pianist and researcher Imri Talgam in relation to the performance of works by Ligeti and Xenakis[317] — despite the fact that his approach is heavily indebted to London's research), comparable acts are both commonplace and unstoppable in new music performance practice. This is especially the case if the 're-notation' is undertaken, as I would do if this passage arose in my professional practice, without leaving any physical trace: *Die Gedanken sind frei!* [Thoughts are free!] The

[315] London, *Hearing and Time*, 103.
[316] This corresponds to an IOI of 938ms per ♩‿𝅘𝅥𝅯 in my re-notation (320 ÷ 5 = 64 bpm equivalent).
[317] Imri Talgam, 'Performing Rhythmic Dissonance in Ligeti's *Études*, Book 1: A Perception-Driven Approach and Re-notation,' (doctoral thesis, City University of New York, 2019); Imri Talgam, 'Performing Xenakis's Polyrhythms: A Perception-Informed Approach,' (conference paper, Global Xenakis Centenary Symposium, The Brook Center, CUNY, New York, 30 Sep, 2022). See also 5.4 below.

difficulty has been converted from an intrinsic-seeming one (that is, one that concerns some type of internal speed-limit) to a mere problem of workflow — and a very simple one by the standards of some new music practices. There has been so far hardly a glimpse of rhythmic 'complexity' in any of its usual meanings. However, performability is not London's main concern, so his misapprehensions about how performers might approach the challenge does not invalidate his argument. His principal interest is perception, so his argument must be met there: or rather, at the intersection between perception and production where this text's conception of musicianship lies.

The JNDs London provides are supported by multiple robust studies conducted in laboratory conditions. However, it may be doubted if they have any practical relevance in the vast diversity of contexts performed music offers. We may ask who the average 'our' is in London's account that mandates such stern limits, and why music must be tailored to their dimensions. My JNDs for rhythm and pitch, which I have been informally self-testing for years, vary according to the amount of sleep and/or coffee I have had, even before musical contexts are considered: I would not offer them as the foundation for any 'critique'. The number of times we are permitted to hear the passage is highly relevant. London does not specify that we are only permitted one hearing (beyond acknowledging that 'I doubt … if most listeners would care to hear the piece a second time.')[318] The acts of notation and titling suggest otherwise; since the invention of recorded sound, we usually feel entitled to hear a work with a title as often as we wish. If the *Subtle Etude #1* is heard just once, and in a MIDI realisation, London's proposition that its distinctions are imperceptible may be accurate. I cannot test this, of course, because I have seen the score.[319] If I perform it, they are obviously highly perceptible for me at least — and I do not value my own experience as being worth less than a non-performing listener's. But even when I listen to someone else performing, I do not lose my identity as a performer — I am an engaged participant. In live performances there is always more to hear, see, and feel, than the score implies. However minimally the *Etude* is performed — for example, even by a solo instrumentless performer seated with eyes closed, 'thinking' the rhythm with sufficient intensity — there will be physical action that will give an alert 'listener' (or watcher) a clue of a potentially-entrainable metric, even if it is a fractional tensing of the glottis or the muscles of the back of the neck. This metric may not be felt at the quasi-10bpm of the notation, but perhaps much faster — perhaps in my suggested subdivisional strategy or a comparable one. (In 7.1 I call this 'bringing it into the workzone,' and note that

[318] London, 'Temporal Complexity,' 64.

[319] I did informally self-experiment with a randomised version of the Etude, in which I used a true random string derived from https://www.random.org, mapping the outputs (1,2,3) to the values of London's original (𝅝, 𝅗𝅥𝅘𝅥𝅯, and 𝅗𝅥𝅘𝅥𝅰). I generated 40 rhythmic values in this way in an order I certainly could not remember. Played back three times the following day via the crisp default piano sound on Dorico v.4.1 and heard on AKG K371 headphones, I could recognise and write down the differences with reasonable accuracy, scoring 30/40 correct on the first playback, 35/40 on the second, and 34/40 on the third. (I had drawn three columns on a sheet of paper corresponding to each value; during the playback I made dots in the appropriate column on each attack.) However, this conclusion is of questionable value, because, thanks to my familiarity with the parameters of the intended 'trick' within the stimulus and my previous act of re-notation, my internal rhythmic faculty was thoroughly entrained in advance to the necessary subdivision speed: 320 ppm, and also the 80 bpm of groups of 4. I did not consult a metronome in the few minutes before the self-test, however. I found it useful to give myself a preparatory internal eight cycles of four pulses (i.e. two 𝄞 bars of my re-notation) before starting playback with the spacebar, and to remember to keep breathing during each *c*.4' of intensive rhythmic concentration. The moments where I felt least secure were, unsurprisingly, after the appearance of a 𝅗𝅥𝅘𝅥𝅯 since, unlike during the easy execution of London's original version, I could not perform a quick mental re-barring to centralise the 𝅘𝅥𝅯s. Although this may seem an extreme or even preposterous challenge, comparable scenarios arise not infrequently in new music performance practice (see 7.2.1).

my suggested rhythmic workzones for subdivision, developed in practice prior to my engagement with the literature on rhythmic cognition, correspond closely to those suggested by London and others.) In laboratory conditions a careful experiment may find ways to exclude these extraneous signals, but in the wild they are always present and constitute an inseparable part of the musical performance. (The stated target of London's critique is *music*.) The piece — and, if we accept London's argument by extension, many comparable metric situations — carries within it the seeds of its own decomposition into entrainable metric units. This is especially the case on first listenings where, due to the listener's unfamiliarity with what is unfolding, the 'signal' of music cannot be easily distinguished from its surrounding 'noise'. In these cases an alert participatory listener is particularly hungry for points of reference — a questing stance that London and others have documented at length — and will grab them wherever they can. An empirical researcher cannot wish this content away or treat it as less worthy of attention; it is not within a commentator's power to delimit what counts as 'the music'. In traditional Korean performing practices (*gugak*), for example, the syllable *ak* indissolubly combines the categories of music, gesture, and dance.[320] This is no mere verbal quibble. Some Korean court music can be exceptionally slow if considered in merely aural terms. A *janggu* (hourglass drum) player, whose role, when approximated in Western terms, can combine those of a conductor and a percussionist, may leave IOIs as great as 9 or 10 seconds between attacks — much longer than London's intended *reductio ad absurdum* — which I nevertheless find to be thoroughly entrainable. Such entrainment takes place less through a feeling of subdivision than via the fusion of sound and sight (and even touch, if you sit close enough to feel the air move) as the player's hand traces out a slow and elastic parabolic contour between its adder-like strikes on the drum's surface. In this way an expert player can create the effect of a controlled and exceptionally slow linear accelerando. I do not think London, or any researcher, would violate the cultural integrity of their subject-matter by imposing a separation of eye and ear in those contexts — indeed, in a more recent publication that takes account of such 'cross-modal complications,' London states explicitly that 'musical tempo involves more than audition.'[321] If new music's performing practices are considered exempt from commensurate sensitivity, we may blame the lingering influence of a small number of twentieth-century voices, for London is not alone in his artificial limitation of 'the music' to what falls on the eardrum alone. To a Darmstadt audience in 1980,[322] Gérard Grisey expressed a frustration intenser than London's, accusing 'our elders' (his Oedipal hitlist included Messiaen, Bartók, and Xenakis) of 'contempt for, or misunderstanding of perception,' 'confusing the map with the territory,' and erecting 'absurd' and 'imperceptible' (London would say 'subtle') rhythmic structures. His first target is

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[320] Even an official training institution with strongly formalising ambitions did not attempt to separate these elements: 'The Jangakwon (掌樂院) [was] a comprehensive performing arts institution in charge of the *ak*' (樂) of the Joseon Dynasty. The word *jangak* from the Jangakwon literally means to manage *ak*; here, *ak* is a comprehensive concept that includes instrumental music, vocal music, and dance.' So Inhwa, 'Ritual Music of the Korean Court,' *Korean Musicology Series 8* (Seoul: National Gugak Center, 2015), 162.

[321] Justin London, 'What is Musical Tempo?', in Wöllner and London (eds.), *Performing Time*, 123.

[322] Gérard Grisey, '*Tempus ex machina*: réflexions d'un compositeur sur le temps musical' [*Tempus ex machina*: a composer's reflections on musical time], in Gérard Grisey, *Écrits: edition augmentée*, ed. Guy Lelong and Anne-Marie Réby (Ile-de-France: Éditions MF, 2018), 62. This is a revised and toned-down version of the original Darmstadt talk; for the earlier version (in English) see Gérard Grisey, '*Tempus ex machina*: a composer's reflections on musical time,' *Contemporary Music Review* 2, no. 1 (1987): 239-275.

Gruppen for three orchestras by K. Stockhausen (1963) [sic.]: the tempi have great structural importance. Who perceives them?[323]

If *Gruppen* is heard for the first time, with closed eyes, or on a recording mixed down to stereo, Grisey's direct, and London's implicit, criticisms hit home. However, if the piece is experienced in a well-balanced, carefully prepared, nimble live performance, in a spacious but not too reverberant hall, with the orchestras sufficiently separated (visually and acoustically) and the energies of the three conductors, facing the public on their raised podiums, focused and well-matched, I would reply 'I do, at least!' At any rate, these multi-sensory factors are strange omissions for writers who claim to be alive to perception in its many forms. Few contemporary voices would cast new music as an experience for the ear alone. For the composer Clara Iannotta, music is as 'an existential, physical experience'; it 'should be seen as well as heard.' For that reason, she prefers 'to talk about the choreography of the sound rather than about orchestration.'[324]

A further problem with London's critique is his straightforward implicit hierarchy of the values of different types of rhythmic experience: entrainment being considered good by definition. As a time-beater myself, I find a true feeling of suspended time to be an exceptionally rare and potentially precious thing, and not necessarily the product of incoherent thinking London seems to suggest (although it may be.) Evoking this feeling requires extra corrective effort on the part of performers to override our hunger for easily-entrainable pulse. This was well understood by John Cage: in *Atlas Eclipticalis* for orchestra (1961-2) the conductor is asked to describe a smooth clock-like circle with their arm, more than twice as slowly as the second hand on a clock moves. Although the overt purpose of this motion is to help orientate the actions of the performers via a rather showy demonstration of space-time equivalence, since in that piece, as in *Parsifal*, 'zum Raum wird hier die Zeit' ('here time becomes space'), its more important function is to disrupt the performers' conventional relationship to signalling and rhythmic initiative. In an effective performance, this can produce genuinely static-seeming results. Composers and performers associated with the Wandelweiser network have made more recent attempts to suspend or disrupt the flow of musical time. Performing these pieces demands intense attention; *pace* London, temporal suspension or disruption may not arise easily or by accident but can require an investment of 'Oliveros-level' discipline to conceive the emergence and disappearance of sound events phenomenologically, rather than slotting into our usual metric hierarchies.

London does not discuss these other ways of 'doing time'. Instead, his attention is drawn to what he diagnoses as an incoherence between scores with a high density of notated rhythmic detail and their supposedly unentrainable sounding results. This multiplication of paper entities, he implies, represents a waste of composers' time as well as that of the listeners. From a NMPT point of view there would consequently be little value in attempting to help performers take part in such a fundamentally incoherent game. Since I too have little appetite for counting angels on pinheads, I would find this argument highly persuasive if I did not have sensory evidence that points in the opposite direction. In my experience of

[323] Ibid., 64.
[324] Clara Iannotta, 'About this artist,' *Los Angeles Philharmonic*, accessed Jun 2, 2024, https://www.laphil.com/musicdb/artists/2541/clara-iannotta.

witnessing the performance of many black-looking scores, including ones of which I have not had prior sight, I rarely feel metrically rudderless. While I do often feel rhythmically disengaged from such performances, it is more usually because I have become bored by the relentless tick of the notational grid, which is often all-too-perceivable — even if I screw my eyes shut to avoid the gesturing conductor or the bobbing scroll of a first violin — in the patterns of accent and tension of performers in high states of physical-cognitive arousal. In such bad performances (and I do mean bad *performances*, to which I have contributed my share — the term permitting blame to be distributed as appropriate between composer and interpreters), the performers' pencilled-in beat markings are perceptually present in ghostly quasi-***ff***, while objectively louder interventions ('the music') seem to be randomly sprayed around this scaffold. In these cases, and in direct contradiction to London's argument in *Hearing and Time*,[325] I feel thoroughly metrically entrained, but to the *wrong metric* — a metric with which no-one (not the composer, nor the interpreters, nor myself) would wish me to engage. The risk of such a trivial-sounding outcome is well known to fine performers, especially those playing in unconducted chamber groups where some form of 'leading' is required. Presumably because recognising it in oneself requires a high degree of self-critical humility, and calling it out in others is a social taboo, this risk has only rarely been acknowledged in the literature: a rare example is Maria Puusaari's revealing discussion of a rehearsal process of Djuro Zivcovic's *Night Music* for small ensemble.[326] In the hands of expert performers, however, the rhythmic practices of composers associated with the reviled 'complexity' label at their most direct and least recherché — for example, the clarinet line in the first part of Ferneyhough, *La chute d'Icare* for solo clarinet and chamber ensemble (1988), as recorded by Carl Rosman[327] — produce a range of unique, and (yes) subtle effects in which something is distinctly felt to be metrically pulling against something else: a high-tensile rubato against a non-isochronous metric (not always the notated metric structure) that itself hovers tantalisingly on the brink of entrainability. That is complexity rather than mere complication, and — for me at least — it feels nourishing.

In contradiction to London's conclusion, these effects are not perceptually random, nor can they be produced casually. I have had the rare opportunity to put this to the test. In Mikolaj Laskowski's *Five Things that Really Matter* for ensemble (2018), the players are given some deliberately perfunctory graphic notation (hundreds of treble clefs sprayed in dense waves across the staves) and asked to '[i]mprovise in a "classical-contemporary-new-complexity-post-serial-music" style' (bars 45-50). The effect — when rehearsed and performed with a group highly experienced at working with 'new complexity' styles, graphic scores, and

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325 London, *Hearing and Time*, 24.

326 Maria Puusaari, '"Leading" as a mode of interaction and communication in contemporary music performance practice,' *TRIO* 10, no. 1 (2021): 40-64. The violinist Puusari describes several contrasting situations where she has 'led' ensembles. In the case of the Zivcovic work, 'Sometimes synchronisation of the ensemble demanded large and active leading gestures that were contradictory to the character of the music or the *piano* dynamics of my part […] Larger gestures were needed as a point of reference to ensure coordination and to compensate for the lack of mutual hearing caused by the quiet dynamics and dry concert hall acoustics. However, larger gestures tend to manifest louder volume in the ensemble and therefore the musicians had to execute quiet dynamics extra carefully' (58). Puusaari notes that a conductor would have been beneficial to achieve a calmer result. I benefited from this insight, since when asked to conduct a programme that included this piece, my initial and suboptimal plan had been to encourage the musicians to work without a conductor. It is often imagined that including a conductor will tend to produce more rigid rhythmic results, while taking a chamber approach will yield more supple ones; here, the opposite was the case.

327 Brian Ferneyhough, 'La Chute d'Icare (Petite sérénade de la disparition),' on *Terrain*, Carl Rosman, solo clarinet / ELISION ensemble cond. Jean Deroyer, recorded May 27, 2007, KAIROS 0013072KAI, 2010, CD.

improvising — was indeed 'incoherent'.[328] However, it did not metrically resemble music by Ferneyhough or Dillon in the least. (Since the piece was an attempt at institutional critique, it is not clear if this was a mark of its success or failure.) London's conclusions might be limited to a declaration that 'MIDI realisations of Milton Babbitt are officially metrically boring, as are random and undirected gestures' — a less controversial sentiment. Evoking Peter Kivy's reading of the much-discussed 'Beethoven's Fifth' scene in E.M. Forster's *Howards End*,[329] London concludes that, in the face of 'hyper-complex' music, '*we all* [my emphasis] become like Mrs. Munt in our experience of the work — our prior musical expertise […] is of little avail'.[330] There exist numerous living counterexamples to this claim, and a goal of NMPT is surely to produce more.

I have dwelt on London's text at such length due to its rarity and value as a critique from an out-of-group perspective, because of the fundamental (indeed, from a NMPT point of view, existential) importance of the taboo-busting questions that it raises, and also because I have repeatedly heard comparable scepticism about new music's rhythmic practices expressed by some musicians, but rarely documented, due — I suspect — to a reluctance to go on record expressing a view that some in-group authority figures may dismiss as crass. Although I disagree with London's conclusions, it is a promising sign that a key researcher in rhythmic perception and cognition has taken an interest in new(ish) music, since there is great scope for future work and knowledge exchange in this area. I hope future studies will seek to enable and expand rather than delimit. London is happy to propose 'innate limits and abilities' that 'are, I presume, universal.'[331] Since I know that few of my 'living counterexamples' have had the limits of their abilities tested by researchers, I am highly suspicious of such a presumption, even if it is made with the intention of explaining 'why we tend to respond to the rhythms of the world's musics in the same, visceral way.' (Note that 'we' again, so clearly intended to be inclusive, but here serving to exclude those who might feel rhythm differently!) Like Tsabary in 2.3.3 above, I propose that it is a pedagogically healthier attitude to view the conclusions of the existing empirical studies in this area less in terms of the discovery of perceptual barriers, and more as personal challenges or starting points for exploration. Some of the examples and exercises in Chapter 7 below could be adapted by researchers for use as material for future investigations of the rhythmic practices and capacities of NMP instructors and trainees.

2.4 On ISMs and NISMs: interim conclusions

There is no sharp distinction between ISMs and NISMs. Despite their distant starting points, as their projects progress, the areas they cover tend to converge. All ISMs are also NISMs in varying degrees of disguise, for while they are on the surface, and when considered individually, the specialised technical manuals they purport to be, taken in context and *en masse* they also reveal themselves to be documentations of aural journeys and lists of favoured musical procedures. Since they offer precious traveller's-eye accounts

[328] London, 'Temporal Complexity,' 66.
[329] In Chapter 5 of that novel, Forster's characters exhibit varying responses to a performance of Beethoven's Symphony No. 5. Mrs. Munt, who lacks musical training, can only 'tap surreptitiously when the tunes come — of course, not so as to disturb the others.' See Peter Kivy, *Music Alone: Philosophical Reflections on the Purely Musical Experience* (Ithaca: Cornell University Press, 1990): 68-92.
[330] London, 'Temporal Complexity,' 66.
[331] London, *Hearing and Time*, 168.

of these journeys, they may be regarded as of particular pedagogical value to players of instruments with contrasting affordances: I would recommend that a violinist study materials on the horn, and a flautist read about percussion. If all the ISMs listed are conceived as circles on a Venn diagram, there is a significant central area of overlap; this zone may be called 'musicianship,' although that is not a complete definition of the term as used here. Conversely, the NISMs that are of most value to a performer are those that embrace performative reality rather than abstractions, whether of pitch-class, tuning theory, or a search for rhythmic universals.

On a heatmap of current activity and interest, ISMs are hot while NISMs are cold. This may not serve the best interests of trainees nor of their instructors. An environment that values embodiment and celebrates unique and fragile things finds — happily — a place for ultra-niche ISM projects that even their own authors would not claim to be of wide applicability (e.g. the expressive capacities of a Strohviol, or of harp multiphonics.) At the same time, there exists no microtonal solfege that has found widespread use outside JI circles, no commonly-used resource for teaching new music's characteristic rhythmic procedures that does not require an extensive re-training in an unfamiliar musical vocabulary, and no widely-used NISM relating to timbre and sound at all.

The identification of a tussle between specialised (instrumental) and general (musicianship) emphases in performer training has a long history. I have already pointed to Schumann's exhortation in 1848 to be unafraid of the word *theory*. This complaint from Hindemith in 1946 echoes several recent discussions I have witnessed:

> Apparently the times are gone when no one was considered a good musician who did not possess, beyond his specialized instrumental or vocal achievements, a thorough knowledge of the subtle mechanism of music. Can the majority of to-day's great virtuosi stand a comparison of their theoretical knowledge with Liszt's, Rubinstein's, or Joachim's? Do not many of them bitterly complain that in their youth they were trained excessively in their special craft and not sufficiently in general musical subjects?[332]

Ilomäki, writing over six decades later, is in agreement:

> Generally, it is possible to say that as a counterpart to the raising of standards for instrumental fluency and security, performing musicians' [musicianship] skills showed a narrowing tendency.[333]

If the conception of 'standards for fluency and security' are expanded to include the pre-occupations of the ISMs discussed above (that is, to include those instrumental techniques that sound more fragile and liminal, or noisier and unstable, than the ones focused on in supposedly 'non-repertoire-specialised,' or 'normal,' conservatoire training), Hindemith's, Ilomäki's, and my own observations correspond to the picture of NMPT that emerges from a review of the literature.

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[332] Hindemith, *Elementary Training*, ix.
[333] Ilomäki, *In Search of Musicianship*, 17.

2.4.1 Alternative approaches: must we generalise?

Some creators of NMPT materials have attempted to sidestep this conflict. Rather than attempting to identify patterns and principles, whether of an instrumentally-specific or musicianship type, these creators have sought to amass documents of expert instruction on a work-by-work or project-by-project basis. In the practical and unfussy tradition of Norman Del Mar,[334] texts including Edwin Roxburgh's *Conducting for a New Era* provide guides to the interpretation of individual pieces without attempting to erect theoretical structures.[335] Roxburgh's 'new era' encompasses Messiaen, Stockhausen, Boulez, and Birtwistle; younger commentators naturally select more recent points of reference. While older authors may adopt a guidebook-like 'here's how to perform *x*' tone, and younger ones tend to prefer less-committal formulations such as 'here's how *I* approached *x*', this usually amounts to the same thing in practice, since texts old and new are consumed by performers in their own terms and will always only form part of their libraries of know-how. (Recordings and videos exert more direct didactic power than any commentary could.) Where a particular work is concerned, performers may shun lengthy texts with publishers' imprints, or doctoral theses festooned with footnotes, in favour of humble-looking documents: influential examples include a single side of A4 paper containing Péter Eötvös's (freely given) beating solutions for Stockhausen's *Gruppen*, which circulated among grateful conductors in photocopy, or tried-and-tested fingerings for particularly athletic woodwind passages in works by Georges Aperghis.

The percussionist, researcher, and educator Tom de Cock and the researcher and 'technologician' Vincent Caers, being conscious of the value and evanescence of such documented knowhow, created the *Living Scores* online project (2015-). Its LS Learn strand was envisaged as a crowd-sourced database for new music performance practice, with its resources listed by composer and work; unlike a wiki, however, its authors retained editorial (and, as it turned out, sole authorial) control. The authors wrote:

> The goal of LS Learn is lowering the threshold to perform contemporary music for students and performers by enhancing the efficiency and output of the studying process.[336]

The project innovated in its ambition to harness technology to enhance the learning experience of individual pieces: these were to include annotated scores, tailored clicktracks with multiple sounds to indicate different structural subdivisions, a visual 'sequencer', and, rather mysteriously, 'analysis software' aiming to 'combine functions coming from image processing software to enhance the analysis of the score.' In combination these would provide 'tailor-made study trajectories' for NMP trainees. As of 2024, the website remains as a (grand) torso, with only eight clickable composer headings and sixteen works, its most detailed and pertinent material relating (unsurprisingly) to percussion writing by Donatoni, Hurel, Henze, and Xenakis. The project's technological ambitions have not borne obvious fruit, even the programmable clicktrack element having been largely superseded by João Pais' Click-Tracker software. Nevertheless, the notion of

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[334] In the *Conducting…* series, including texts on Brahms, Berlioz, Elgar, and more. The work-focused tradition is continued by his son, the conductor and musicologist Jonathan Del Mar, in his many Urtext commentaries for Bärenreiter and *Orchestral Masterpieces under the Microscope* (Woodbridge: Boydell & Brewer, 2023).
[335] Edwin Roxburgh, Conducting for a New Era (Woodbridge: Boydell & Brewer, 2014).
[336] Tom de Cock and Vincent Caers, 'Mission Statement,' *Living Scores Learn*, accessed Oct 30, 2023, http://www.living-scores.com/learn/lslearn/missionstatement/.

a wiki-like space to facilitate work- or project-specific knowledge exchange among new music performers remains a highly promising one. However, even if a vast and rich database of work-specific knowhow were to exist — recalling the ambitions of Ulrich Kaiser's Open Music Academy (2.3.2.1) — it would no more replace the need for taught and curated NMPT programmes than the arXiv research-sharing platform replaces taught courses in mathematics or physics. While a database can inform the content of a programme, it does not seem promising for a NMPT programme's structure to have a database-like shape, since any approach that sees training as an undirected negotiation of a succession or constellation of individual projects will wear itself out rapidly in the face of the field's sheer variety, as the LS Learn project seems to have done. Project-specific NISMs can only complement, and not replace, musicianship materials.

2.4.2 Supply and demand: the riddle of the missing NISMs

One final question relating to these resources cannot be avoided: if the field of NISMS, or musicianship materials, that relate to new music is as patchy and sparse as I have described, might this simply indicate a lack of need or desire for such resources? This question admits of multiple answers. The first is to ascribe the absence to the broad anti-generalising, or anti-theoretical impulse within new music's pedagogical discourse that I have identified. This, I have argued, is the result of a historically inherited structural distortion that has privileged the voices of composers (with their vested interests in promoting a 'splittist' outlook) over those of performers. On this reading, the governing presence of individualising composers within tertiary new music departments and as overseers of summer academies and the like — the ad hoc NMPT approach — has had a persistent muting effect over the production of generalising materials.

This only provides a partial answer to the question. In Chapter 4 I argue that serious obstacles to the creation of useful NISMs are to be found within 'the music itself' — specifically, in its characteristic materials (4.1) and its procedures (4.2). I adumbrate this argument briefly:
1) New music's materials, are in the greatest part, 'post-spectral' by default, even in cases where they have been produced by composers who would not claim allegiance to nor even particular familiarity with spectralism (considered as a historical-aesthetic movement). These materials tend to sprawl across multiple musical-parametric categories (pitch, timbre, rhythm) which were previously regarded as naturally separable for pedagogical purposes. Consequently, they tend to score lower on an arrangeability test than earlier musics, and are therefore less amenable to the treatment in some degree of isolation that the construction of a NISM would necessitate.

2) New music's characteristic gestational procedures also mitigate against the construction of NISMs. The *grand récit* about the ever-greater value ascribed to the parameter of timbre during the nineteenth and twentieth centuries, while broadly veridical, is only part of a wider move towards an interest in ever-more-specific instrumental and gestural procedures. The composer Evan Johnson talks of 'hyperidiomatic' instrumental writing. In such an approach, a composition might not only be specified as written 'for the clarinet' (and hence permitting a very broad set of possible gestural and sonic responses to, for example, a written A♮♩), nor even merely for 'nine-key boxwood basset clarinet', but (whether this prohibition is stated explicitly or implicitly) 'for *[x]* interpreter, and after a lengthy collaborative process with that interpreter,

with results that may be meticulously notated (as in Johnson's own practice) or not (as in many other cases.)' While the worlds of Johnson, Simon Steen-Andersen, or Jennifer Walshe may seem poles apart — their compositions do not sound similar, nor do their fields of cultural reference overlap to any great extent — there is much procedural common ground when viewed from the performer's point of view, and certainly from the performer-pedagogue's. In such contexts surgical isolation and extraction of musical material for pedagogical purposes can rarely be undertaken without killing the patient, so to speak. Any useful NISM cannot pretend that these obstacles do not exist. Nevertheless, I propose that they may be usefully surmounted in many cases by adopting a NMPT stance that robustly places the performer's experience first, and which is not in thrall to composers' explanatory narratives, nor automatically waits for composers to set the rules of engagement for every encounter. Indeed, it may be desirable to encourage students to approach certain pieces against the apparent or declared grain of their conception, with specific pedagogical goals in mind.

So runs the argument of Chapter 4. However, I do not think that this completely answers the riddle of the missing NISMs, since it is essentially proposes that the problem is too difficult — and, by implication, that instructors have shirked their responsibilities in this regard. Given the depth of expertise and passion in this field, I find this unconvincing.

A more fundamental answer, I believe, lies within the complex and poorly documented behavioural taboos that surround new music's performing practice, and in particular, the exceptionally delicate area of performing standards. One such taboo is that it is virtually unknown for a composer to criticise a performer after a performance — even a disastrous one. As one composer put it to me, 'you've just got to bow, hug, and smile, even if you're dying inside.' Outside dedicated training environments, there are no mechanisms for, and little appetite for, post-mortems on performances, and no courts of appeal to rule on problems of intonation, tempo choice, or balance. If a performance has generally gone well, revisiting these details amid the smiles, hugs, and selfies would seem churlish and pernickety. If it has generally gone badly, one is even less inclined to revisit the event. I have witnessed even unequivocal errors — a player being lost for most of a performance, or every triggered sample in a piece with electronics being incorrect due to the player having started on sample #2 instead of #1 — being swept under the carpet in this way. 'Error', here, more usually means less an unwarrantable divergence from a composer's notation, and more a feature of a performance with which the performer themself would find fault in the short term: I am thinking of a sensitive player making a recording, wincing in the booth on playback, and deciding to go back for another take. Consequently, despite errors and awkwardnesses small and large being a feature of almost all performances that I have witnessed and taken part in, their documentation is virtually absent from the discourse of new music. The few cases that are documented are of disasters of historic proportions, such as the 1969 premiere of Stockhausen's *Fresco* at Bonn's Beethovenhalle (in which the 'players made a lot of crazy nonsense, got drunk during their breaks, and finally handed over their instruments to members of the audience')[337] — situations less likely to arise in today's more restrained performing culture.

[337] Karlheinz Stockhausen, *Kompositorische Grundlagen Neuer Musik: Sechs Seminare für die Darmstädter Ferienkurse 1970*, ed. Imke Misch (Kürten: Stockhausen-Stiftung, 2009), 250.

My initial intention in this project was to make the case for a greater emphasis on musicianship within NMPT by compiling a taboo-busting database of such sins. I envisaged that this would proceed along the lines of an air accident investigation or the 'after action review' that follows a hospital incident (albeit with much lower stakes), with the aim not to ascribe blame but to investigate the conditions that led to each suboptimal outcome and to learn from them. I was interested less in errors with clear causes (under-preparation due to poor scheduling, intervening personal crises, or arrogance, the challenges of unpredictable humidity or temperature, of sheet music knocked off stands, of errant trombone mutes rolling through the ensemble, etc.) and more in the condition of *lostness* that can arrive without warning: the moments when a performer's internal musicianship armature collapses, such as when a singer 'loses their pitch' or when a rhythmic groove that is intended to sound tight becomes blurred or uncertain. I also collected cases where the errors could be ascribed to cultural misunderstandings, such as a British performance of an intensively microtonal German composition in which every entry was scrupulously rhythmically placed and dynamically balanced but almost no attempt had been made to realise the microtonal accidentals, or a French performance of a well-known American 'minimalist' piece in which the pulsation was subject to a tender, supple, but definitely inappropriate rubato. Naturally, I intended to include many of my own performing catastrophes. I abandoned this attempt, not (alas) for lack of data,[338] but because I found the process too depressing, and also because it seemed unlikely that there was a way of publishing the data ethically. More seriously, I came to doubt that amassing even great quantities of such evidence would have much persuasive effect in the absence of robust metrics of comparison. Indeed, if it is possible to generalise at all in this matter, I would say that performing standards in new music have actually improved significantly in my lifetime. Nevertheless, in many of my professional interactions, all of which combine aspects of performance and pedagogy, I have heard musicians expressing anxiety and uncertainty about their own capacities to negotiate aspects of new-music-specific musicianship. These are

[338] Quite the reverse, indeed. I will give a flavour of this earlier stage of the project, in which it rapidly became clear that errors are a feature of recordings of 'modern classics' and less well-known works alike. Grisey's *Vortex Temporum* certainly would fall into the former category: nevertheless, to take a short passage as example (movt. 1, fig. 20-30, cello line only), there exists a significant divergence among recordings. In the Ictus studio recording (all references below), the cello plays an E♮ as if in 𝄞, perhaps due to a rehearsal-derived 'forward memory' of that pitch, which emerges in the violin at fig. 25. In the Risognanze recording the cello here plays about an eighth-tone lower than C♯ rather than higher. At fig. 30 in the Ensemble Recherche recording the cello plays an E lowered by about an eighth-tone, while in the Risognanze recording we hear an F♮, that is, 'only' a quarter-tone out. I have chosen recordings from well-established and truly expert groups only; there exist performances on YouTube that exhibit far more serious problems of intonation and ensemble. Rather than blame the players for these errors, I would highlight failures of supervision in the listening chain, from conductors, producers, 'musical supervisors,' reviewers, analysts, etc. In the case of fig. 30, the extreme physical extension of the preceding pizzicato triple stop, combined with the altitude of the pitch itself, is the proximate cause of the problem. But proper oversight and prioritisation would have informed the cellist that the sustained pitch is far more audibly prominent than the preceding pizzicato, which merely provides a buzz of onset inharmonicity and is well covered by other players. The player should prioritise the held note and not the pizzicato. Looking at the part, the problem is clear: the pizzicato has three 'notes', and is adorned with an accent and a l.v. mark, and so has 'difficult' written all over it, whereas the held pitch is only 'one note', arco ordinario. The players did not give themselves licence to fudge the pizzicato in favour of the held note.
Gérard Grisey, 'Vortex Temporum I [Studio Version],' ICTUS ensemble, *Ictus*, 2015, accessed Jan 02, 2022, https://www.ictus.be/grisey; Gérard Grisey, 'Vortex Temporum: 1,' on *Gérard Grisey: Vortex Temporum, Taléa*, Ensemble Recherche, cond. Kwamé Ryan, recorded Nov 1996, Accord 206352, 2001, CD; Gérard Grisey, 'Vortex Temporum, I,' on *Gérard Grisey: Vortex Temporum / Périodes*, Ensemble Risognanze, cond. Tito Ceccherini, recorded Nov 23, 2005, Stradivarius STR 33734, CD. **Note to examiners:** for ethical reasons this footnote will be redacted prior to online publication, and so the recordings are not listed in Works Cited below.

the aspects I focus on in Part II of this text. As I have become more open in acknowledging my own musical limits and uncertainties, I have found that colleagues have opened up in turn.

With this in mind, I propose that a significant explanation for the relative absence of NISMs is not a lack of need or desire for such materials among trainees or instructors, but rather a reluctance to be seen to criticise within a small world that rightly values collegiality, and for any author to place themselves in a putatively-superior (authoritative) position with regard to musicianship. (It is much more straightforward and defensible to self-identify as an authority on the contraforte or the Fokker organ.) I am not immune to the effect of this taboo — a 'who am I to write about…' sense of imposterhood has stalked me throughout this project — but have made temporary peace with myself by recalling that in most cases an incomplete guidebook is better than no guide at all. While silence on the subject is the easy option, it is not in the best interests of trainees, who are subject to obligatory processes of selection and assessment in which their musicianship is evaluated, the consequentiality of which does not depend on the (im)modesty, diffidence, strictness, or lassitude, of their instructors. They deserve better. In the awareness that this only gives an indication or flavour of a small number of participants' viewpoints, I close this chapter with some uncomfortable words from my interviewees, all of which strengthened my sense that the field of NISMs needed attention:

I'm happy teaching complex rhythms but I don't really work on pitch with my students. Honestly I'd feel on shaky ground.

(A new-music-focused percussionist and conservatoire professor)

No, we don't do any rhythm training with them [postgraduate conducting students].

(A conducting course leader in a large European conservatoire)

You can't get a solfege to help with this kind of repertoire! (*pointing to stacks of scores in the library of a new music ensemble*)

(A member of a new music ensemble and instructor on a side-by-side programme)

All we try to do, really, is expose them to a good variety of pieces.

(A counsel of despair from another instructor on a different programme)

I don't think my ear is good enough for all this microtonal stuff. It's so confusing.

(A recent graduate of a NMPT Master's programme, whom I had previously witnessed tuning their instrument with cent-specific precision.)

Chapter 3: Inside institutions

3.1 Who, or what, is the instructor?

In the overview of NMPT in Chapter 1 I focused on the outsides of institutions and generally avoided discussion of their insides: what is actually being taught, which repertoires are chosen, and the teaching styles of individual instructors. I attempted to avoid telling the story in terms of decisive encounters with charismatic individual instructors, although an element of this is inevitably present and probably intensified when the living composers and premiere-givers of a repertoire take part in its transmission: I am sometimes asked *did you know [insert name of famous deceased musician]*, and where the answer is 'yes', my interpretative decisions are usually accorded extra respect, whether merited or not. After all, even the wildest claims made by interpreters of older music are limited to boasts about possessing a hotline to a dead composer's intentions, rather than actually claiming to be a reincarnation of them.[339] Classical musicians tend to report their training in professor-first, rather than institution-first terms: *I studied with x* (then, possibly, *at y [conservatoire]*). A leader of a large conservatoire proudly confirmed their institutional policy to me in similar terms: 'Der Lehrer ist frei!' ('The teacher is free!') Despite this reflex, in this section I argue that the real principal instructor is rarely the individual charged with responsibility for tuition (*my professor says*…), and that in most cases structures, networks, and even ambiences, rather than individuals, undertake the pedagogical heavy lifting. In 3.2 I consider what the implications of this are for NMPT.

Nevertheless, some observations about the approaches of individual pedagogues may be made. During the current century the methods of tertiary-level music pedagogy have attracted increasing scrutiny, with significant contributions from practitioners themselves. This has been characterised as the development of an 'inquiry stance' among practitioners.[340] It has yielded numerous documentations of teaching practice using methods such as peer observation and collaborative reflection.[341] Since this stance originated in tertiary institutions, it was natural that the courses in such institutions should receive the most attention. The summer courses, masterclasses, mentorship schemes, and private tuition arrangements that form important parts of NMPT remain largely free from scrutiny. In the majority of these, the model for providing such preparation is as uncomplicated as the selected repertoire is not: trainees play side by side with their instructors in traditional rehearsal phases followed by public concerts, and receive sectional coaching alongside a limited amount of individual tuition. In the case of the early years of the LFA, only the presence of specialised instructors and the Boulez-approved choice of repertoire, and not the pedagogic

[339] In 2018 the conductor Teodor Currentzis — shrugging off entire fields of scholarship and indeed the Veil of Mortality itself — felt able to declare to a journalist, 'I only do what the [dead] composer wants.' (Teodor Currentzis interviewed by Thea Derks, 'Teodor Currentzis: Music to die for,' *Thea Derks*, accessed Oct 10, 2023, https://theaderks.wordpress.com/2018/05/05/teodor-currentzis-music-to-die-for/.) Not only did this statement go unchallenged, but was actually characterised as a demonstration of humility. Kurtág and Lachenmann, on the other hand, are happily still among us, intervening actively and passionately in their rehearsal processes. Despite the greater intensity of media attention on the conductor than on the composers, I have no doubt whose rehearsal interventions will prove most consequential in the long run. Note also that 'I … do' in Currentzis' formulation should be understood as 'I cause others to do.'

[340] Mary Cochran-Smith and Susan Lytle, *Inquiry as Stance: Practitioner Research for the Next Generation* (New York: Teachers College Press, 2009).

[341] A representational example is Paul Williamson, Eugene Ball, and Emily Wilson, 'Developing one-to-one contemporary trumpet teaching strategies through peer observation and collaborative reflection,' *International Journal of Music Education* 37, no. 4 (2019): 622-635.

model itself, differentiated it from longer-established orchestral academies such as the Aspen Music Festival and School in the USA or youth orchestra courses such as the UK's National Youth Orchestra. Many of the short courses referred to in 1.2 replicate this basic approach so uncritically that it might be called institutional NMPT's own 'no model' model. When I was asked to tutor on one such course, my suggestion that I run some workshops and seminars alongside my normal conducting duties came as a complete surprise to the artistic management (although a pleasant one, as it turned out.) An observer relying on published academic sources alone would receive a highly imbalanced picture that does not correspond to the intensity of activity in the NMPT field. While there exist numerous auto-documentations of small-scale creative practice collaborations and learning journeys (their authors tending to have affiliations with tertiary institutions), there are almost no internal investigations of even large-scale NMPT initiatives beyond admiring press features, concert reviews, and a few hagiographic documentary films.[342] Despite the hundreds of students who have passed through the NMPT programmes in 1.2, and the many thousands more who encounter new music in non-specialised performance courses, the *International Journal of Music Education*, the *Journal of Research in Music Education*, and *Music Education Research* are largely silent on the subject. According to Kirsty Devaney, tertiary-level 'composition pedagogy is a vastly under-researched area.'[343] While true, that field is at least starting to receive focused attention in fora such as the 2024 symposium 'Kunst der Kunstlehre: Wie Komponieren unterrichtet wird' ['Art of teaching art: how composing is taught'] at the Basel Hochschule.[344] The pedagogy of new music-specialised performers is murkier still. Accordingly, the studies cited in this chapter relate to performers on non-specialised courses.

The Polifonia Working Group for Instrumental and Vocal Teacher Training in Europe (2007-2010) emphasised the need for dialogue and mutual learning between practitioners with different approaches.[345] Helena Gaunt and Heidi Westerlund make a powerful case for an increased role of collaborative learning within conservatoires,

> … not only in the most likely contexts such as group teaching or popular music, but also in relation to the core of conservatoires and within one-to-one teaching—learning activities.[346]

The educational philosophy of John Dewey, with its 'belief about the strengths of communication and collaboration in education as well as the need for democratic ethics in education' is their acknowledged starting point.[347]

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[342] *Pierre Boulez and the Lucerne Festival Academy: Inheriting the Future of Music*, directed by Günter Atteln and Angelika Stiehler (EuroArts Music International / Lucerne Festival, 2009), film. Also released as *Workshop for the Future of Music: Pierre Boulez and the Lucerne Festival Academy* (EuroArts Music International / Lucerne Festival, 2010).
[343] Kirsty Devaney, 'Heads of Composition Perspectives on the Role of Composition Teaching in UK Music Conservatoires Composition Department,' *Music Education Research* 24, no. 5 (2022), 620.
[344] Johannes Kreidler, convenor, *Kunst der Kunstlehre: Wie Komponieren unterrichtet wird* [Art of teaching art: how composing is taught], symposium, Apr 13-14 2024, Hochschule für Musik Basel. The contributors were Carola Bauckholt, Beate Florenz (and colleagues), Roland Moser, Gordon Kampe, Johannes Kreidler, Katharina Rosenberger, Michel Roth, and Martin Schüttler.
[345] Mary Lennon and Geoffrey Reed, 'Instrumental and vocal teacher education: competences, roles and curricula,' Music Education Research 14, no. 3 (2012): 285-308.
[346] Helena Gaunt and Heidi Westerlund, 'Prelude: The Case for Collaborative Learning in Higher Music Education,' in *Collaborative Learning in Higher Music Education : Why What and How?*, ed. Helena Gaunt, Heidi Westerlund, and Graham Welch (Farnham, Taylor & Francis: 2013), 9.
[347] Ibid., 4.

Aspects of these recommendations for good practice are integrated into the basic structures of some existing NMPT courses, including the IEMA and the PPCM. These courses place an emphasis on group teaching via ensemble coaching and workshops. They foster strong collaborative peer interactions — as evidenced by the profusion of alumni ensembles. Their multi-instructor format simultaneously reduces the risk of unhealthy dependency on a single professor and structurally supports (indeed, necessitates) dialogues between instructors about curriculum content, students' progression, and models of assessment. A feature of these courses that sets them apart from 'core' conservatoire programmes is that, thanks to the multi-instructor format, students receive some input from professors outside their instrument family. It is perhaps surprising that this should be considered an innovation, but it is still entirely possible for string students on certain conservatoire courses not to have any interactions whatsoever with brass, woodwind, or percussion professors for the entirety of their course of study. Asked about this, one violinist who had recently graduated from a conservatoire in France claimed that they had never even met a viola professor! Correspondingly, a long-standing composition professor in a large university music department in the USA told me that they had never met certain colleagues in the electroacoustic faculty, nor had a single professional interaction with an instrumental instructor in that institution.

Group teaching via chamber music coaching and workshops is not the only mechanism of NMPT. With the exception of the musicianship-first approaches in 1.2.7, one-to-one teaching remains a core element of all the conservatoire programmes listed and is also included in most of the non-conservatoire ones. Such teaching is notoriously hard to characterise and evaluate. While it is viewed as an 'indispensable, intense and intricate' part of performer training,[348] it is part of a learning culture that has been described as 'largely unresearched and, crucially, relatively unchallenged.'[349] Carey et al. conducted a quantitative analysis of one-to-one teaching in a single conservatoire.[350] Using an established typology,[351] they reported that they observed two contrasting teaching styles: 'transformative' and 'transfer' pedagogy.

> Type 1: transformative pedagogy places emphasis on a depth of student understanding and ownership. It is characterised by a 'deep' approach to learning orientation on behalf of the teacher, and pedagogical agility in terms of its collaborative, explorative, scaffolded, meaningful and contextualising qualities. In this type of teaching, the learning outcomes for the student are transformative. The approach is open and exploratory, with deep learning and an emphasis on sense-making and contextualising content […] within the learner's experience. Transformative-style teachers are able to promote both performance and learning outcomes in their students, though the primary goals are in terms of learning (increasing ability through new knowledge or skills), not performance (with its aim to validate one's ability or avoid demonstrating a lack of ability). […]
>
> Type 2: transfer pedagogy contrasts with transformative pedagogy in that the approach is largely didactic. It is characterised by instruction, scaffolding that promotes mimicry, less flexibility, orientation towards assessment and

[348] Helena Gaunt, 'Learning and teaching breathing and oboe playing: action research in a conservatoire,' *British Journal of Music Education* 24, no. 2 (2007), 230.
[349] Rosie Perkins, 'Learning Cultures and the Conservatoire: An Ethnographically-Informed Case Study,' *Music Education Research* 15, no. 2 (2013): 196.
[350] Gemma Marian Carey, Ruth Bridgstock, Peter Taylor, Erica McWilliam, and Catherine Grant, 'Characterising one-to-one conservatoire teaching: some implications of a quantitative analysis,' *Music Education Research* 15, no. 3 (2013): 357-68.
[351] Heidi Grant and Carol S. Dweck, 'Clarifying Achievement Goals and Their Impact,' *Journal of Personality and Social Psychology*, 85, no. 3 (2003): 541–553.

decontextualised learning. Its objective is 'defined' excellence versus the 'expansive' excellence of transformative learning. […] Although teachers expressed a desire to foster independent learning abilities in their students, the development of technical and musical skills dominated their practice. Like Type 1 (Transformative) teachers, transfer-style teachers may produce both performative and learning outcomes in their students, but with much greater emphasis on the former; thus, learning outcomes are more confined/focused than expansive.[352]

Although the authors strenuously attempt to avoid evaluative language, claiming only to 'characterise', no reader of their report could doubt that for Carey et al. 'Type 1: transformative' beats 'Type 2: transfer' pedagogy every time. Much NMPT provision would unproblematically fall into their approved transformative category. Cross-instrumental-family teaching in ensemble contexts is particularly apt to be described as transformative, since by its nature such teaching avoids 'mimicry', fosters 'flexibility', and promotes 'sense-making.' A modest example of how these qualities can naturally arise from such structures occurred in a recent *Lehrprobe*[353] on a NMPT programme. A conducted ensemble of 13 musicians was rehearsing, comprising two instructors (the horn and piano players), ten trainees playing other instruments, one professional musician who had been engaged to fill in for an unwell trainee (the trombonist), and one externally-engaged conductor (me.)[354]

> *Cellist (trainee):* [to the conductor, but also looking around] How do I get that low F? [F♮4 lowered by 31 cents = the 7th natural harmonic of G♮1][355] Is anyone else playing it in [that bar]?
>
> *Conductor:* No, it's just you there. But the trombone is on the G which should help.
>
> *Hornist (instructor):* [plays the pitch quietly as a natural harmonic, then, smilingly] It's easier on the horn…
>
> *Cellist:* [takes over pitch from the horn, nods]
>
> *Trombonist:* [chimes in with the missing fundamental G♮ (G♮2 rather than G♮1, but it makes no difference); it's slightly flat]
>
> *Conductor:* [looking up with mild concern — it's one of my 'anchor pitches' (see 6.3.2 below) so I notice the divergence from the G♮ in my memory, and also note that the interval does not sound like a natural seventh]
>
> *Pianist (instructor):* [discreetly plays the octave G♮1-G♮2, perhaps on my implicit cue, perhaps unprompted]
>
> *Trombonist:* [raises eyebrows, makes a small pitch correction towards the piano's G♮]
>
> *Cellist:* [plays the F♮4-31c. again] OK.
>
> *Hornist:* [responds with a confirmatory F♮4-31c., nods briefly]

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[352] Carey et al., 'Characterising,' 361-362.

[353] *Lehrprobe*: a 'teaching rehearsal' — meaning alternatively an assessment of teaching practice, or a rehearsal (usually in a conservatoire) in which the performers are principally there to learn rather than produce a performance. The fact that no directly-equivalent term exists in English is indicative of a tendency to resist explicitly pedagogical language in student ensemble training in the UK; in my experience of working with such ensembles, the members — understandably — preferred to imagine they were preparing a concert for the benefit of listeners rather than for themselves. In German conservatoire culture, on the other hand, an acceptance of the pedagogical process tends to be more overt. Proponents of the UK approach defend it as a robust way of preparing students for the rigours of a professional performing career and criticise the German attitude as promoting an 'eternal student' attitude, while proponents of the German approach find this attitude lacking in both definitional clarity and humility, pointing out that a student concert is not a professional one, and should not be promoted as such.

[354] Retrospective permission was granted by all participants to document this interaction. Some participants preferred to remain anonymous, so (following the approach in Preface*: the voices of others in this text*) all participants have been anonymised.

[355] Pitches are given throughout in international pitch notation where middle C is C4. A cent (abbreviated to c.) is 1/100 of an equally-tempered semitone.

An observer of this unspectacular few seconds of rehearsal might have struggled to identify who was/were the pedagogue(s). Indeed, they may not have recognised it as especially pedagogical in nature but simply part of a rehearsal process of the traditional type, in which performers work together to attempt to meet the written demands of a composer. (It was also just that.) However, several aspects of the interaction corresponded to the broad picture of good practice that emerges from Gaunt and Westerlund and Carey et al.:

- The cellist recognised a problem themself (in a little moment of self-directed, or self-regulated, learning)[356] and looked both to instructors and to their peers to find a solution (collaborative learning);

- From the cellist's point of view the learning process was of the transformative rather than transfer type. Although it came about through pitch-matching, which on first glance might be considered an act of transfer-type 'mimicry,' because the demonstration came from an instrument outside their family and therefore one with a fundamentally different pitch 'fret-structure' (see 5.8 below) matching it required an act of translation and not simple emulation — as the hornist's gentle words implied. The important learning outcome — although it may not have been recognised as such in the moment, but only after the accumulation of several similar interactions — was not the achievement of a well-placed F♮-31c. in that particular instance, but rather the aural introduction of the 7:4 pitch ratio with a view to its future recognition and production in different contexts ('sense-making and contextualising content'), and the awakening of understanding that accompanied the translation of pitch-finding strategies from instrument to instrument ('agility' and 'deep learning');

- Although a clearly definable act of learning occurred, the power dynamics were distributed and not concentrated in a single instructor. The cellist initially looked to me for guidance more out of orchestrally-derived habit than with the assumption that I would provide a solution (which indeed I did not — if I had been thinking more quickly I would have asked the hornist to supply the F♮-31c. directly). The hornist provided the most important individual contribution, but also could not be described as the sole instructor. I provided some context and cohesion. Even the imperfect contribution of the trombonist, as refined by the pianist and possibly influenced by me, had an ultimately helpful effect.

'The instructor' in this case was a composite phenomenon that had arisen from the overlapping play of interactions. Since this included the physical nature of the instruments themselves (the natural seventh being native to the horn and not to the cello, the tempered G♮ to the piano and not the trombone) the instructor here resembles the hybrid *actant* in the influential formulation of Bruno Latour:

… the *someone else*, the hybrid actor composed (for instance) of gun and gunman. We must learn to attribute — redistribute — actions to many more agents than is acceptable to either the materialist or the sociological account.

[356] Gary E. McPherson, Peter Miksza, and Paul Evans, 'Self-Regulated Learning in Music Practice and Performance,' in *Handbook of Self-Regulation of Learning and Performance*, ed. Dale H. Schunk and Jeffrey A. Greene (New York: Routledge, 2017): 181-193.

Agents can be human or (like the gun) nonhuman. […] Since the word *agent* in the case of non-humans is uncommon, a better term is *actant* […][357]

It does not require extensive familiarity with actor-network theory, however, to appreciate the implications of instruction being offered by a hybrid entity of this sort, since they are concrete and practical. This act of learning could have only happened in context in which there are multiple sources of expertise and a co-operative working ambience that allows them to be heard and interact. (As it happened, the person who was most obviously being 'corrected' here — correction being a characteristically 'transfer'-style act — was the trombonist, who was a freelance performer and formally neither instructor nor trainee.)[358] It might be thought that, of the NMPT programmes listed in 1.2 above, those which foreground 'creative practice' (1.2.6) might seem to fall most naturally into the positive categories 'transformative' and 'collaborative,' particularly if such categorisation is made by their deployment of self-descriptive adjectives — *collaborative*, *open*, *exploratory* — rather than through external scrutiny of their actual practice, while more traditional 'interpretative' programmes might seem to struggle. I chose to highlight this relatively unexciting and limited interaction in preference to more swashbuckling instances of practice as an example of collaborative and transformative learning with no obviously open or exploratory elements. In my experience similar unglamorous interactions form the bread and butter of NMPT and go largely undocumented.

All this would seem to sit well with the broad consensus in the pedagogical literature that instructors should strive to offer transformative teaching and promote collaborative learning. However, in many cases the transformative/transfer opposition itself breaks down. There are numerous situations in NMPT where transfer-style teaching is the only reasonable option. Examples include the acquisition of many of the instrumental techniques referred to in 2.2 above: harp multiphonics, some clarinet dyad multiphonics, most inside-piano work including the location of multiple harmonic nodes on a single string, and those string arco overpressure techniques that seek to elicit a particular pitch. In these cases, a 'deep approach to learning orientation' would be both unnecessary and distracting: the skills are limited and knack-like, even though they may be individually challenging to acquire. They are efficiently transmitted via 'mimicry' (Type 2) in the form of in-person or audio-visual demonstrations. (As in the interaction described above, but more straightforwardly, 'the instructor' in such demonstrations is neither the person nor the instrument alone but the hybrid *actant*.) A trainee who wishes to learn such techniques is unlikely to welcome an accompanying attempt at root-and-branch musical transformation; they are more likely to demand 'Just show me!' — as in the video tutorials referred to in 2.2.2. Once the technique in question has been acquired, the trainee is free to apply it in multiple contexts across the interpretative-creative spectrum — to meet composers' written demands, or to offer to a composer as part of a collaborative process, or as raw material for a devising performance practice, or in a free improvisation freakout. It is a portable skill. Due to this portability, such teaching approaches could be seen as ultimately transformative in nature — trading short-

[357] Bruno Latour, 'On technical mediation,' *Common Knowledge* 3, no. 2 (1994), 33.

[358] This is characteristic of NMPT and new music ensemble practice in general — a generally collaborative environment in which markers of status are worn lightly, and in which the value of post-conservatoire and lifelong learning is well understood. This last is a consequence of acquiring a repertoire in adulthood, since while child prodigy pianists routinely summit the pinnacles of the nineteenth century virtuoso repertoire, they do not yet play Ligeti's *Études* or Michael Finnissy's *The History of Photography in Sound*, nor do they habitually commission new works. As long as we play new music, we are all adult learners.

term restricted didacticism for long-term exploratory liberation — but this seems to stretch the Type 1/2 opposition to the point that it is no longer meaningful. More broadly, if an instructor strongly favours the use of technical etudes and exercises, are they a narrow, Gradgrind-like martinet (Type 2) or an informed practitioner of scaffolded pedagogy (Type 1)? The answer may depend on the length of time that the observer takes into account.

Musicianship skills call the transfer/transformative opposition into question in a similar way. My own musicianship education (that is, the parts of my practical music training that did not concern my principal instruments, which are the violin and piano) included: tonal ear-training via choral practice from a young age, tonal keyboard harmony and figured bass, and the then-usual menu of stylistic exercises — Palestrina-style counterpoint, fugue, mock Bach chorales and Haydn string quartets — and subsequently a shock immersion into new music in my first job as assistant conductor with Ensemble Intercontemporain, in which I rapidly had to familiarise myself under pressure with a welter of novel (to me) musical features, including microtones, nested tuplets, and my first encounters with parametric fusion (4.1). Almost all of this training would fall into Carey et al.'s Type 2: it was thoroughly didactic, prioritised mimicry, employed 'defined excellence' criteria, and was highly inflexible and assessment-orientated, allowing no time for an 'exploratory' approach even if it had been seen as desirable. However, the skills I acquired thereby directly underpin my professional practice, often with surprisingly little need for extra translational effort — a practice that has encompassed highly exploratory situations that are culturally very distant from the strict 'English organ-loft plus French polish' ambience of the training itself. According to Carey et al.,

> … students taught in a predominantly 'transfer' style may be less prepared for a diverse career and less resilient when faced with career challenges or crises after their tertiary studies than those students who have experienced transformative teaching.[359]

This may be a fair critique of the way some solo performance programmes operate (perhaps especially those focused on the nineteenth century virtuoso repertoire) but is not a picture I recognise in the new music space. For example, while I know of several musicians who have moved with seeming ease from receiving transfer-type training similar to mine, to an experimental practice (and many who have not made that journey), I know of no-one who has trained in a 'creative performer' way who has attempted the reverse journey into older new music practices of the 'virtuoso decoder-replicator' type (into what might be crudely summarised as the Berio *Sequenze*, or Boulez *Sur incises* traditions), nor do I think that such a journey would be feasible without significant re-training. Carey et al.'s observation certainly does not apply to my own case: it is the skills that I acquired via transfer pedagogy that have proved the most adaptable in the face of change. Furthermore, the encounters after my formal training that have most productively disturbed and expanded my musical capacities — including my endeavours to make sense of the world of extended JI (6.1) and my ongoing engagement with non-isochronous rhythmic practices (7.2) — have not been acquired through particularly 'open' or 'exploratory' methods (Type 1) but rather via a (self-imposed, partially financially-motivated) discipline that is notably 'inflexible', 'confined/focused', makes heavy use of 'mimicry' (Type 2) and even could be said to place me in a temporarily submissive position. However, their

[359] Carey et al., 'Characterising,' 364-365.

acquisition, by expanding my expressive range and freedom of action, makes me feel more confident and empowered. This expansion not only takes the form of an ability to jump through trickier technical hoops than before while performing ('nail that $\frac{7}{15}$ bar!') but also provides me with valuable perspective. From such an external platform, I feel able to examine and reflect on my current and past practice. For example, as my understanding of the 'in tune / out of tune' opposition has broadened over time, I am able to identify times when my pitch-finding (and my expectations of that of my colleagues) was overly lax, resulting in unfocused or incoherent performances. Conversely, there were other times when I was over-precise (insisting on too narrow target ranges in contexts where other musical parameters were more important), resulting in cautious and expressively-restricted performances. I try to learn from these experiences; such acts of (transformative) reflection having been been made possible by (transfer-type) 'didactic […] instruction, scaffolding that promotes mimicry, less flexibility, [and] orientation towards assessment.' As in the instrumental-technical examples in the previous paragraph, the question of whether such training is ultimately Type 1 or 2 depends on the observed timeframe: transfer in the short term, transformative in the long. It is unlikely that Carey et al intended their categorisation to be subject to such a wave-particle 'Copenhagen interpretation'; nevertheless, the existence of this duality is present in my own professional activities and those of many colleagues with similar training backgrounds. In the words of one interviewed performer, describing an intensive (konnakol-based) rhythmic training course: 'When you're doing it, it's a mental and physical workout but at the same time kind of dumb […] like building a muscle. But it's worth putting in the effort because it's been so helpful for things I hadn't even imagined it could be used for.'

Since no-one would advocate a blinkered and unreflective approach to performer training, it is likely that virtually all instructors, however they really teach, would self-identify as Type 1. Carey et al hint as much: 'Although [Type 2] teachers expressed a desire to foster independent learning abilities in their students…'[360] Instructors' self-characterisations should accordingly be heavily contextualised. I have witnessed a conducting masterclass in which the instructor actually grasped and manipulated both arms of a trainee in front of an orchestra, and subsequently delivered a homily about 'the importance of developing your own style'! The capacity of those trainees who are put through a mainly one-to-one teaching model adequately to characterise or evaluate the training they are receiving may also be questioned, since they have been deprived of points of comparison. External scrutiny of such provision is therefore highly desirable. However, it does not seem that the transfer/transformative distinction is the best conceptual framework to underpin future investigations of how NMPT operates. It may be that champions of a constructivist, student-centred learning approach risk underestimating the ability of (some) students to contextualise their own learning. In my experience, the relatively sophisticated and well-informed trainees on the (generally postgraduate-level) programmes referred to in this chapter are better placed than most conservatoire students to understand and manage their own learning journeys. Many may be trusted to adopt temporarily submissive stances while labouring to acquire particularly demanding skills without the concomitant risk of permanent narrowing of focus or demotivation. It was this kind of stance that motivated one (interviewed)

[360] Ibid., 362. It would be surprising to discover any instructor in a conservatoire who demands direct mimetic discipleship comparable to the tyrannical drum instructor in Damien Chazelle's film *Whiplash* (2014), let alone the master-archer Droṇa's demand for dakṣiṇā (the voluntary sacrifice owed to a guru) in the form of his student Ekalavya's severed thumb in the Mahābhārata. It is possible to imagine a very different placement and breadth of the Overton window (the 'window of acceptable discourse') in performer training than the mild differences of approach discussed in this text.

composer-pianist with a busy professional performing schedule to identify a gap in their own expertise and take an unpaid sabbatical year to study privately in a *guru–shishya* model with a tutor in India. (ECTS credits were not discussed!) My own pedagogical responsibilities involve the oversight of a course taught by a team of a dozen instructors. While I have neither the desire nor the authority to intervene in their one-to-one teaching approaches, my instinct tells me that, so long as they ensure that they provide sufficient context to trainees so that informed consent may be given before entering such processes, and avoid making claims about the universal applicability of any method, I may trust them to proceed intensively, passionately, and unashamedly didactically where appropriate, without fear of their provision being labelled of the deprecated 'transfer' type. An awareness of the complicated relationship between labour and liberation dates back to Virgil. His lines *Labor omnia vicit / improbus*[361] have been co-opted as a motivational motto for labour unions and educational institutions to mean 'anything can be achieved if proper effort is applied'; an alternative reading is the downbeat 'insatiable toil occupied all areas of existence.'[362] The occupants of conservatoire practice rooms are (grimly, joyfully) driven by and consumed by these twin meanings; no resolution of them is attempted here.

To propose a better framework for future evaluations of individual cases of NMPT provision would exceed the ambitions of this study. It may be that a future vocabulary will borrow more from sports studies than the humanities. It is even possible that the field may acquire sufficient self-confidence to engender a native evaluative vocabulary, and that music pedagogy will export, rather than import, concepts. With these confounding considerations in mind, it seems more productive to focus on structures of provision than attempt to probe more deeply into individual instructors' approaches, since, as in the example of the interaction recorded above, the structures themselves have significant pedagogic agency. The principal instructors are not individual actors but *actants*. How may we help create the conditions for such benevolent hybrids to emerge and thrive?

3.2 Busting siloes: why do some common features of new music go untaught?

3.2.1 Differences between the defaults of orchestral practice and new music ensemble practice, and their pedagogical implications

The historical evolution of conservatoires is so intertwined with that of the development of the modern professional symphony orchestra that, when viewed from a distance, the two heritage structures may be compared to the mythic Baucis and Philemon, an old married couple transformed into inosculated trees. One composer, who happily embraced the label 'experimental,' expressed the same notion to me with less affection: 'music schools and orchestras sometimes look like two drunks propping each other up — but don't quote me!'[363] The dominant meta-skill taught and practised in both — for professional orchestras too are the sites of learning journeys — is musical unanimity: playing together. This is generally considered so self-evident as to hardly be worth pointing out. Unanimity provides not only a habitat for performers that

[361] Virgil, *Georgics*, Book I, lines 145-6. As well as the common use of the phrase as a school motto, see *Alexia: Labor Omnia Vincit* (Amazon Prime Video, 2022), a documentary mini-series about the football player Alexia Putellas, who has the full phrase tattooed on her back.
[362] Richard Jenkyns, 'Labor Improbus,' *The Classical Quarterly* 43, no. 1 (1993): 243-248.
[363] Nevertheless, permission was granted (on the condition of anonymity, since the composer had an institutional position.)

goes mostly unnoticed, like that of the young fish that asks 'what the hell is water?' in David Foster Wallace's viral 2005 graduation speech,[364] but also suffuses our performing selves as a structuring principle. Many professional musicians are less river fish and more jellyfish, supported internally and externally by a hydrostatic skeleton of musical consensus. Unanimity has been seen as the defining feature of basic ensemble practice since the time when orchestras were new music groups by obligation. For Johann Joachim Quantz, writing in 1752 (just two years after Johann Stamitz was named as *Hofinstrumentalmusikdirektor* in Mannheim, with that orchestra's era-defining period yet to come), the equation of orchestral unanimity with beauty was an undeniable starting-point, and the only question was how to achieve it:

> *Given that* [my emphasis] […] the beauty of an orchestra principally lies in the fact that its members must all play in the same way…[365]

Quantz's simple advice was that players should follow their leader and accept a 'proper / reasonable [*vernünftig*] and necessary subordination, without which no good music can exist.'[366] In modern professional orchestral practice, and in its training, the notion of subordination — whether to a wielder of a magic wand on a podium, or to a concertmaster, or a section principal — has receded in favour of quasi-gravitational clumping, instigated by members of the group themselves and assisted where necessary by a conductor-facilitator. Lully's fateful staff has given way to distributed and undemonstrative self-policing:[367] the willingness and aptitude to do so forms a major part of the orchestral skillset that is called *professionalism*.

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[364] David Foster Wallace, "'This is Water'" *FS*, accessed Sep 2, 2023, https://fs.blog/david-foster-wallace-this-is-water/.

[365] '*Da nun* […] die Schönheit eines Orchesters hauptsächlich darinne besteht, daß die Mitglieder desselben alle einerley Art zu spielen haben…' (my italics.) Johann Joachim Quantz, *Versuch einer Anweisung, die Flöte traversière zu spielen* [*An attempt at a method for playing the transverse flute*, usually translated as *On Playing the Flute*], (Breslau: Korn, 1780), 180. (Hauptstück XVII/VII, paragraph 16.) Accessed online at Münchener DigitalisierungsZentrum, Bayerische Staatsbibliothek, Jan 3, 2023, https://www.digitale-sammlungen.de/en/view/bsb10527689?page=3.

[366] '[Eine]… vernünftige […] und nöthige […] Subordination ohne welche keine gute Musik bestehen kann…' (Ibid.) Within elite orchestras in particular, a simultaneous *counter*-gravitational tendency also exists, created by the strength of individual artistic personalities. A tension between these two forces can be already detected in Charles Burney's much-quoted 1772 characterisation of the Mannheim orchestra as 'an army of generals, equally fit to plan a battle, as to fight it' — a description that was presumably intended as praise, although it is unclear how militarily effective such an army would be. Simon Rattle, interviewed on leaving the Berliner Philharmoniker in 2018, laid out this tension with striking openness: '[It's] not like an orchestra. It's like an absolutely gigantic string quartet, with all the arguments and verbal violence and frustrations of a string quartet […] I think this orchestra was born in struggle, and will always be in that state.' (He had previously described it as 'an orchestra that burns.') Simon Rattle interviewed by Shirley Apthorp, 'Goodbye, Sir Simon!' *Berliner Philharmoniker*, accessed Sep 2, 2023, https://www.berliner-philharmoniker.de/en/stories/goodbye-sir-simon/. In a comparable fashion, much of the thrill of Claudio Abbado's collaborations with the Lucerne Festival Orchestra between 2003 and 2013 — a genuine 'army of generals,' consisting of international soloists, chamber groups, and invited principal players from leading European orchestras — arose from the sense that an implausible excess and diversity of artistry had been crammed onto a single stage; the effect could at times be clamorous. (As a member observed to me in 2011, while nevertheless describing the LFO residency as the highlight of his year, 'apparently we're the best musicians in the world, but it feels like things could fall apart at any minute. And we can't get those bloody pizz-es together.') Following the collapse of London's radical Scratch Orchestra (1969–1974) — an ensemble conceived under very different conditions from the Mannheim, Berlin, or Lucerne groups, but similarly brimming with dissenting voices — the former member Eddie Prevost observed that 'the fundamental contradiction confronting the [Scratch] Orchestra was perhaps its dependency upon its own constitution, the paradoxical aim of "legislating for nonconformity."' Simon Yuill, 'All problems of notation will be solved by the masses,' *Mute Magazine* 2, no. 8, 25. In the film *Prova d'orchestra* (1978), Federico Fellini depicts these tensions as fundamentally irresolvable: after a mid-rehearsal gunfight, a giant wrecking ball smashes through the wall, burying the harpist in rubble. Nevertheless, orchestras persist — for the moment.

[367] Not always 'undemonstrative'. According to a (possibly apocryphal) late twentieth-century anecdote, a guest musician with the ultra-professional Cleveland Orchestra who played a note out of place in a rehearsal would face the cry *'Donuts!'* The unfortunate player's penance was to buy doughnuts for his colleagues.

Such distribution does not imply that the strength of the consensus-force within orchestras, and the corresponding responsibility to inculcate consensus-building skills in conservatoires, has loosened in the slightest in the sense of tolerating dissent. (Quite the reverse is the case, since, following what is widely perceived as an improvement in orchestral playing standards in the past decades, even orchestras snobbishly regarded as 'second tier' during the twentieth century now generally play very well together by default.) Rather, such raising of standards has involved a redistribution of the origins of the force vectors that create such unanimity: away from the picture of a forward-radiating point at the orchestra's front and towards one of a spider's web of musician-to-musician communication pathways that overlap most densely in its middle. When applied to repertoire earlier than the focus of this text, this networked route to consensus can be highly efficient, as vividly shown by performances by unconducted orchestras such as Daniel Grimal's Les dissonances.

Recent critiques of the goals and models of performer training, including passionate calls to action by Daniel Leech-Wilkinson,[368] have focused on the supposedly unhealthy and subservient attitude of classically-trained performers to quasi-sacred written texts. Even if this diagnosis is accurate, I have found that the power exerted by the text is very often trumped by the imperative to play together: by the gravitational clumping of gesture and sound. Consider two parallel examples, one concerning rhythm, the other, pitch:

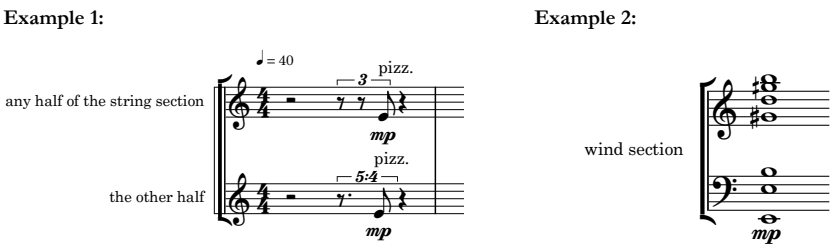

Figure 8: Two varieties of orchestral auto-correct.

In many orchestral contexts the *pizzicati* in **Example 1**, while no(ta)tionally separated by a very noticeable 100 milliseconds, are highly likely to be played in unison on first reading, even by orchestras who play a lot of new music, unless and until an explicit anti-clumping force is applied: *oh, we're / you're not supposed to be together there.* (This might come from a conductor, from a section leader equipped with the full score, or from an attentive player taking a swift glance at their neighbour's part.) Similarly, the G♯ and G♮ in **Example 2** may very likely be 'auto-corrected' into consensus on first reading by a wind section, since the G♯ will already tend to slip downwards, away from its tempered tuning, in search of a blended 'just' sonority (see 6.2 below.) Differences between written dynamics are even more likely to be erased in favour of consensus, since there is no agreement on their default meaning: if, in the same verticality, a trumpet is marked ***mp*** and a flute ***mf***, it might mean that the composer — imagining that a trumpet is naturally louder an a flute — wishes for an equal-sounding balance (as in notational approaches by orchestrational micro-managers such as Ligeti, Ravel, Maurice Delage, and numerous composers who emerged in the era of MIDI and DAWs), or it could mean that the flute is really intended to be more perceptually present. (We might call the latter strategy

[368] Leech-Wilkinson, *Challenging Performance.*

'interventionist,' in that it implies that the reason for a composer to write a dynamic is to alter a performer's default practice rather than to set volume levels — as usually seems to be the case in Haydn's scores, for example.) In such cases it is necessary to hunt for that most elusive of notions — the composer's intention, which is here an even more Snark-like quest than usual, since in many cases composers have not themselves fully interrogated their own communicative strategies with respect to dynamics. Unless and until the strategy is determined — and if an orchestra is workshopping eight pieces by young composers in a single day, gaining an exact understanding of where each composer's approach falls will likely be a low priority — the performers will fall back on their professional unanimising defaults. They have no other reasonable option.

The strength of these unanimising tendencies frequently comes as a surprise to less experienced composers whose scores include such deliberately non-unison effects: chords with feathered and overlapping onsets and offsets, hockets, scattergun *pizzicato* or *col legno* effects, and tight microtonal clusters. Such composers often discover in the first rehearsal that such intended effects, despite seeming simple with respect to the decoding required by each individual player and possessing a perfectly obvious shape to anyone following a full score, fail completely or sound unwontedly tentative. This is sometimes ascribed to sloppiness on the part of the players: *why don't they just play what I've written?! it's just a triplet!* This criticism ignores the fact that for the great majority of their time orchestral players certainly do not 'just play what is written,' as notation software or a DAW would, and indeed have received extensive training and incentives not to do so. To say of an orchestra 'they play like chamber musicians,' for example, is high praise in relation to most repertoires, while 'robotic' would usually be an insult. Intentionally disunited effects have been common features of new music compositional practice since at least the 1950s; while orchestral players are generally perfectly familiar with them and will execute them unproblematically once an anti-clumping force is applied (*oh, you've got a G♯ against my G♯*), a non-unison stance will never be an orchestral default, and therefore not a conservatoire one either.[369]

It is harder to make comparable generalisations about coalescing forces within new music ensemble practice, since new music ensembles embody two broad performing identities which are sometimes at odds with each other. The first and most coherent one is their self-identification as cut-down orchestras, sacrificing heft in favour of mobility without fundamentally changing performers' rules of engagement: the sports model of a range of cars. This tradition can be traced back to Schoenberg's cut-down (and cut-price) Verein für musikalische Privataufführungen (1918-1921);[370] it was reflected in the core line-up of the London Sinfonietta (founded in 1968), which directly influenced the formation in 1976 of the Ensemble Intercontemporain, and subsequently the other established ensembles referred to in 1.2.4. Their condensed-orchestra status is encoded within many of the flagship works associated with these ensembles. There may be little common ground between the sound worlds or aesthetic priorities of Oliver Knussen's *Coursing*

[369] A great part of my communications in rehearsals takes the form of variations of the sentence 'you're together / not together / with the bassoon / in bar *x*' (meaning, 'you *should*' or '*shouldn't* be…') I have sometimes wished for notational innovations to lighten this workload, perhaps by using coloured notation in players' parts coded by the level of caution required (red for a passage in rhythmic and pitch unison, amber for only rhythmic unisons, and green for solo passages) before realising that this would go a long way towards putting me out of a job.

[370] The Munich ensemble *taschenphilharmonie* ('pocket philharmonic') which was founded in 2005 with the explicit intention of reviving the Verein's approach, appropriately styles itself as 'das kleinste Sinfonieorchester der Welt' ('the smallest symphony orchestra in the world.')

(written for London Sinfonietta, 1979), Pierre Boulez's *Répons* (Ensemble Intercontemporain, 1981-1985), Wolfgang Rihm's *Jagden und Formen* (Ensemble Modern, 1995-2001), or Enno Poppe's *Speicher I-VI* (Klangforum Wien, 2008-2013), nor do they sound 'orchestral,' but they are linked by a certain attitude of expectation towards their performers. They all demand (conductor-led) preparation in quite traditional workflows, working towards unanimity in a way with which Mahler, for example, would have been quite familiar. Even where these composers dramatize a temporary local dispute between musical layers, an overall controlling voice is strongly present. The second, looser, category is the 'everything else': the vast field of experimental practices which are linked only by their appetite for setting their own rules of engagement, and which therefore resist further generalisation. New music ensembles exist in a state of permanent tension between these two broad identities and their very different workflows — a fact that any NMPT programme that includes repertoire from both categories should make explicit.

To interrogate the nature of ensembles' default praxes, a thought experiment could be devised to stretch players' allegiances to their two masters (textual fidelity versus ensemble unanimity) past breaking point. Consider a piece consisting of successions of **Example 1** altered by microscopic degrees: the temporal separation decreased from the definitely rhythmic-sounding 100ms gap to the spread resulting from a Furtwängler downbeat (a notoriously quantum-like phenomenon), and yet further towards the asymptote of unison — but presented in a random order.[371] By analogy, a vexing **Example 2**-based game of pitch could, by widening or narrowing the intonational spread, investigate what degree of microtonal separation counts as a unison in different ensembles' default praxes; this is a different question to the listener-focused perceptual preoccupations of James Tenney in superficially-comparable works such as *Critical Band* (1988). Such 'solicitations' of the assumption of consensus (recalling Derrida's ground-shaking term *solliciter*) are reflexively avoided by musicians since they fall into nobody's comfort zone: they are neither aligned to familiar 'orchestral' (condensed or otherwise) nor 'experimental' procedures. This very awkwardness gives them value as limit-exploring probes. Such probing should certainly remain a Deweyan 'deliberation,'[372] since real empirical testing would be impractical, expensive, and intensely irritating for the players.[373] In my

[371] Composers have repeatedly attempted to challenge the assumptions of orchestral alignment and consensus, from Lutosławski's aleatoric boxes, through the Ligeti of the *Chamber Concerto*'s labyrinthine second movement, to the polytemporal practices of Marc Yeats and Philippe Kocher. Despite these challenges, the force of default unanimising 'gravity' remains strong. See also the discussion of works by Benedict Mason in 7.2.2.2 below.

[372] 'Deliberation is an experiment in finding out what the various lines of possible action are really like. It is an experiment in making various combinations of selected elements of habits and impulses, to see what the resultant action would be like if it were entered upon. But the trial is in imagination, not in overt fact. The experiment is carried on by tentative rehearsals in thought which do not affect physical facts outside the body. Thought runs ahead and foresees outcomes, and thereby avoids having to await the instruction of actual failure and disaster. An act overtly tried out is irrevocable, its consequences cannot be blotted out. An act tried out in imagination is not final or fatal. It is retrievable.' John Dewey, *Human Nature and Conduct: An Introduction to Social Psychology* (New York: Henry Holt, 1922), 190.

[373] Previous experience has taught me caution about the viability of drawing useful conclusions from an empirical research procedure that asks orchestral musicians to repeat a passage multiple times with fine changes. As a contribution to the multi-institutional ACTOR project (Analysis, Creation, and Teaching of Orchestration, actorproject.org) I conducted the orchestra of the Haute école de musique de Genève in two days of recording sessions intended to provide raw materials for the subproject ODESSA (Orchestration and Re-Orchestration: A Study of Combinations and Contrasts.) The task involved multiple captures of short passages, ranging from single chords to phrases, in a succession of changes of orchestration: some minor, like deleting an *a 2* indication in a tutti, others more dramatic, such as swapping the roles of winds and strings in a Tchaikovsky symphony's development section. It rapidly became clear that, despite the seeming simplicity of the material to be recorded, the effects of the intonational, dynamic, and rhythmic flux that resulted from attempting such a gruelling and counter-intuitive task (and which could not be entirely overcome in the available time, despite everyone's best efforts) had a negative effect on the usability of the recorded results. It only required one musician among dozens to play in a

mind's ear, I can conjure up both the sounds I would expect and the anticipated moment that a riot would ensue. Offering the challenge to the phantom groups held captive in my own memory (comprising not merely the memory of sounds and images, but of the quality and nature of their habitual responses to notation and to my conducting gestures), I would anticipate very different responses from a fleet-footed London orchestra, a majority German-trained Japanese orchestra, a relatively isolated orchestra in a post-Soviet state, and indeed differences within my 'memory banked' versions of various European new music groups. Chapters 6 and 7 contain attempts to make interrogations of the nature of such defaults in the service of musicianship education.

Such questions do not arise in the traditional conservatoire orchestral training model. The internal division-by-instrumental-families that is the basic structuring principle in almost all conservatoires conceives the departments of wind, brass, etc. as workstations on a series of efficient assembly lines whose end product is a group of musicians imbued with the meta-skills of orchestral consensus ('professional standards.') Each line starts with a 'press shop' of instrumental teachers ensuring that (for example) individual clarinet students can play rapid legato chromatic scales seamlessly across the registral break, whose products (the instrument+player *actants*) are sent onwards for further assembly in the appropriate training sub-ensemble (a wind quintet or band), before final 'wedding' (as car manufacturers call it) with other sub-ensembles in a Strauss tone poem in the symphony orchestra. In fact the relationship between production method and product in such training is even closer than this metaphor suggests, for while it took active conceptual interventions by pioneers such as Henry Ford and Ransom E. Olds to create the assembly line concept for car manufacturing, here, the production model grew alongside the product organically and largely in the absence of an inquiry stance. While it is relatively simple to add or remove discrete skill modules from this model (e.g.: add vibraphone tuition / remove ophicleide tuition; add atonal sight-singing / remove fugue; add repertoire by marginalised nineteenth-century composers / remove repertoire by over-represented ones), it is much harder to integrate practices which demand different meta-skills, and in particular those which require freedom of movement between the workstations — a demand that, by definition, threatens to undermine the line's efficiency. In the example of the clarinet's chromatic scales it is easy to trace the path of the discrete component from individual to ensemble, from scale practice to Strauss. In the case of a failure of quality the line may diagnostically be traced backwards, and an individual may even be held responsible: unjustly, in all probability, since the true teacher is the entire structure.

3.2.2 Cinderella skills, hiding in plain sight between the siloes

This mostly-efficient system fails in the face of some very common — even trivial — features of new music. It is universally acknowledged that it is not an appropriate pedagogical fit for the 'everything else' second category of experimental music *sensu lato*. Accordingly, participants on the 'creative performer' type of NMPT programme in conservatoires (1.2.6) usually have little or no contact with instructors or trainees in

marginally divergent way to confound an entire take. In this case, and also in the discussion of orchestral intonation in 6.2 below, an imaginary orchestra is the best — and certainly the most compliant and inexpensive — research tool. In addition to these immediate hurdles, the discussion here relates to *defaults*: i.e. situations where the matter under consideration is not put under the spotlight, putting musicians' guards up — as certainly would be the case if the rhythms adapted from **Example 1** were presented sequentially. A true test would sneak these challenges unannounced into multiple rehearsals over the course of months and years.

orchestral departments. (Like a pair of childhood friends, one of whom later emigrated to a distant metropolis while the other stayed in the hometown, they find they have irretrievably grown apart and have little to talk to each other about.) Perhaps less obviously, the system also fails to teach some features of the unanimising type. Consider the case of *dal niente* and *al niente* transitions (fade-ins and fade-outs). Such transitions are common to the point of cliché in new music old and new, their familiar 'hairpin+circle' notation having been invented (according to Salvatore Sciarrino) by Salvatore Sciarrino.[374] The habit was sufficiently metonymically associated with new music to provide the name — via Lachenmann's 1970 composition — of a prominent Chicago new music ensemble (Ensemble Dal Niente.) During the 1990s almost every student composition I saw seemed to have more ⟙s than clear onsets. So we might expect teaching trainees how to negotiate these transitions to form a major part of NMPT, but this is not the case. When an individual ⟙⟘ appears in an trainee's part or a solo piece, a teacher might supply technical advice for its maximally-seamless production on a particular instrument. However, the meta-skill is not its production but its integration into ensemble practice: a clarinettist's understanding that the controllable duration of the transition differs greatly in other instruments, and that the notion of instrument families offers no help here — the controllable duration is relatively long on the flute, bowed vibraphone, and cello, while it is short or non-existent on the oboe and trombone. The meta-skill embraces the permutations of such understanding for each instrumentalist and the accretions of practical adaptations that flow therefrom (*since this transition is in unison with the oboe, I'll help that player hide their entry by placing my crescendo a touch sooner…) Mutatis mutandis*, the same is the case for the other common new music transitions: between airy sounds and focused pitch, or between focused pitch and 'scrunchy' saturated noise (created by string overpressure, dirty woodwind multiphonics, a brass *son fendu* or friction sticks on percussion instruments.) All these skills together form a 'transitions' skill-cluster. For such meta-skills which cross the siloes of instrumental families there is no clear pedagogic pathway. Their assembly line generally stops at the press shop of one-to-one lessons.

This remains the case even within many of the dedicated NMPT courses listed in 1.2. Instances of the meta-skill may well arise in a new music ensemble's concert programme, but it would be unusual for repertoire to be chosen with the tuition of such basic meta-skills in mind. The instrumental line-ups of these programmes are much more changeable than symphony orchestras, so whether a particular player will happen to encounter the skill or not is usually quite random. Such was the case in the cellist's awakening to the sound of the 7th harmonic in the interaction above, which was initially presented as an example of good practice: while it was a useful moment of realisation for the cellist, other trainees missed this insight due to the accident of the piece's instrumentation. In a concert-orientated NMPT model, performers of instruments that figure less frequently in ensemble configurations (e.g. bassoon and tuba) and who consequently receive fewer opportunities to play in ensembles, risk never encountering entire sectors of repertoire and their attendant skillsets. Conservatoire concert programming is a balancing act between competing imperatives, all of which are reasonable (perform a certain number of student compositions! give participants as many performing opportunities as possible! achieve greater representation of minority

[374] 'Forty years have gone by since, with a simple notational artifice, I found the way to represent this principle: ⟙⟘, a zero at the beginning and one at the end of opposite converging forks, thus aiming to express the nothingness that generates sound, to which it returns shining.' Salvatore Sciarrino, *Carte da suono* (Rome/Palermo: Novecento, 2001), 204.

groups! construct artistically coherent and/or audience-friendly programmes!) Consequently, a concert-orientated approach to NMPT all but guarantees patchy transmission of skills.

Orchestral training is different. The mere presence of a symphony orchestra within a conservatoire virtually guarantees the transmission of certain rudimentary unanimising skills. Certain orchestral features are bound to 'come up' and be practised, or at least witnessed, by all participants, almost regardless of the choice of repertoire. If we permit our focus to loosen and blur away certain known facts about what an orchestra is doing (for example, the title of the piece being rehearsed, the the name and life story of its composer, our familiarity with its themes, motivic development, or its large-scale form — in Husserlian terms, if we apply a local *epoché*, or bracketing-off,[375] to these aspects of our knowledge) we may perceive a very large set of its activities as an authorless succession of unison *pizzicati*, soft brass-section attacks, woodwind-section rapid flourishes, dynamically-balanced held chords, and so on, continually repeated with small variations. This de-auraticised, de-contextualised, even melancholy perceptual stance has similarities with the way artificial intelligence recognises the borders of objects in large datasets. Taking such a stance permits a long view of the sparsely-documented way conventional orchestral training (*conditioning* might be a more appropriate term) works: in a succession of rehearsals driven forward by the tantalising red herrings of preparation for always-imminent concerts, while the deeper pedagogical pathway, answerable to and controlled by no individual, finds its own AI-like way through. Much orchestral repertoire is effectively self-teaching, and may be thought of as an example of self-organisation or, in the words of the biophysicist-philosopher Henri Atlan, an emergence of 'complexity from noise.'[376] Despite colourful interventions by charismatic instructors who imagine that they alone are doing the teaching (once again, I have conductors in mind),[377] the production line runs with minimal supervision. A marker of its success and dominance is how it has consumed the choicest cuts of 'musicianship,' pushing designated musicianship instructors to the margins (2.3.1.) Another is its generally unchallenged and even unnoticed status, like the water for Foster Wallace's fish. This may not be a bad thing, since there is less imperative to adopt an inquiry stance when a system is generally efficient. In respect to orchestral training, an act of *epoché* is imaginable but perhaps not necessary.

On the other hand, a dose of such *epoché* is helpful when attempting to identify common features in new music with a view to selecting skills for training. The attempt itself pushes against a relentlessly-individualising discourse. While some conception of 'common practice' is a lived reality for training performers of 18th and 19th century music — surviving robustly in training models despite having been subject to sustained academic attack[378] — the opposite is the case in new music, where a 'no-common-

[375] Christian Beyer, 'Edmund Husserl, 6: Epoché, perceptual noema, hýle, time-consciousness and phenomenological reduction,' in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta and Uri Nodelman (Online: Stanford, 2022), accessed Mar 3, 2023, https://plato.stanford.edu/archives/win2022/entries/Husserl.

[376] 'Le principe de complexité par le bruit.' Henri Atlan, *Entre le cristal et la fumée: Essai sur l'organisation du vivant* [Between crystal and smoke: an essay on the organisation of living things] (Paris: Seuil, 1979).

[377] In 2024 I was invited to give a conducting masterclass on Ligeti's *Kammerkonzert* (1969-70) at Geneva's Haute école de musique. Being sceptical about my fitness to advise the students on matters of physical conducting, and unsure whether I could offer effective help if I identified a serious problem, I instead gave a 'rehearsal masterclass.' I allotted a longer-than-usual period of time for each student (one hour) and encouraged them to rehearse a short passage in the best way they saw fit. I then attempted to help the students understand when their explicit interventions had had positive outcomes and when they might have been better relying on the rehearsal's natural 'production line.'

[378] Alexander Rehding skewers 'common practice' virtuosically: '…this scintillating term, coined by Walter Piston in his influential textbook *Harmony* of 1941, is a Saussurian masterpiece, oscillating as it does between an (idealized) historical

practice' assumption prevails. If this proposition is even viewed as worth writing down, it is usually presented axiomatically and without evidence as an argument's starting point. Thus, Friedmann asserts confidently that

> The community of musicians has never before been confronted with the level of fragmentation that exists today.[379]

Similar blanket disclaimers abound in Prefaces and Introductions throughout the discourse of twentieth- and twenty-first century music; understandably, it seems obligatory to start with an observation that the subject matter is more diverse than is generally acknowledged.[380] A metaphor to which John Cage frequently returned, when asked to offer general observations on the compositional styles and practices of his own time, was to characterise them as a 'delta' of multiple gently-branching streams — in implicit distinction to the governing metaphors of the discourse of self-consciously avant-garde institutions like IRCAM, which characterised musical discoveries and developments more like a powerful tidal bore, sweeping everything it touched along with it or alternatively throwing it aside as wreckage.[381] It is not within my thoroughly emic perspective to judge whether this picture corresponds to reality, but I do not think it should be assumed to be the case. There may be some sense in the singular advertising slogan formerly used by the new music recording label KAIROS: '*the* irresistible sound of new music' (emphasis added.)[382] I suspect that in some cases the assumption can be ascribed to simple recency bias: the failure of historical sympathy that arises from seeing more difference in close-up than from afar. In my case, I have engaged in detail with the work of two or three hundred living composers, but only with (at most) ten contemporaries of Mozart; colleagues specialising in HIP assure me that the late eighteenth century was a period of great musical variety. In the case of the 'transitions' skill-cluster, despite its ubiquity within practice, its procedures are generally seen as too rudimentary to be worthy of attention in composers' narratives — as expressed in promotional materials such as programme notes, interviews, etc. Viewed cynically, it could even be said that it is their very status as elements of a common practice that contributes to their neglect, since such materials exist to advertise the composer's practice as distinct from that of others and thus worthy of notice. It is unlikely that a composer with influence in a tertiary institution of the ad hoc NMPT type would be either interested in, or feel responsible for, finding a way directly to teach such skills which are not obviously creatively interesting in themselves. Even to point them out involves a little act of de-composition ('analysis' seems

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period and an abstract set of rules.' Alexander Rehding, 'Three Music-Theory Lessons,' *Journal of the Royal Musical Association* 141, no. 2 (2016), 251. A frustrated conservatoire professor in charge of a nineteenth-century harmony course in Germany expressed the sentiment to me more bluntly: 'There never was a common practice, and anyone who thinks that there was is an idiot.' [private communication, 2020] The cause of their frustration was that (in their view) their teaching colleagues were quite happy with the notion — but as an unwritten assumption rather than an argued-for position. Citable commentaries in the field of musicianship tend to be written by thoughtful critics, while many real-world institutional decisions are made on the basis of undocumented or unacknowledged assumptions. Consequently, we cannot gain a reliable overview of real perceptions from the published literature alone.

379 Friedmann, *Ear Training*, xvii.

380 For example: 'Modernism in music, then, is a diverse phenomenon.' Björn Heile and Charles Wilson, 'Introduction,' in *The Routledge Research Companion to Modernism in Music*, ed. Björn Heile and Charles Wilson (London : Routledge, 2018), 12.

381 'We live in a time I think, not of mainstream, but of many streams or even, if you insist upon a river of time, that we have come to [a] delta, maybe even beyond [the] delta to an ocean which is going back to the skies,' John Cage, Radio interview with Charles Amirkhanian, KPFA, Berkeley, Jan 14, 1992. Quoted in David W. Bernstein, 'Introduction,' in *Writings through John Cage's Music, Poetry, and Art*, ed. David W. Bernstein and Christopher Hatch (Chicago and London: University of Chicago Press, 2001), 1.

382 'Der unwiderstehliche Klang der Neuen Musik,' as printed on CDs and advertising materials from KAIROS, including an annually-released promotional sample CD of that name containing extracts of music recorded that year.

too grand a word here, and in any case no single work is being analysed.) Nevertheless, thinking up exercises of this type is not difficult:

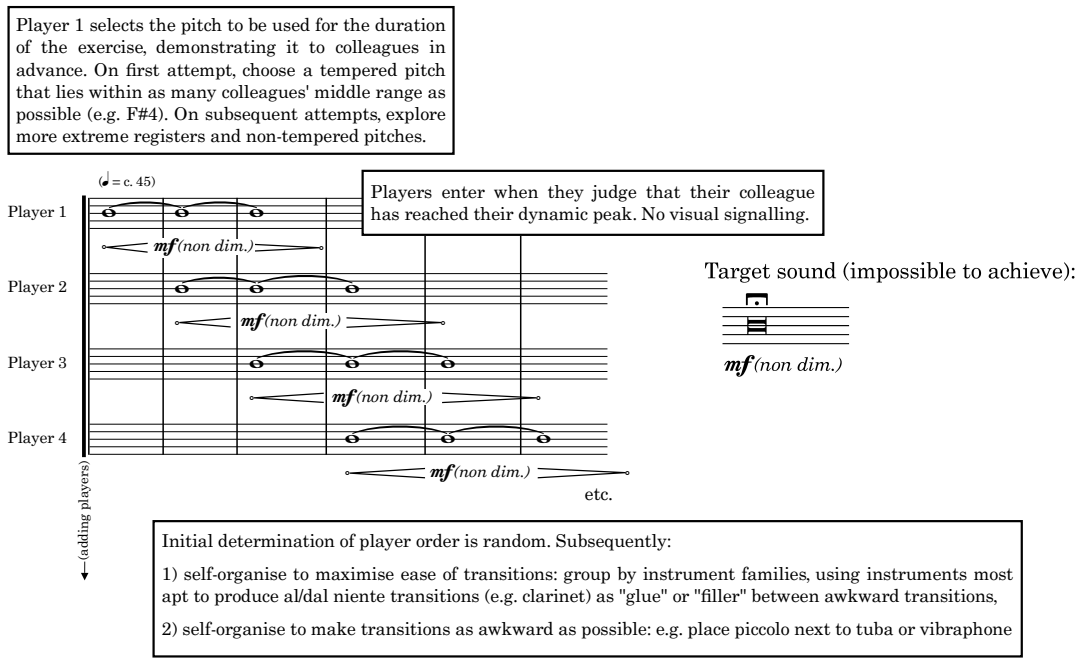

Figure 9: Exercise: transitions.

This exercise may be developed in various ways; each player could instead be given the prompt:

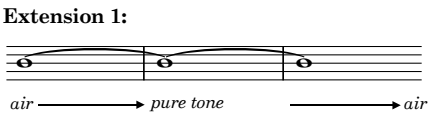

Figure 10: Transitions, extension 1.

targeting an (unachievable) consistent half-air / half-tone sound, or:

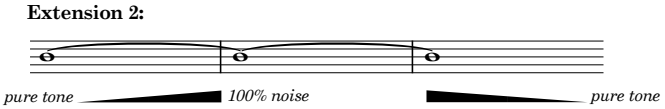

Figure 11: Transitions, extension 2.

targeting an equal mix of noise and tone. I have written these down only for the purposes of this text; in practice they do not require notation and can be transmitted in a few words or gestures by a workshop leader. Part II contains much more developed examples of such exercises. They are unashamedly pedagogical in that they are directed towards the players themselves and not any public, and also because their goals are narrowly fixed, each aiming to develop a single skill, rather than open. They have similarities with the 'musical games' in Trevor Wishart's 1975 book *Sounds Fun*,[383] although they are deliberately blander and (in distinction to Wishart's socially inclusive approach) openly directed at the goal of professional

[383] Trevor Wishart, *Sounds Fun ♫ a book of musical games* (York: Schools Council Project / University of York, 1975).

performing excellence, and therefore (alas) less fun. Their intended learning outcomes are closer to those made in a funding proposal by Pauline Oliveros to the University of California, San Diego (also in 1975.) Adopting a tone severer than Wishart's, Oliveros proposed a rhythmic group exercise which is both 'extremely difficult' and 'extremely effective,' and in which '[if] the individual fails, the whole group fails':

> The group forms a circle (about 20). Three people face each other in the center of the circle and a fourth person is the critic-conductor. The critic-conductor begins to clap a tempo. The large group takes it up. In the center, person A invents and claps a rhythm, with respect to the tempo person B must repeat it and add his or her own rhythm, person C must repeat A's and B's and then add his or her own rhythm. Then the center group must clap together (A+B+C), and then the whole group claps the whole rhythm. The critic-conductor must stop the exercise whenever he or she detects an error and explain exactly what was wrong. Some possible errors: Person A, B, or C does not repeat exactly; Person A, B or C lags the tempo; group is too loud or goes out of tempo; critic-conductor does not perceive error; etc. The group determines whether the critic is accurate. Then a new group comes into the center. No errors are allowed. As the group improves, more people are added to the center group.[384]

A difference is that Oliveros' exercise is explicitly aimed at a general notion of 'basic musicianship,' which in her view necessarily involves creativity (inventing rhythms), while mine is deliberately limited to performer training and targeted at historically contingent features of musical practice. (I see no special reason to designate the transitions in my exercises as basic or fundamental — I merely note that they are very common.) In the examples above I have attempted to include intrinsic 'control of error': the recommendation — associated with the methods of Maria Montessori — that learning materials should contain built-in tendencies that allow learners to evaluate the success of their own work. In this case, these are the sounding 'targets,' the knowledge of which is made available to all participants and not just the instructor. This is certainly adult learning, however, since while Montessori's famous cylinder sets offer young children the satisfaction of a sense of completion when all the cylinders are positioned correctly, in these exercises a linear progression towards a clear goal is possible, but perfection itself is unreachable — a vexing 'gradus *paene* ad culmen Parnassi' ('steps leading *almost* to the summit of Parnassus.') Because they are not intended as an act of composition, and because they are thoroughly disposable, they are left authorless.

If institutional structures permit it, comparable exercises, formed to fill any identified gap in skill acquisition, may be constructed and discarded freely by attentive instructors who have access to large datasets of musical experience. These may be offered to trainees in group workshops and adapted as appropriate to support trainees' learning journeys. One meta-lesson that such exercises may convey is to offer an alternative to what Richard Sennett called 'the tyranny of intimacy' — the dominating narrative that what must finally interest us are particular details of individuals' psychologies (here: as manifested in acts of creative practice) rather than commonalities.[385] The construction of Chapters 6 and 7 of this text was motivated less by my ambition to write down particular exercises, and more by my hope of encouraging my fellow instructors to address my errors and omissions by creating their own.

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[384] Pauline Oliveros, 'Modes of Attention and Awareness in the Teaching of Basic Musicianship,' in Pauline Oliveros Papers, UC San Diego Library (Box 8, Folder 30), digital copy accessed Jul 7, 2023, https://library.ucsd.edu/dc/object/bb3487549v.
[385] Richard Sennett, *The Fall of Public Man* (New York: Vintage, 1978), 337.

3.3 Belling cats: the emergence of a new role within NMPT

The picture of institutional NMPT in this chapter so far can be summarised as follows. Musicianship skills (cross-project, cross-instrument skills) are transmitted mostly by actants. Where there are failures of provision, institutional structures rather than individuals should be examined first. While individual NMPT instructors have frequently diagnosed existing structures of performer-training provision as being unfit for their purposes — such acts of diagnosis having motivated the very creation of NMPT programmes — the development of more appropriate models to replace them is in its infancy. The inquiry stance should be extended beyond the conservatoire environment to embrace those summer courses and academies that pursue the 'no model model' (the assumption that organising rehearsals and concerts alone is pedagogically sufficient.)

NMPT seems to flourish most where it is offered by a large group that contains internal diversity of approaches, and where members of the group have detailed knowledge of each others' areas of strength and deploy such knowledge actively and flexibly. Institutions can encourage this by providing support to 'unglue' the one-on-one teaching model, and encouraging (for example) a horn instructor to work with string players to learn the harmonic series, or a percussionist instructor to work with singers to develop their rhythmic skills. In this way, the training gaps characteristic of the ad hoc model are more likely to be filled through serendipity.

Despite the importance of such group learning, individuals have a crucial role to play in overseeing new models and setting curricula. A key part of such oversight is the ability and willingness to look for absences and lacunae. An individual should actively seek out cases where responsibility for the transmission of skills has fallen through the cracks, even where a diverse group of instructors is available. This is a difficult task, since dark areas hard to spot by definition, even where they are close at hand. The 'transitions' skill-cluster is one among many examples of such dark areas hiding in plain sight, since it falls between the training siloes of instrument families. The difficulty of this task could be eased if individual overseers had access to a large and high-quality corpus of ISM and NISM resources to inform their search; however, at present they have the former but not the latter.

The 'assembly line' model of orchestral training should not be scorned as outmoded but rather learnt from, since its efficiency in conveying key skillsets seemingly by accident is enviable. Although it cannot be directly replicated in NMPT contexts, a carefully-selected syllabus of works to be prepared for performance can approximate aspects of it (8.2) so that some skills may be transmitted without trainees and instructors being burdened with the responsibility of conceptualising each skill anew. When informed by the wisdom of a group, and overseen by a figure whose primary responsibility is actively to look for and seek to redress that group's inevitable omissions, the beginnings of a productive new model training 'assembly line' may emerge. In this respect NMPT is not a natural branch of the humanities as conceived in academic institutions, since while to be insufficiently reflective is an academic sin, in performer-training contexts the imperative to constantly re-examine our terms of engagement can feel inhibiting: if properly contextualised and entered into consensually, periods of 'transfer'-style teaching and learning may sometimes be highly appropriate

(3.1.) Consequently, as Ian Pace also argues,[386] evaluative frameworks that are derived from the humanities alone cannot be automatically applied to this field.

Institutions can support this model by providing incentives for individuals to 'bell the cat' and accept responsibility for the oversight of the (very wide) conception of musicianship argued for here. The search for such an individual may not be an easy task, since such cat-belling would be rewarded neither by the proprietorial pride of a pedagogue who has mentored an individually brilliant trainee, nor the thrill of performance, nor the satisfaction of a defined and easily documentable act of creativity. It fits poorly in a professional climate that demands individualising self-descriptions ('*my* practice involves…'), and also in an academic one that elevates the value of specific embodied encounters above projects that push in a generalising direction (2.2.3.) There is no obvious job description with which we might label the individual who steps forward to accept such responsibility: non-work-specific chamber coach? plenipotentiary musicianship teacher? non-composing composer? non-conducting conductor? A job description that appropriately combines its utopian aspect — since it is fundamentally motivated by the spirit of *care*[387] — with the readiness to get one's hands dirty with quite humble musical materials and be unafraid to poke into a few dark corners, might be: new music *caretaker*.

[386] Ian Pace, 'Performing arts need a research and practice excellence framework,' *Times Higher Education*, May 10, 2022, accessed online, Jan 5, 2023, https://www.timeshighereducation.com/opinion/performing-arts-need-research-and-practice-excellence-framework.
[387] William Blattner, 'Care (Sorge).' Chapter, in *The Cambridge Heidegger Lexicon*, ed. Mark A. Wrathall (Cambridge: Cambridge University Press, 2021): 137-144.

Chapter 4: Who takes care of the caretaker?

There is some evidence that institutions are engaged in re-imagining the roles of NMPT instructors and course leaders, or at least are sensing that some such need is desirable. Recent vacancies for the leadership of NMPT courses are phrased in more open terms than was formerly the case, emphasising broad responsibility for overseeing a set of musical practices rather than setting a role with narrowly defined duties: while the right person for such a job was once assumed to be a conductor, this is no longer so obvious. This openness, while welcome, comes with challenges. To expect every 'caretaker' of a NMPT programme to invent an entirely new conceptualisation of the musical practices under their care would be both exhausting and unnecessary. However, in the near-absence of existing documented conceptual models, a newly-appointed caretaker may well feel the need to do so at present. Resources exist to help guide many of the important aspects of a NMPT programme alluded to in the Preface that are not addressed here (stagecraft, curatorship, musicians' health, etc.) as well as a rich store of ISMs (2.2.) In this chapter I return to the 'riddle of the missing NISMs' I identified in 2.3 and 2.4.2 — now re-named 'musicianship materials' — and look within new music's characteristic materials (4.1) and procedures (4.2) to ask why their creation seems such a daunting task. In the following Chapter 5 I offer a conceptual vocabulary intended to alleviate this difficulty.

4.1 Plasmas, parametric (con)fusion, and unweaving rainbows: which features of new music's materials vex prospective creators of musicianship materials?

> We have also sound-houses, where we practice and demonstrate all sounds and their generation. We have harmonies, which you have not, of quarter-sounds and lesser slides of sounds. Divers instruments of music likewise to you unknown, some sweeter than any you have, together with bells and rings that are dainty and sweet. We represent small sounds as great and deep, likewise great sounds extenuate and sharp; we make divers tremblings and warblings of sounds, which in their original are entire. We represent and imitate all articulate sounds and letters, and the voices and notes of beasts and birds. We have certain helps which set to the ear do further the hearing greatly. We also have divers strange and artificial echoes, reflecting the voice many times, and as it were tossing it, and some that give back the voice louder than it came, some shriller and some deeper; yea, some rendering the voice differing in the letters or articulate sound from that they receive. We have also means to convey sounds in trunks and pipes, in strange lines and distances.
>
> *Sound-Houses* (*New Atlantis*, Francis Bacon, 1624-5)[388] as pinned to the wall of the newly-opened BBC Radiophonic Workshop in Maida Vale by Daphne Oram, 1958.[389]

If translated into scientistic modern French, this extract from an unfinished Jacobean novel could easily be a press release from IRCAM in its prime. For Daphne Oram, citing Bacon's text in lectures had by the 1970s become 'an established routine,' along with her explanation that in this remarkable passage the author

[388] Francis Bacon, *The Advancement of Learning* and *New Atlantis*, ed. Arthur Johnston (Oxford: Clarendon Press, 1974), 244.
[389] Robert Barry, 'Beyond Both the Old World and the New: Music, Magic, and Media in the New Atlantis of Francis Bacon,' in Francis Bacon, *New Atlantis and selections from the Sylva Sylvarum*, ed. Robert Barry (London: Repeater Books, 2020).

had predicted almost every innovation in electronic music, and indeed in new music generally.[390] Every aspect of sonic practice seems to be up for grabs in Bacon's vision; any sound can be transformed into any other. In the twentieth- and twenty-first centuries, composers have fulfilled all these predictions and more.

This playground for the visionary and the composer, in which every imaginable sound and its transformation is, in principle, available for music-making, creates immediate obstacles for a would-be creator of musicianship materials, of which the most immediate is a lack of agreed-upon vocabulary. Not only is it not obvious what, for example, would count as a difficult rhythm meriting special assistance (2.3.4.1, 7.1) it is not even straightforward to identify and isolate the musical categories in which such assistance might be offered. This is not due to neglect among participants. Rather, it results from intrinsic turbidity within a broad area of consensus about the categorisation of new music's constituent musical materials. I call this area the *post-spectralist consensus*, although I might more whimsically have called it *in the Sound-House*. This is a rather paradoxical coinage, since the 'consensus' here is not a well-mapped area of agreement, but rather a broadly agreed zone of doubt, like the location of a perilous whirlpool on a nautical chart — stay well clear! Within this turbid area, musical parameters which were previously considered to be naturally separable, such as pitch, rhythm, and timbre, tend to be treated as if they were fused (*parametric fusion.*) The results of such fusion are referred to as musical *plasma*, and musical approaches which favour such fusion are called *plasmic thinking*. I am conscious that these terms arrive freighted with associations with the various spectralist traditions — French, Romanian, German, and others — documented in Julian Anderson's (2000, and still definitive) article, 'A provisional history of spectral music.'[391] However, I do not see their applicability as limited to these repertoires. I see the musical thought and outputs of a great number of composers, including many who have little obvious connection with the music Anderson discusses and/or who would actively resist a designation as post-spectralist,[392] as part of this consensus.

To help locate this consensus, consider two publications that appeared almost at the same time, which became iconic in different ways, and which may be taken as shorthand for two ways of thinking about the fundamental materials of music: 1) Karlheinz Stockhausen's article '… wie die Zeit vergeht …', written in the autumn of 1956 and published in *Die Reihe* the following year,[393] and 2) the handbook *Rudiments and Theory of Music*, written in 1957 and published in 1958 by the UK's Associated Board of the Royal Schools of Music (ABRSM).[394]

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[390] Ibid., 13.
[391] Julian Anderson, 'A Provisional History of Spectral Music,' *Contemporary Music Review* 19, no. 2 (2000): 7-22.
[392] This distaste includes the figures most usually associated with spectralism: 'As far as I can ascertain, the nomenclature "spectral" is regarded by virtually every major practitioner of the trend as inappropriate, misleadingly simplistic and extremely reductive.' Ibid., 7. 'Post-spectral' is even worse, since it implies that the composer in question is epigonic. The terms are so unfashionable that we may expect their rehabilitation at some point.
[393] Karlheinz Stockhausen, '… wie die Zeit vergeht …,' *Die Reihe* 3: *Musikalisches Handwerk* (Vienna: Universal Edition, 1957): 13–42. Translated as '..... HOW TIME PASSES .....' for its publication in the English version of *Die Reihe*, 1959.
[394] No author given, *Rudiments and Theory of Music: Based on the syllabus of the theory examinations of the Royal Schools of Music* (London: The Associated Board of the Royal Schools of Music, 1958). For authorship, see footnote 412 below.

4.1.1 Stockhausen versus the ABRSM

1) Plasmic thinking: … *wie die Zeit vergeht* …

Stockhausen's text rapidly became a ubiquitous and unavoidable point of reference within European post-war new music's discourse. Although this is not, in fact, the principal concern of the article itself,[395] its message is routinely summarised as follows: that, since the parameters of music intersect at their limits, music as a whole may be viewed as a series of impulses in time. Stockhausen begins: 'Musik stellt Ordnungsverhältnisse in der Zeit dar' — 'music presents / lays out / describes relationships of order in time.' Slow vibrations are perceived as pulse or rhythm, faster ones (those above approximately 20Hz) are heard as pitch, and simple pitch-yielding waveforms may be combined to produce harmony and/or timbre (these latter two categories being particularly interrelated.) Noise results when these impulses arrive aperiodically (=inharmonically). The conventional parameters of music are not separate by nature; in certain circumstances they can collapse into a plasma. Many of the conventional terms musicians use are therefore in need of revision, because the categorical limits they imply are placed in misleading locations. For example, '[t]he confusing term sound-"colour" would better be replaced by sound-rhythm, and in general one should speak of *formant-rhythm*' [italics and scare quotes in original.][396]

I mention this article due to its cult status — in what it has come to mean rather than its content — since the unifying insight associated with it was certainly not Stockhausen's alone. Even putting Bacon's plasmic vision aside, the article forms part of an amply-documented tradition associated with the Westdeutscher Rundfunk (the public broadcaster of the federal state of North Rhine-Westphalia.) It was informed by the thinking of Werner Meyer-Eppler and Herbert Eimert,[397] who in turn influenced Clarence Barlow and his 'musiquantics' teaching approach in Cologne (1985-2005),[398] as well as a host of other figures including Stockhausen's former copyist James Ingram, who has explored the implications of this insight for notation.[399] The writings of Hugues Dufourt, Horaţiu Rădulescu, Gérard Grisey, and Tristan Murail take the fusibility (in principle) of the parameters of music, and their unity (in principle) under the sign of time — *l'unification du champ sonore* (the unification of the sound-field) — as a starting-point.[400] I have borrowed the term *plasma* from Rădulescu, shorn of his mystical associations. As for its novelty: the mathematical apparatus that revealed that complex waveforms are reducible (in principle) to a series of simple periodic

[395] The key concern of '… wie die Zeit vergeht …' is not the 'unity under the sign of time' under discussion here, which is dealt with swiftly, but rather Stockhausen's argument for the use of logarithmic over linear transformations as corresponding more closely to our perceptual experience (this is the 'how' in 'how time passes'.) The 'unity' insight is more directly expressed in Stockhausen's later article 'Die Einheit der musikalischen Zeit,' ('The unity of musical time,') the title of which speaks for itself. Karlheinz Stockhausen, 'Die Einheit der musikalischen Zeit,' in *Texte zur elektronischen und instrumentalen Musik* vol. 1 (Cologne: DuMont Schauberg, 1963): 211-221.

[396] 'Der verwirrende Begriff Klang-"Farbe" wäre besser durch Klangrhythmus zu ersetzen, und allgemein sollte man von *Formantrhythmen* sprechen.' Stockhausen, '… wie die Zeit vergeht,' 25.

[397] Werner Meyer-Eppler, *Elektrische Klangerzeugung : elektronische Musik und synthetische Sprache* [Electrical sound generation: electronic music and synthetic speech] (Bonn: Dümmler, 1949).

[398] Clarence Barlow, *On Musiquantics* [translation by the author of *Von der Musiquantenlehre*], Report No.51 of the Musicological Institute / Musikinformatik & Medientechnik of the University of Mainz, 2008. Accessed online, Sep 2, 2023, http://clarlow.org/wp-content/uploads/2016/10/On-MusiquanticsA4.pdf.

[399] James Ingram, 'The Notation of Time,' originally published in *Contact: a Journal of Contemporary Music* no. 29 (Spring 1985). Accessed online, Aug 10, 2023, https://james-ingram-act-two.de/writings/TheNotationOfTime/theNotationOfTime.subdivisions.html.

[400] Guy Lelong, 'Introduction: L'œuvre du son,' in Grisey, *Écrits*, 15.

oscillations, and therefore that musical parameters were fundamentally connected, was developed in the eighteenth century by Pierre-Simon de Laplace, Joseph Fourier, and others, and adumbrated even earlier by Marin Mersenne in the seventeenth. Alexander Rehding points to the largely-forgotten figure of Friedrich Wilhelm Opelt (1794–1863), who developed 'a whole conception of how music works on the basis of the mechanism of the siren, which caused all-too-brief excitement in the 1830s,' Charles Cagniard de la Tour's multiphonic *sirène* having been created to demonstrate that 'the two musical parameters, rhythm and pitch, are in fact not separate dimensions at all, but exist on a continuum,' since 'when rotating at sufficient speed, the ♪♬♪ rhythm will turn into the interval of the fifth.'[401] During the twentieth century the probing of parametric boundaries was also an area of interest to musicians outside the European new music heartlands. Liza Lim writes about the Ronda instrument created by the Brazilian composer and inventor Walter Smetak:

> Rather like Stockhausen's insight [sic] into the unity of pitch and rhythm as a function of time … Smetak says, 'It is the slow turn that sets the rhythm. It creates intervals. At a faster speed, the instrument does not allow us to perceive the intervals, forming a melodic line. At an even faster speed, we only hear harmonies, because the rotation is so fast that we hear many strings at the same time. We thus can conclude that rhythm, melody and harmony depend on the speed of rotation. They are three elements in one that depend on speed.'[402]

We could pile up further examples: Smetak's 'carousel producing sounds' recalls an earlier instrument, the Rhythmicon (1931), a mechanical musical instrument built by Leon Theremin for Henry Cowell. Scooping 'Stockhausen's insight' by at least two decades, this machine automatically correlated musical intervals and rhythmic pulsation.[403] Parametric interplay was an obsession for Cowell: as documented in *New Musical Resources* (1919, published in 1930) and in his compositional practices, such as the 'rhythm-harmony' of the *Quartet Euphometric* (1916–19). Likewise, Percy Grainger's various 'Free Music Machines' have strong similarities to the futuristic ideal cross-parametric instrument proposed by Stockhausen in the conclusion of '… wie die Zeit vergeht …,' which on Grainger's account was not so surprising, since the pursuit of Free Music was 'hardly personal', but rather 'the goal that all music is clearly heading for now and has been heading for through the centuries.'[404] For Varèse, 'our musical alphabet is poor and illogical,' and in the future '[t]here will no longer be the old conception of melody or interplay of melodies … The entire work will flow as a river flows.'[405] The 'insight', in its most banal form, was also readily available to anyone living in the recording era who was aware that a complex waveform could be encoded on the surface of a vinyl record or in the bits of a soundfile, or who had watched a loudspeaker cone vibrate as it plays music. It was and remains, literally, in the air.

For James Tenney, the insight itself was axiomatic:

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[401] Alexander Rehding, 'Instruments of Music Theory,' *Music Theory Online* 22, no. 4 (2016), 11-12.
[402] Liza Lim, 'Travels in hyper-reality,' *Liza Lim*, accessed online, Aug 4, 2023, https://lizalimcomposer.com/2016/08/10/travels-in-hyper-reality/
[403] Greg Dixon, 'Turning Pitch Into Rhythm,' *Perfect Sound Forever* (online magazine), Oct 2009, accessed online, Jun 3, 2023, http://www.furious.com/perfect/henrycowell.html.
[404] Andrew Hugill, 'Percy Grainger: Pioneer of Electronic Music,' in *Grainger the Modernist* ed. Suzanne Robinson and Kay Dreyfus (Farnham: Ashgate, 2015), 231-253.
[405] Edgard Varèse and Chou Wen-chung, 'The Liberation of Sound,' *Perspectives of New Music* 5, no. 1 (1966), 11.

A theory of harmony, therefore, can only be one component in a more general theory of musical perception, and that more general theory must begin—as the work of John Cage repeatedly demonstrates—with the primary dimension common to all music: time.[406]

Music was obviously a vibrational phenomenon that existed in time, and considering it holistically was no great achievement. What mattered was finding ways to identify, separate, and make sense of chunks of the stuff without falling prey to the prejudicial influence of the conventional division into musical parameters imposed by the historical legacies of Western theory and notation. As Stockhausen had noted, these were full of presuppositions and traps. In *Meta ≠ Hodos* (1964), Tenney adopted the language of Gestalt theory to help him carve the blob:

In place of 'sound,' 'sound-configuration' or 'musical idea' (as these have been used up to this point in this book), I propose the word *clang* — to be understood to refer to any sound or sound configuration which is perceived as a primary musical unit — a singular aural gestalt. For the subordinate parts of a clang, I shall continue to use the word *element* - whether these are articulated in the vertical dimension as 'linear' or *concurrent* parts, or in the time dimension as *successive* parts - i.e. tones, chords, or sounds of any kind. Finally, some term is needed to designate a succession of clangs which is set apart from other successions in some way, so that it has some degree of unity and singularity, thus constituting a musical gestalt on a larger perceptual level or temporal scale though it will not be as 'strong' a gestalt […] as is the clang. For this larger unit I shall use the word *sequence* …[407]

Clang, *element*, *sequence* (Tenney), *son complèxe* (Leippe), *objet sonore* (Schaeffer), *sound-mass* (Varèse), *aural atom* (Tsabary), *accord-timbre* (Grisey), *elements of the macroscopic sound-complex* (Xenakis), *free music* (Grainger), and even the *streams* and *chunks* of auditory scene analysis (Bregman), which Santarcangelo and Wanke have recently attempted to apply to new music with a view to determining its *pure temporal proto-objects*:[408] wherever we find an exotic taxonomic term straining against, straddling, or bursting, the semantic boundaries of classical music's everyday parametric categories, we are in the realm of plasmic thinking. All these re-conceptualisations stem from their authors' intense attunement to the fundamentally messy nature of their subject matter; everything flows into and infuses everything else. As Cage put it, 'each aspect of sound … is to be seen as a continuum, not as a series of discrete steps favored by conventions.'[409] In their different ways, the people who felt impelled to create these new terms channelled the spirit of the mountaineer and naturalist John Muir in his observation that:

When we try to pick out anything by itself, we find it hitched to everything else in the universe.[410]

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[406] James Tenney, 'John Cage and the Theory of Harmony (1983),' in James Tenney, *From Scratch: Writings in Music Theory*, ed. Larry Polansky, Lauren Pratt, Robert Wannamaker, and Michael Winter (Chicago, University of Illinois Press, 2015), 303.
[407] James Tenney, 'Meta ≠ Hodos: A Phenomenology of Twentieth-Century Musical Materials and an Approach to the Study of Form (1961), in Tenney, *From Scratch*, 33.
[408] Vincenzo Santarcangelo and Riccardo Wanke, 'The Early Stage of Perception of Contemporary Art Music: A Matter of Time,' *Organised Sound* 25, no. 2 (2020): 130-141.
[409] In Tenney, 'John Cage and the Theory of Harmony,' 292.
[410] John Muir, *My First Summer in the Sierra* (Boston: Houghton Mifflin, 1911), 110.

2) LEGO thinking: *Rudiments and Theory of Music* (1958)

The second text is a book aimed principally at children, and which has nothing obviously to do with new music. It contains preparatory material for the Music Theory examinations of the ABRSM — the internationally-dominant music examination board in 1958 and still today. Since it is small, scarlet, and full of advice, music teachers in the UK naturally came to nickname it the 'Little Red Book,' with a nod to Chairman Mao.[411] Like the Chinese volume, it had a semi-official status, since without passing ABRSM Grade 5 Theory a student was not permitted to proceed to the higher Performance grades. Its anonymity adds to its air of inscrutable authority; its contents (in contrast to its replacement from the 1980s, the *Music Theory in Practice* series, authored by the gamelan enthusiast Eric Taylor) being too 'rudimentary' and inevitable to be ascribable to any named author.[412]

According to the Board in 1958, the basic unit of music is the note; any idea that notation might not have a 1:1 correspondence with music is not entertained. A note, like a LEGO block, is imagined as possessing a set of discrete and quantifiable qualities. Just as the distinctions 'red or blue' and 'four studs or eight' are entirely separate considerations in LEGO, a note may be graphed as having *x* pitch and *y* duration; the axes do not interact. (While the '*z*' of timbre is absent from the ABRSM text, this can easily be added to its conceptual model by thinking of timbre changes like the voices on a basic digital synthesiser — press one button for 'strings' and another for 'piano'.) The book then shows how notes may be built up into well-known pedagogical patterns: triads, modes and scales, cadences, and so on.

Despite the focus on 'notes,' this familiar way of conceiving the basic materials of music is not necessarily linked to Western staff notation. The underlying conceptual architecture of MIDI, being a series of discrete instructions, comparably conceives music in a Cartesian-coordinate-like way. Adding more parameters as desired (loudness, for example) is simply a matter of adding another dimension on the graph; any musical event could be represented as the values of an *n*-dimensional matrix in which values may be assigned separately. Such an assumption of the infinite potential interchangeability of parametric values also recalls the discussion of Friedmann's serial ear-training text (2.3.2.1), along with its relevant repertoire and the real-world implications of such thinking within certain conceptions of what a professional performer should be expected to do — the readiness to produce on demand any pitch available on their instrument, at any dynamic, with any articulation, at any point in time. Adherents of this view would of course understand that not every such combination is available in reality but would tend to regard unavailable combinations as a limiting stencil placed over a theoretically infinite background: the unplayable C𝄫4 (sounding pitch) on a bass clarinet, for example, would have a Platonic Ideal prior existence comparable to Mendelssohn's projective E𝄫 in 2.2.1 above; it might not currently 'reside within' the instrument, but in a better world, it would.

[411] The ABRSM volume actually pre-dated *Quotations from Chairman Mao Tse-tung* by six years.
[412] Thanks to the kindness of the ABRSM's Publishing Department, who ransacked their archives at my request, I can reveal that the authors were the organist and choral conductor Douglas Edward Hopkins (1902-92) and the composer and organist Craig Sellar Lang (1891-1971). Writing contracts were signed in March 1957, each author being paid £100 upfront (roughly £3000 today) plus £52-10-0 royalties for the first 14,000 copies.

The implication of LEGO-type thinking for practical musicianship is that musical parameters may be dealt with one by one. This is not only an early-years preoccupation. According to Gunther Schuller, there are at least 'seven different ears' which the 'compleat conductor' should command: ears for

(1) harmony; (2) pitch and intonation; (3) dynamics; (4) timbre; (5) rhythm and articulation; (6) balance and orchestrational aspects; and (7) line and continuity.[413]

We can leave aside the details of Schuller's peculiar typology, and the apocalyptic image of a seven-eared conductor. What matters here is that in this view such 'ears' are conceived as separate components; a trainee might plausibly aspire to grow them, or others, one by one.

In new music's characteristic discourse, plasmic thinking is obviously right and LEGO thinking is obviously wrong. Despite my chosen texts being contemporaneous, and despite the ABRSM text having unquestionably reached a far wider readership than Stockhausen's, the latter text is seen as progressive and sophisticated in that it takes account of the fact that musical parameters do interact significantly and complexly, while the former is viewed with an amused eyeroll at best and may even be associated with reactionary tendencies. Whatever the basic units in works by Lisa Streich, Chaya Czernowin, or Rebecca Saunders may be (if there are any), they are not 'notes', nor could works by these composers be expressed as a series of discrete MIDI instructions or via the numerical pile-ups of Friedmann's text. A notion of 'notes' having a basic value feels more applicable to the music of scorned out-of-group figures such as Ludovico Einaudi; thinking otherwise may be the shibboleth that grants entry to the new music circles in this text.[414] There are innumerable examples of resistance to note-based thinking in the discourse of new music; from this profusion we can select a commentary on the music of Roland Kayn (1933-2011), a pioneer of cybernetic composition, and certainly no self-declared spectralist:

Words such as 'harmony', 'melody' and 'rhythm' no longer apply […] 'Music is sound, and sound is self-sufficient,' Kayn declares emphatically.[415]

Curtis Roads describes his 'microsound'-based practice in comparable language, strongly recalling Bacon's Sound-Houses:

Microsonic techniques dissolve the rigid bricks of music architecture — the notes — into a more fluid and supple medium. Sounds may coalesce, evaporate, or mutate into other sounds.[416]

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[413] Gunther Schuller, *The Compleat Conductor* (New York and Oxford: Oxford University Press, 1997), 17-18. Schuller tells us that Carlos Kleiber, Haitink, Skrowaczewski, and Gardiner possessed all seven, while Boulez had only the second, and 'most conductors have 'at best one "ear," and many simply none.' (Ibid.)

[414] And not, for example, features such as the degree of consonance or triadic harmony in evidence, as casual observers in the late twentieth century often assumed. Many recent works, such as Cassandra Miller's *I cannot love without trembling* for viola and orchestra (2023) exhibit high levels of consonance (in this case, derived from the work's source material — recordings of a Greek-American fiddler) but still fall well within the domain of new music in the sense of this text.

[415] Massimo Ricci, 'Biography: Roland Kayn,' *Roland Kayn*, accessed Mar 3, 2023, https://kayn.nl/biography/.

[416] Curtis Roads, *Microsound* (Cambridge, Mass. and London: MIT Press, 2001), vii. The notion of 'microsound' is perhaps most familiar to musicians in the form of granular synthesis. As in the beginning of '…wie die Zeit vergeht…,' Roads starts his history with an overview of 'Time Scales of Music,' sketching out the characteristic temporal regions where each musical parameter conventionally holds sway, and drawing attention to their fuzzy boundaries (2-41).

If music education proceeded in Kuhnian paradigm shifts, with new patterns of thought reliably replacing old ones, plasmic thinking would have superseded LEGO thinking long ago. However, it does not work in this way. The copy of the 'Little Red Book' I refer to is my own, bought for me second-hand in 1985 at the age of five, almost three decades after Stockhausen's article and over three centuries since Bacon's. I did not encounter explicitly-expressed plasmic thinking until my postgraduate training in the first decade of the twenty-first century — and then only through serendipity, by dropping in on composition seminars given by Julian Anderson at the Royal College of Music, London. Notwithstanding the spread of institutional NMPT, this remains the basic conceptual direction of musicianship in performer training in 2024. A recent publication, the multi-authored *Fundamentals of Music Theory* (2021) is presentationally a long way from the quaint, schoolmasterly tone of the 'Little Red Book';[417] it is an open-access e-book with embedded video links presenting the contents of a MOOC, written in accessible informal language that takes care to contextualise its content socially. However, its LEGO-like treatment of musical parameters is essentially identical to that of the 1958 volume (and so, in fact, are the things built with the blocks: we encounter the same triads, scales, cadences, etc.) In 2023, the edutech company Duolingo added 'Duolingo Music' to its popular language-learning app — a gamified presentation of the same old approach ('Unit 1: Acquire building blocks of sound' — actually meaning 'notes.')[418] The Music Aptitude Test (also known as the Bentley Test, originally the *Measures of Musical Abilities* (1966)),[419] various versions of which are used widely in the UK to determine the allotment of school music scholarships at the eleven-plus stage, includes a 'Textures' test in which the ability to determine 'whether a chord has 2, 3, or 4 notes,' without taking account of the phenomenon of spectral fusion that renders this question unanswerable in some cases. The metaphor and its implications seem to be as indestructible as LEGO blocks themselves. As the ABRSM website in 2024 puts it:

> Our Music Theory exams cover the essential building blocks of music.[420]

Despite plasmic thinking's long history, it seems that as long as NMP trainees come from backgrounds in Western classical performer training,[421] caretakers of their courses must take account of the fact that their trainees' core conceptual apparatus with respect to their categorisation of the materials of music, as laid down in childhood, will be LEGO-like. Unless there are profound changes in early-years music pedagogy — and there is no suggestion that there will be — NMPT-focused musicianship will entail a significant degree of 'un-learning' to destabilise the parametric boundaries that an earlier layer of LEGO thinking had imposed. From the perspective of a would-be creator of musicianship materials today, it is not enough to repeat the high-minded frustrations of twentieth-century radicals like Oram, Grainger, and Tenney, and

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417 Nikki Moran, Michael Edwards, John Kitchen, Zack Moir, and Richard Worth, *Fundamentals Of Music Theory* (Edinburgh: University of Edinburgh, 2021). E-book with embedded links to video tutorials, accessed Feb 2, 2023, https://books.ed.ac.uk/edinburgh-diamond/catalog/book/ed-9781912669226.

418 'Our brand-new Music course hits all the right notes,' *Duolingo.com*, Oct 11, 2023, accessed Dec 2, 2023, https://blog.duolingo.com/music-course/. On the bright side, Duolingo Music can save users 'up to $400 per session' that they otherwise would have spent on music instruction.

419 Original presentation: Arnold Bentley, 'Measures of Music Abilities,' (London: Harrap Audio-Visual Aids, 1966), LP and paperback manual.

420 'About the exams,' *ABRSM*, n.d., accessed Mar 4, 2024, https://www.abrsm.org/en-gb/music-theory/about-music-theory.

421 And from many non-classical traditions, as well. See footnote 163 above on the ear-training approach offered by Berklee College of Music.

propose that performers' durable heritage terms should be replaced wholesale. We will need to work with what we have.

4.1.2 Parametric interaction zones from the performer's point of view

I could cite endless examples of parametric interplay and transitioning in new music scores, and by such amassing attempt to justify my claim of a plasmic or post-spectralist consensus in new music's practice as well as in its discourse. This task has already been undertaken by Giovanni Verrando et al. in *New lutherie: orchestration, grammar, aesthetics*, and I do not repeat their many examples here.[422] The authors argue that during the twentieth century timbre shook off its cladding-like status and emerged as a load-bearing 'structural parameter' (they might have more persuasively called it a semi-independently expressive one, since they present no equivalents of timbral archetypes that might add up to a '*Klangfarbe-Formenlehre*' to merit so grand a designation as 'structural.') Within this emerging parameter, inharmonicity (noise) gained in expressive importance, fulfilling Cowell's 1929 optimistic prediction that

> [s]ince the 'disease' of noise permeates all music, the only hopeful course is to consider that the noise-germ, like the bacteria of cheese, is a good microbe, which may provide previously hidden delights to the listener, instead of producing musical oblivion.[423]

Accordingly, the examples offered by Verrando et al. are mostly of timbre-harmony intersections. These are easy to find, even in music earlier than the focus of this text. Works written in the early twentieth century in the shadow of Wagner and Debussy[424] are rich in verticalities that resemble a watermelon tourmaline crystal in their twofold nature — clearly green (or harmonic) when viewed at one end, and clearly red (or timbral) when viewed at the other, but of an indeterminate colour (or parametric-categorical identity) at their centre.[425] The shifting sound-masses of Tristan Murail's *Gondwana* for orchestra (1980), in which 'the entire orchestra is engaged in a single objective — to become a synthesiser, an instrument of synthesis capable of producing a sound (i.e. a timbre, a spectrum) that is complex but single'[426] are their direct descendants. With historical distance, the details of that work's vaunted technical novelties (the sounds of the application of FM synthesis to acoustic instruments) recede in significance, and its poetic approach to parametric ambiguity comes into the foreground. Claude Vivier's *couleurs* — gorgeous multi-pitch verticalities derived by expanding the sum and difference tones of dyads — are located right at the indeterminate centre of our tourmaline crystal. There exist a great number of more recent comparable

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[422] Verrando et al., *New lutherie*, 35-131.
[423] Henry Cowell, 'The Joys of Noise,' in *Essential Cowell*, ed. Dick Higgins (New York: McPherson, 2001), 251-252.
[424] See Robin Holloway, *Debussy and Wagner* (London: Eulenburg Books, 1979).
[425] Of course, to a sufficiently 'participatory' listener, all music may be heard as possessing such a dual identity. However, composers can significantly influence the choice, twisting listeners' heads towards the poles of 'green' or 'red.' Listening to the *Goldberg Variations* played on a harpsichord, we can choose to engage with Bach's counterpoint and harmonic direction ('green'), *or* to focus on the chatter of the instrument's falling jacks, rattling key levers, and so on ('red'). The choice feels binary, one activity actively excluding the other, and few would argue that the 'red' experience is as rich as the 'green'. Daniel Muzzulini points out a paradox in this binarism: 'Die Klangfarbe ist entschwunden, sobald der Ton als Akkord seiner Teiltöne analysiert wird. Insofern zersetzt das Prisma, der Inbegriff der Farbigkeit, die Klangfarbe!' ['Sound-colour / timbre disappears the moment a tone is analysed as a chord of its partials. In this way the prism, the epitome of colour, destroys the sound-colour!'] Daniel Muzzulini, 'Das Entschwinden der Töne und ihrer Farbe im Dschungel der Philosophie' ['The disappearance of sounds and their colour in the jungle of philosophy,'] *Basler Zeitung*, Jan 3, 2007, 8-9.
[426] Verrando et al., *New lutherie*, 110.

examples, such as Rozalie Hirs' *Roseherte* for orchestra (2008 / 2014). One crude but effective test for a musical passage's proximity to the 'perilous whirlpool' of the post-spectralist consensus is to consider whether it might be plausibly arranged for a contrasting instrumentation — asking whether it would suffer a massive loss of meaning or even become unrecognisable. While virtually all arrangements seem now to be billed as 're-imaginings' (this is evidence of the consensus at work, busily striking down the crude assumptions of LEGO thinkers) few would disagree that some musical passages are more naturally arrangeable than others, and therefore located further from the whirlpool.

A caretaker in the sense of this text does not necessarily need to ask in great depth what the materials under their care are truly made of, but rather how they behave in the performers' hands. Indeed, questions about ingredients are characteristically compositional preoccupations and may be associated with the ad hoc NMPT approach in that they place the conceptual ball in the composer's court. A pertinent question for the performer and performer-pedagogue is: even if LEGO thinking is deprecated in the discourse and even if it does not well describe the materials we tend to encounter, does that actually hold us back in practice? Must we deal with parameters in plasmic, 'all-at-once,' terms, or may we carve musical substance along simple parametric lines — perhaps even ones that the authors of the 'Little Red Book' would have recognised?

First, let us consider performers' preparatory workflows. In some cases, even within unimpeachably in-group new music contexts, a performer can make straightforward parametric incisions when preparing a passage:

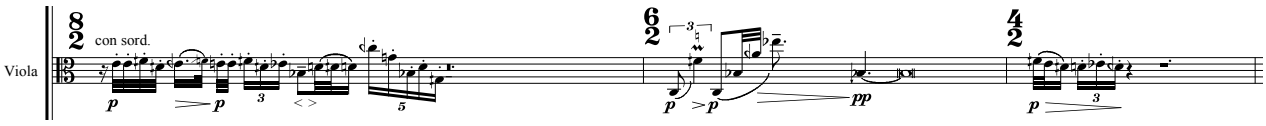

Figure 12: Enno Poppe, *Salz* for ensemble (2005), bars 1-3. Tempo ♩=72. Time signatures moved from the top of the full score to the viola part for reasons of space. Omitted: bar 2, bass flute short phrase; bar 3, drumkit (one 𝅘𝅥𝅯 in ***ppp***); bars 1-3, low quiet chords in microtonal synthesiser ('Salzorgel'). Copyright by G. Ricordi & Co. Bühnen- und Musikverlag GmbH. Reproduced with kind permission of the publisher.

This viola solo starts the piece. While it is not easy to sightread, there is no mystery or irreducible parametric complexity here. It can be learned, and taught to be learned, in a simple workflow familiar to most working musicians: First separate the rhythm from the pitches, leaving the dynamics to one side. Mark in the beats and any necessary subdivisions. Tap or clap the rhythm until it feels easy (strictly speaking, this is not 'the rhythm' but the 'inter-onset intervals' (2.3.4.3)). In slow time, learn the pitches. Ideally this would involve working both on the instrument and off (singing and listening), using context-appropriate strategies — here, I might use my equally-tempered quarter-tone keyboard setup as a reference. Finally, mate the two processes together, adding the dynamics. The result is this pawky, neurotic, garrulous, yet intimate, phrase, which sets the tone for a wild musical ride ahead. Either the pitch element or the rhythm may be worked on first; this is a feature and benefit of easy parametric separability from the performer's point of view. As for the parameter of timbre here: the passage is well written for the muted viola but in another context could be conceivably played on a different instrument while retaining much of its identity. It would be

organisationally complex but conceptually simple to create musicianship materials to aid performers' workflows in comparable contexts: instructors could create singing exercises in tempered quarter-tones along the lines of Edlund's, tuplet drills to help the quintuplets 'flow like oil' (to echo Mozart's advice),[427] and so on. This is a work by a composer who is amply aware of spectral and post-spectral practices; nevertheless, a performer's use of LEGO-like thinking seems perfectly appropriate here. I would also use a comparably traditional, non-spectral, workflow when preparing some of the key works associated with spectralism, such as Grisey's *Modulations* for 33 musicians (1976-77). The performer is not obliged to retrace the steps of the composer.

However, there are a great number of contexts where it is not appropriate because the musical material's parametric bonding is too strong. Let us imagine that our viola player now decides to learn a solo piece by Rădulescu, *Das Andere* op. 49 (1984):

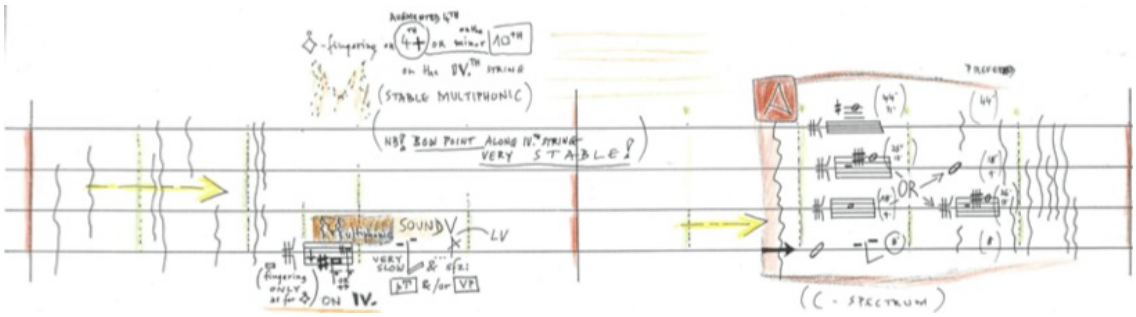

Figure 13: Horaţiu Rădulescu, *Das Andere* for solo viola, op. 49 (1984), page 16, upper system. Image courtesy of Lucero Print.

From the first glance at the score and its voluminous performance notes,[428] it is clear that no comparable separation in the learning process would be helpful, or indeed possible. Rădulescu's very special bowing techniques, including 'little devils' and 'u du 'u du,' preclude preparation in a workflow comparable to the one I proposed for the Poppe example. The piece needs to be 'swallowed whole,' with the actions of bow, left hand, and even perhaps breathing and patterns of bodily tension learnt together. It might be proposed that the key difference is the notation, since the Poppe example is written in conventional Western notation, which heavily favours parametric separability, while Rădulescu uses a home-made tablature specifically designed to melt parameters into a plasma. Certainly, notational matters occupy a great deal of our attention as performers, particularly in the early learning stages of a project. However, this is to ultimately to mistake cause with effect, and in any case we could find plenty of examples where the notation does not reflect the strength of the parametric bonding: glancing up at a nearby shelf I see a *Ukulele Songbook: Shanties and Songs of the Sea*, which is written in tablature but offers ready parametric separability, jostling Hèctor Parra's *Caressant l'Horizon* for large ensemble (2011), which is written in (extended) conventional Western notation but is highly parametrically fused.

[427] Wolfgang Amadeus Mozart, letter, dated Augsburg, Oct. 23, 1777. In *The Letters of Wolfgang Amadeus Mozart*, vol. 1., trans. Lady Wallace, heading 68. Accessed online, Jan 3, 2024, https://gutenberg.org/files/5307/5307-h/5307-h.htm.
[428] For a detailed explanation, see Martin Suckling, 'Rădulescu: The Other Spectralist,' *Tempo* 72, no. 285 (2018), 29-38.

There are many cases that sit between the Poppe and Rădulescu examples. In the following virtuosically-orchestrated passage from Unsuk Chin's *cosmigimmicks* for ensemble (2011-12), the ***mf*** attacks in the guitar's lower system, the harp and violin harmonics, and the prepared piano, operate as a single instrument:

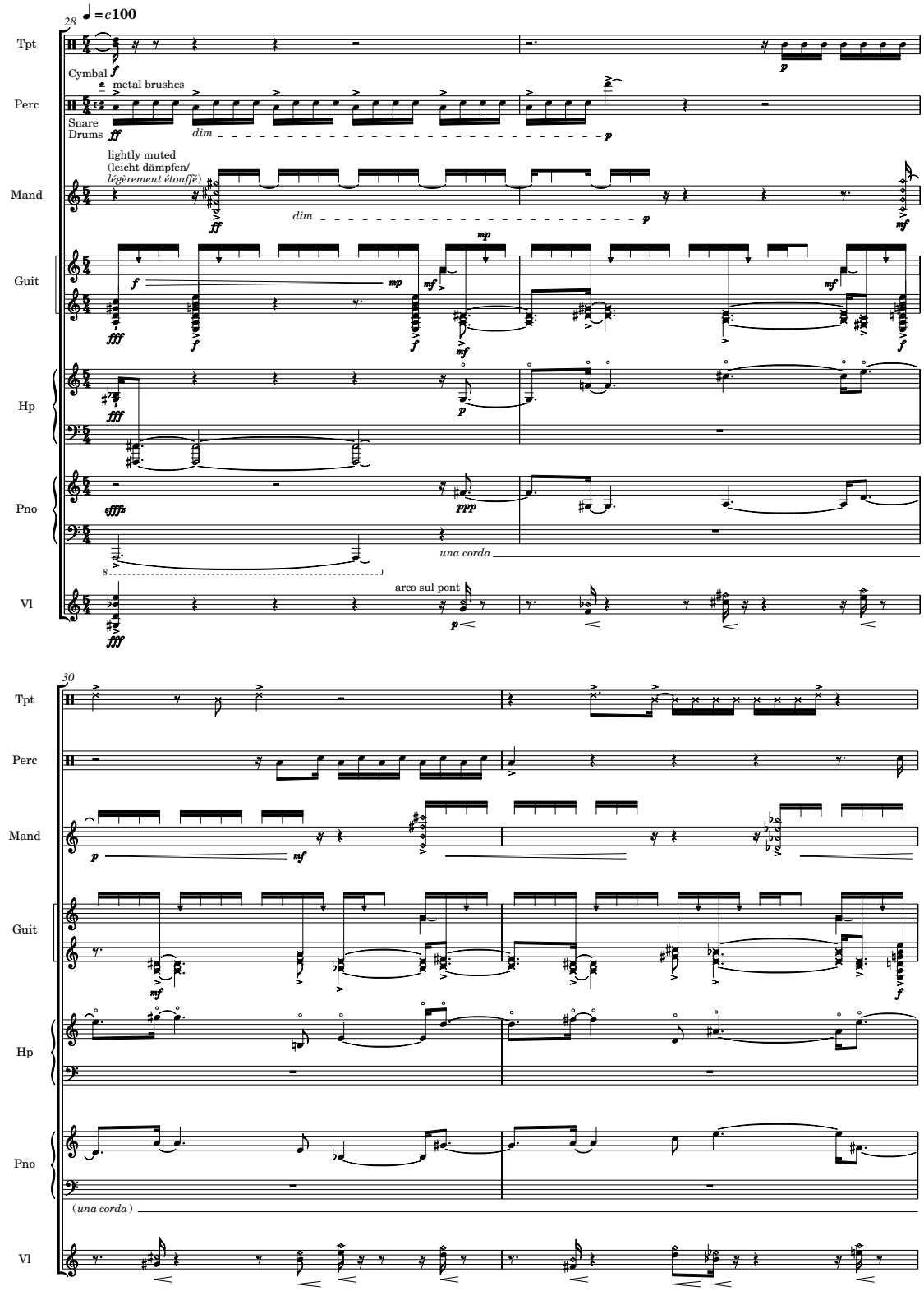

Figure 14: Unsuk Chin, *cosmigimmicks* for ensemble (2011-12), movt. 2 ('Quad'), bars 28-31. Trumpet plays maracas and sandbox. Guitar lower system: crossed notes indicate half-harmonic pressure, upper system: tapping on fingerboard and instrument body. The piano has extensive preparation.

Here, the parameter of rhythm can be readily separated for the elementary purposes of 'getting it together,' although this should not really pose a problem. The attacks may then be worked on one-by-one in slow time. 'Working,' here, means striving for the appropriate internal balance, articulation, and intonation for each attack so that the pitches may achieve timbral fusion. This is a similar process to the way an organist carefully selects a registration: hearing-out the effect of adding individual stops, then testing the total effect, then returning to individual stops, and so on. (But no organ I know has such spicily inharmonic stops!) However, this 'registration' is not fixed throughout the passage; the piano's preparation makes every attack different, while the harmonics in violin and harp may be 'the same notes' but require continual re-adjustment for balance as the octave separation changes. The players are working with pitches to create timbre — and not the ambiguous, fleeting notion of timbre that we encountered in the academic literature (2.3.3), but in pursuit of timbral targets that are very tightly defined to my ear, even if I might struggle to find sufficiently precise descriptive language.

The examples so far have been on a small scale and relate to performers' finesse rather than their survival. More dramatic examples of collisions between plasmic thinking — or rather, plasmic reality — and LEGO thinking are distressingly common in the rehearsal processes of new operas. The conventional workflow of an opera house is predicated on the assumption that timbre and pitch are readily separable. Over four to six weeks of staging rehearsals, a piano — played by a professional parametric translator, or repetiteur — is the proxy for the orchestra.[429] The orchestra, being extremely expensive, may only be added two or three days before the general rehearsal. This assembly line works efficiently for music that possesses a natural parametric 'cleavage' (a light tap of the geologist's hammer and Verdi's timbral choices fall to the side) but can be disastrous when applied to music within the post-spectralist consensus. In one case — a main-stage world premiere in a major European opera house — the unthinking retention of this model, exacerbated by a hurriedly-produced vocal score that was little more than a copy-paste of the orchestra's notes into the rehearsal piano part, led to the near-collapse of the rehearsal process. The singers' strategies for pitch-finding and recognition of cues and entries that had been laboriously established in piano rehearsals were suddenly useless when the orchestra arrived a few days before the premiere and deemed to sound unrecognisably different (the piece contained extensive use of inharmonicity-yielding techniques, including a large percussion set, string overpressure and multiple simultaneous wind multiphonics.) A singer, who had seriously considered withdrawing from the project at this late stage, actually cried when recalling to me the stress this had created.[430] The opera house's management may be squarely blamed for this debacle, since they had ample prior warning — and not only via the examples of previous rehearsal processes of new operas. In the nineteenth century, Liszt had issued a stern warning about the dangers of transferring undigested musical material between the piano and the orchestra: 'In matters of translation, there are some exactitudes that are the equivalent of infidelities.'[431] While I and others have tried to find creative solutions

[429] Expert repetiteurs do not simply play what is written in published piano reductions (vocal scores). Having a deep knowledge of the full orchestration, they incorporate or omit orchestral features as they feel necessary to guide the singers they are coaching; a less-than-rhythmic singer may receive an extra lower-octave 'kick' in the left hand, and so on.
[430] I was not involved with this project and have anonymised it (and my sources of information) for obvious reasons.
[431] Alan Walker, *Reflections on Liszt* (Ithaca: Cornell University Press, 2011), 23.

to this known problem in other projects,[432] it persists as a powerful default. Just as NMPT programmes need to take account of the residual LEGO thinking lurking in trainees' (and instructors') early-years training, they also need to provide their graduates with tools to help them engage with the many institutions that have failed to take the implications of the post-spectralist consensus seriously; this may be done by equipping them with a practical vocabulary that creatively extends, and does not abandon, everyday musical terms (see Chapters 5, 6 and 7.) I now provide a very brief discussion of three parametric interaction zones as seen from a performer's point of view.

4.1.2.1 Between rhythm and pitch

Not all zones of parametric interaction are of equal significance for the performer. First listed in Stockhausen's article, and first on a scale of slow to fast vibrations, is the transition between pulsation and pitch. The effect in its raw form is a one-trick pony: as in the revving of a motorcycle engine as it passes from coughs to an 'engine note' — or the rotor blades of a helicopter as it takes off, if we wish to keep Stockhausen in mind. Where it appears in musical contexts it is usually presented either as a metric feature stretching across several bars of a score or in pre-recorded electronics parts; in both cases a performer usually has little or no influence over the outcome. This is largely the case in Stockhausen's own explorations of the zone (e.g. *Kontakte* for piano, percussion and tape (1958-1960)), in numerous works by Tristan Murail including *Les courants de l'espace* for ondes Martenot, synthesiser, and small orchestra (1979), and in James Tenney's *Beast* for contrabass (1971) — the last-mentioned explicitly probing the transition zone between infrasound and rhythm. Here we should also note the existence of numerous compositional explorations of the way time affects the perception of other musical parameters, including Sky Macklay's *Many, Many Cadences* for string quartet (2015), Leif Inge's sound installation *9 Beet Stretch* (2002/2004), or indeed Pérotin's polyphonic discants, in which the line allotted to the tenor was often a well-known melody slowed beyond recognisability. In these cases a performer is typically not in a privileged position — they play an essentially functional role, the hard work being done by the 'participatory listener' — and so can play little part in helping convey or obscure the particular 'trick.' Where this situation prevails, a performer can recognise the fact and focus on other concerns.

4.1.2.2 Between rhythm and timbre

The intersection of rhythm (or duration) and timbre is a much richer area, and one which can be more amenable to a performer's expressive control. Nevertheless, in some contexts performers have to accept that flexibility within this zone is taken out of their hands. While the dense spider's web of crawling

[432] In the premiere production of Liza Lim, *Tree of Codes* (Cologne Opera / Hellerau – European Center for the Arts Dresden / Numero23Prod. / Ensemble Musikfabrik / cond. Clement Power, 2016) it was necessary to have all sixteen instrumentalists available for the entire rehearsal process, since in Massimo Furlan's production all participants (singers, dancers, singing instrumentalists and conductor) were on stage throughout, costumed and often performing from memory. While no piano rehearsals were envisaged or possible, Cologne Opera retained its customary terminology for its rehearsal schedule: Klavierhauptprobe, Sitzprobe, etc. In other projects, such as Wolfgang Mitterer, *Marta* (Opéra de Lille / Ictus, cond. Clement Power, 2016), and Hèctor Parra, *Hypermusic Prologue* (Gran Teatro del Liceu / Centre Pompidou / Ensemble intercontemporain, cond. Clement Power, 2009) the working method involved an uneasy hybrid of piano rehearsals and the use of synthesised mockups and 'working recordings' (unpolished recordings of the ensemble parts, made in advance for this purpose.) As of 2024, no new 'production line' has emerged for the preparation of new operas that is remotely as efficient as the repetiteur model.

entangled lines in Ligeti's *Melodien* for orchestra (1971) creates an enticingly ambiguous textural effect of a just-barely-rhythmicised timbre to the listener, from the individual performers' perspectives there is little to do other than to decode their own lines (the conductor's role is also limited to basic coordination and balance.) For an individual, trying to listen and adapt to the totality, perhaps attempting to push the effect towards one parametric pole or the other, would be quite impractical. The same could be said for the role of the individual particles that form the clouds in many works by Xenakis. In *Pithoprakta* for 49 musicians (1955-56), each instrument is imagined as a molecule and the overall result as a gas (i.e. what is rhythmic to the individual is timbral to the collective); the degree of expressive responsibility allotted to each individual performer is correspondingly microscopic.

However, in other contexts the performer can intervene directly in this zone. In Boulez's *Éclat* for fifteen instruments (1964-65) the conductor is given a high degree of freedom to select the order and placement of a palette of glinting mini-phrases: mostly single or small groups of fast attacks and their resonances played on instruments the composer called 'les résonnants' — piano, celesta, harp, mandolin, cimbalom, etc. Once the surface details of the complex rules of the game and the piece's unique language of cues have been internalised (fingers show numbers pointing up or down; two very independent hands are required) the piece reveals its playful side. Although it has been suggested that the risky element of live selection may be eliminated and the modules fixed in advance, this is to misunderstand the exercise: the piece is not a fixed composition but an invitation to engage in interactive cross-parametric play.[433] The jeopardy is part of the point; if the vibraphone player happens to play a fragment louder (and therefore longer-sounding) than had been anticipated in the rehearsals, the conductor needs to extend the duration between the next attack(s) or choose a different module. This is a sophisticated development of a basic inter-parametric intervention undertaken by almost all performers: selecting a slower tempo in a more resonant performing environment, or vice versa. According to the preferences and aptitude of the conductor, some passages in *Éclat* may be made to sound sharply rhythmicised or alternatively resemble timbre-like collectivities.

When rhythm is understood as a series of LEGO blocks, only the temporal placement of the start and end of events (the lengths of the blocks) are considered: examples include MIDI's triggering 'note-on /note-off' commands, or London's focus on IOIs in 2.3.4.3 above. Performers specialising in new music are also highly conscious of the internal rhythmic life of sounds. Some common techniques are located precisely at the timbre-rhythm intersection: circular bowing on string instruments (do we count each scratchy whoosh or hear a continuous machine-like whirr? — the answer depends on the speed, the number of players, and

[433] Boulez was familiar with the ideas of the pioneering play theorist Roger Caillois, which were in vogue in France in the 1960s and 70s. Caillois proposed a fourfold typology of play forms: *agon* (competition, e.g. the game of draughts), *alea* (chance, e.g. roulette), *mimicry* (role-play), and *ilinx* (meaning whirlpool or vertigo, e.g. riding roller coasters or taking drugs). Most acts of play combine these: backgammon = *agon* + *alea*. Boulez's *Éclat* is *alea* only on the surface; *agon* (in the form of the competitive *sprezzatura* of the virtuoso conductor, for *éclat* also can mean 'excellence' or 'clout') and *ilinx* (pulse-racing danger) are also present. On Callois' twofold view of the fundamental nature of play — *ludus* (structured activity such as games with rules) versus *paidia* (spontaneous playfulness) — *Éclat* is certainly the stricter *ludus*. However, it is perhaps no more bounden to its rules than are contemporary works by Cage or Kagel, despite its severer reputation. Roger Caillois, *Les jeux et les hommes: le masque et le vertige* [Translated as 'Man, play, and games'] (Paris: Gallimard, 1992). Originally published in 1958.

the degree of ensemble unanimity),[434] the use of friction sticks on percussion instruments (do we count individual clicks or entire rubs?), the action of a rosined glass on piano strings (countable squeaks or a continuous squeal?), and so on. It might even be proposed that the level of rhythmic-timbral interplay that results from an instrumental technique is directly proportional to how characteristically 'new musicky' it is:

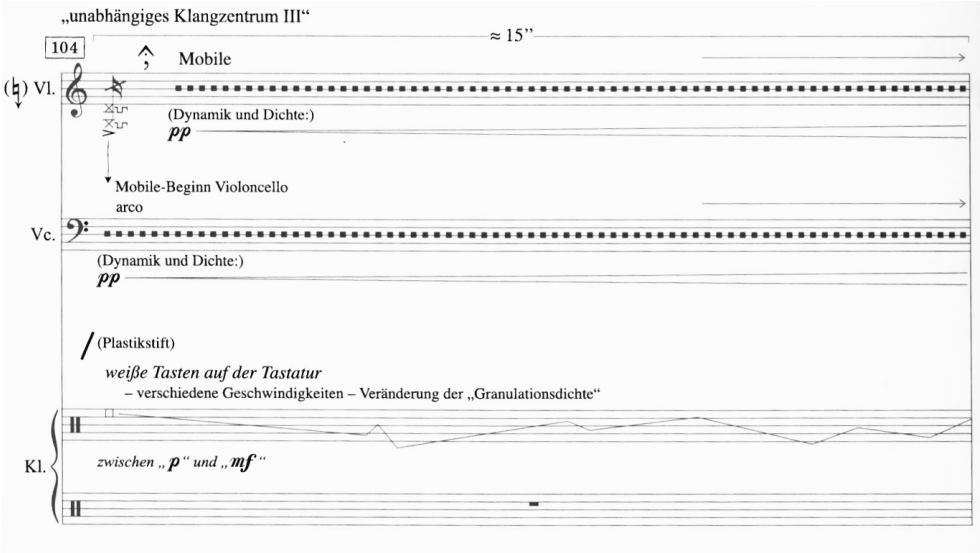

Figure 15: Olga Neuwirth, *Quasare / Pulsare II* for violin, violoncello, and piano (2016), bar 104. The pianist plays on the surface of the white keys with a plastic stick, creating a varied 'granulation' effect between countable clicks and a continuous rattle.

The proliferation of such techniques is the reason that so many new music scores contain lines (wavy, wiggly, jagged, etc.); each line being a signpost for the looming presence of the sorites paradox[435] of rhythm-timbre fusion and a signal that thinking in discrete 'notes' or even attacks is inappropriate. A high-point of sophistication in the detailed mapping of this intersection is Chaya Czernowin's *Sahaf* (2008), written for the mixed quartet of Ensemble Nikel. This work contains a virtuoso part for ratchets (rotating cog rattles.) The player is tasked with controlling the speed of rotation with an exceptional degree of precision, probing the boundary between individual clicks, entrainable pulsations, and sustained whirs. The remaining players become a sounding analogue of this exploration.

The desire to take expressive control of the inner life of a sound is a characteristic preoccupation among performers of new music. Such taking-control most frequently (but not invariably) involves a move on the timbre-rhythm axis away from treating a sound timbrally and towards parsing it rhythmically. In Chapter 7 this is called 'delaying the clock→cloud transition point.'

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[434] No agreement exists about whether a single unit of rhythmically-notated circular bowing is a complete circle, or each semicircle, since the former initially seems logical but yields two sounding 'attacks' per stroke. This can cause confusion in rehearsals; I have even seen very experienced players unable to agree about whether circular bowing notation refers to the ('double speed') sound or the ('half speed') stroke. While in itself a trivial detail, this underscores the general point that 'notes' have little meaning in much new music.

[435] From Ancient Greek: *sōritēs* ('heaper'). Traditionally ascribed to Eubulides of Miletus (4th century BCE), the paradox can be informally summarised as follows: a single grain of sand is not a heap, nor is the addition of a single grain of sand enough to transform a non-heap into a heap; when we have a collection of grains of sand that is not a heap, then adding one single grain will not create a heap, and yet we know that at some point we will have a heap. Also known as the 'bald man' paradox. For a formal presentation see Sergi Oms and Elia Zardini, 'An Introduction to the Sorites Paradox,' in *The Sorites Paradox: Classic Philosophical Arguments* ed. Sergi Oms and Elia Zardini (New York: Cambridge University Press, 2019), 3-18.

4.1.2.3 Between pitch and timbre

The intersections between combinations of pitches (or harmony) and timbre have been seen by composers in terms of potential musical material — as in the Unsuk Chin 'organ registration' example above. Members of the early generation of composers who worked with electronics were intensely conscious of this intersection, since it was then so technologically arduous to build complex sounds out of simpler ones. Xenakis writes:

> Hecatombs of pure sounds are necessary for the creation of a complex sound. A complex sound may be imagined as a multi-colored firework in which each point of light appears and instantaneously disappears against a black sky. But in this firework there would be such a quantity of points of light organized in such a way that their rapid and teeming succession would create forms and spirals, slowly unfolding, or conversely, brief explosions setting the whole sky aflame. A line of light would be created by a sufficiently large multitude of points appearing and disappearing instantaneously.[436]

This description is vivid but also — in retrospect — quite conventional, since it conceives compositional materials in the absence of the performer. It is less often documented that these zones are particularly susceptible to direct interventions by performers. The most common cases involve our control of the level of homogeneity of a passage, which we usually just call *blend*. This usually involves intervening in multiple parametric interactions, including dynamics and articulation. It is one of our main expressive responsibilities when performing works by composers including Michael Jarrell or Pascal Dusapin, where ambiguity of this type is strongly foregrounded. A piccolo player in such a work might ask themself: *should I audibly 'enter' with a self-consciously new pitch in this bar, or allow my sound to emerge like a sheen from the bowed cymbal?* The two options differ not only in dynamics and articulation, but also intonation, since choosing the 'sheen' option might entail adjusting the piccolo's pitch to one of the sounding overtones of the cymbal.

A cruder, but unanticipated and thought-provoking, example of performers' live control of the pitch-timbre intersection arose in a rehearsal of a student composer's work with an experienced ensemble; I was conducting.[437] The score contained a sustained verticality (feathered entries leading to a held chord) that included several microtonal accidentals. On hearing it, the composer seemed dissatisfied, and complained to the effect that 'it sounds too normal — are you sure that you're playing the right pitches?' The players and I checked the sounding pitches carefully and verified that they were indeed very close to the written targets. However, the composer still seemed unsatisfied. A woodwind player suggested that, rather than altering the reference pitches, the moment could be made to *sound* more microtonal through timbral changes: the flute played with a brighter sound, the trumpeter selected a more nasal-sounding mute, the strings moved their contact point a step closer to the bridge, and all players entered with a slightly sharper accent. Sure enough, the verticality did sound 'more microtonal' without any change to the reference pitches, and the composer was satisfied. While I was amused at what struck me in the moment as a piece

[436] Iannis Xenakis, *Formalized Music: Thought and Mathematics in Composition* (Stuyvesant, New York: Pendragon Press, 1992), 43-44.

[437] The context was a professional ensemble's residency in a conservatoire. The piece was workshopped and given a public performance. Wherever there is a possible implication that a composer made poor choices, names and context are anonymised.

of trickery, or even witchcraft, on reflection this was not the whole picture. The composer-approved version *was* indeed more microtonal — just not with reference to the written pitches. The brighter flute sound, the trumpet's mute change, and the *sul ponticello* bowing had amplified the presence of non-tempered higher partials, and the little initial accent added a burst of extra inharmonicity (a few 'hecatombs of pure sounds') which, despite their evanescence, lingered in the resonant hall and in the memory like the afterglow of Xenakis' firework. I, rather than the composer, had been guilty of insufficiently plasmic thinking, and I was thankful that I had swallowed the criticism that had initially sprung to my lips. The highly-experienced woodwind player's intervention was an example of live plasmic thinking *par excellence.* When I thanked that player the next day for providing me with that little epiphany, they reported that the ensemble commonly undertook such interventions, including when collaborating with composers well-known for 'their' specialised pitch practices. The player smilingly called it 'a bit of a cheat'; I disagreed, and suggested that such interventions should not be done discreetly — that is, to save the face of the composer, who in Parnassian conceptions of the composer-performer relationship is deemed to be at fault if they do not arrive with fully-realised sonic expectations — but rather advertised proudly as a mark of the ensemble's expertise. Once brought into the open they could also be directly taught in NMPT contexts.

4.1.3 In praise of LEGO

Because the discussion so far has highlighted the richness of cross-parametric play in new music performance contexts (I have tried to offer a condensed version of what anthropologists call a 'thick description')[438] it might seem that I think that a creator of musicianship materials should broadly follow new music's tendency to favour plasmic thinking and deprecate LEGO thinking. However, I do not. Although I agree with the consensus that an awareness of plasmic thinking is a prerequisite for fine performance, and that NMPT instructors should transmit their own sensitivity to parametric interactions passionately and intensively as particular cases arise in the course of instrumental lessons, chamber coachings, and ensemble rehearsals, highlighting the interactions that are most amenable to performer intervention, there is a risk that over-emphasising the impact of these interactions continues to leave us without a useful pedagogical vocabulary. Not a single one of the exotic plasmic terms proposed in 4.1.1 above have found take-up by practical musicians, and there has been plenty of time for these terms to percolate into practice. The attractively sophisticated discourse of the post-spectralist consensus has a less-pleasing prohibitory underside: the implication that to treat musical parameters in isolation is to 'unweave a rainbow,' and to agree with Keats that such unweaving is inevitably a bad thing.[439] We seem no further forward in helping caretakers develop a musicianship vocabulary that might help performers of new music.

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[438] A description that 'not only tell[s] us *what* was done but *how* it was done,' most usually given by the actor themself, and including the actor's interpretation of how they did the act. A concept discussed in Gilbert Ryle's *The Concept of Mind* (1949) but most usually associated with the anthropologist Clifford Geertz. Martyn Hammersley, 'On thick description: interpreting Clifford Geertz,' in *Questioning Qualitative Inquiry* (Online: SAGE Publications, 2008), 53.

[439] 'Philosophy will clip an Angel's wings,
Conquer all mysteries by rule and line,
Empty the haunted air, and gnomed mine—
Unweave a rainbow, as it erewhile made
The tender-person'd Lamia melt into a shade.'
John Keats, *Lamia*, Part II, lines 234-238. In *Lamia, Isabella, the Eve Of St. Agnes, and Other Poems* (London: Taylor and Hessey, 1820), 41.

I propose that NMPT musicianship would, in fact, benefit from a rehabilitation of LEGO-style thinking, albeit in an updated form. LEGO itself has consistently outperformed its competitors because it sits at the sweet spot between the ready interchangeability of its components and the morphological similarity of the models to the things they represent. It exists between the poles of a toddler's building blocks, which are highly interchangeable but crude, and its competitors' offerings, which tend to be more specific and therefore offer less play value. While a Pokémon built with Mega Bloks can only be that Pokémon (because its blocks are marked accordingly) LEGO's blocks contain in-built conceptual portability, or constructive ambiguity: LEGO part 6420922, for example, finds use as a car's hub cap and the stigma of a Welsh poppy. While an attempt at sketching what these conceptual 'blocks' might look like in NMPT musicianship is the work of Part II, an early example feels necessary here: A player may initially get to know the sound of the 11th natural harmonic (to be precise, the interval between the 8th and the 11th harmonics) in a highly timbrally-specific and context-specific way: it is the so-called 'alphorn-*fa*.' Once this interval has been internalised, however, it may be used as a proxy for the tempered quarter-tone in a host of contexts that have nothing to do with how it was initially encountered (6.3.3.2.) It is not the interval itself that is the 'block' — that would simply be to add extra blocks to old-style LEGO thinking — but rather the learning process: the series of attempts, failures, and self-corrections that lays down a conceptual-aural-sensorimotor pathway from real-world example that we have encountered (something external to us that recedes as we move away) to core skill (something internal that we carry with us.)

Some broad parametric divisions feel uncontroversial. The most basic one is that it does not feel problematic to train skills of pitch and those of rhythm separately, since the pitch-rhythm transition is of little relevance to performers of new music (4.1.2.1.) I divide Chapters 6 and 7 accordingly. Timbre, however, is always present in these categories, not treated as an problematic irritant or late-stage addition to a fundamental framework, but baked in from the start. A division for the purposes of training does not mean that these parameters exist in separate siloes. Indeed, they are ripe for productive comparison. I have already made reference to Imri Talgam's characterisation of Ligeti's rhythms as 'rhythmic dissonance' in preference to 'polyrhythms.' The percussionist and conductor Steven Schick vividly describes how an instructor may make positive use of cross-parametrical metaphors. Notionally addressing percussionists, with the aim of helping them make sense of rhythm — which he characterises as the '*quality of tension* between an event and its surrounding temporal context'[440] — Schick suggests that

> […] you might wish to think in harmonic terms: a triplet has the same relationship to rhythmic unity that a perfect fifth has to its root. The sequence of dotted rhythms has the same ratio as a perfect fourth. This might be useful if, the next time you struggle with a rhythm like 15:8, you think of it as a just-tuned major seventh – nearly but not quite at unity.
>
> 'Tuning rhythms' can be a useful strategy because arriving early to a downbeat is like playing sharp. Simply play the rhythm a little 'flatter' (or later, if you will) and you'll be right. And, like intonation, there are many versions of correctness. A just-tuned major third above C will be fourteen cents lower than a tempered major third. Both are thirds, but they behave differently in context. A just-tuned third feels settled to me, while a high seventh – a favorite

[440] Steven Schick, 'A Percussionist Understands Rhythm in Five Essays of Exactly 1,000 Words Each Not Including Titles and Subtitles,' in *The Cambridge Companion to Rhythm*, ed. Hartenberger, 62. Italics in original.

for leading tones everywhere – seems skittish, unsatisfied. Triplets, quintuplets, and backbeats have many of the same variations of behavior, though in the rhythmic space, we think of these small variations in rhythmic behavior not as intonation but rather as 'feel.' Imagine these distinctions as the difference between a Charlie Watts backbeat resting firmly in the pocket of a groove and an edgy, spring-loaded David Lang rhythm.[441]

This is an evocation of portable practical musicianship in the sense of this text in its purest form. It arises from but is not in thrall to individual acts of practice, and is unafraid to imbue cross-project musical objects (blocks) with a sense of real existence. Musical parameters are understood to interact and are productively comparable but do not collapse into a plasmic blob. Schick seems to have found a cross-parametric sweet spot. This metaphor originated among tennis players (the sweet spot of a racket is also, appropriately, its 'centre of percussion'); it can propel us forward.

4.2 Miserable mimesis, marionettes, and 'me': locating musicianship within the gestural consensus

O body swayed to music, O brightening glance,
How can we know the dancer from the dance?

W. B. Yeats, *Among School Children* (1928)[442]

Perhaps the audience can't tell the dancer from the dance, but the dancer knows. I wonder if Yeats ever tried a pirouette?

Barbara Gail Montero, *Thought in Action: Expertise and the Conscious Mind* (2016)[443]

Before proceeding directly to an attempt to build on Schick's approach, I should acknowledge that I have been dancing around some central preoccupations of new music's discourse today: gesture and embodiment. This may seem perverse, since all the parametric interactions discussed so far obviously result from real bodies interacting with real instruments. Consider the action of a contrabass bow on a marimba: as the player increases speed and pressure, the perceived volume increases. In addition, a pitch bend results, the extent of which depends on the pressure and length of the stroke.[444] This is a multi-parametric interaction that is inextricably linked to a physical gesture.

My rationale for this de-emphasis was my desire to write with historical sympathy and take account of a paradigm shift within new music thinking. In 4.1 I argued that the post-spectralist consensus provided the first obstacle to the creation of a new-music-focused musicianship vocabulary. Many of my examples were from twentieth-century new music, and my choice of terms (plasma, spectralism) was deliberately old-fashioned; I wanted to talk about the twentieth century in its own language. Here I identify another obstacle,

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[441] Ibid.
[442] William Butler Yeats, *The Tower (1928): Manuscript Materials*, ed. Richard J. Finneran (Ithaca and London: Cornell University Press, 2007), 361.
[443] Barbara Gail Montero, *Thought in Action: Expertise and the Conscious Mind* (Oxford: Oxford University Press, 2016), 185.
[444] This phenomenon does not seem to have been widely documented. Pitch bends on the vibraphone, created with a sliding mallet, have received more attention: e.g. Randy Worland, 'The physics of pitch bending on the vibraphone,' *The Journal of the Acoustical Society of America* 127, no. 3 (supplement) (2010), n.p.

and one which is more characteristic of the current century. ('New music,' defined in the Preface as the repertoire which tends to be taught in NMPT courses, straddles both centuries.) Despite its contrasting vocabulary, I see it as the direct child of the first one, and propose that it may be surmounted in a similar way. The twentieth-century post-spectralist consensus concerns the characteristic materials of new music — a fundamentally compositional preoccupation, albeit one with implications for performers. Its twenty-first century successor might be called the gestural, hyper-idiomatic-instrumental, or whole-body consensus, and concerns the characteristic procedures of new music and the discourse that surrounds these procedures. It has been extensively documented.[445] Like the post-spectralist consensus, it originates from a specific repertoire but its implications are not limited to it. In this case, that core repertoire might be summarised as 'the repertoire addressed within, and emanating from, the "creative performer" courses in 1.2.6,' although, again, its implications stretch well beyond this repertoire. This gestural consensus goes further than merely recognising and making compositional use of the fusion of sounding parameters. To return to the example of the bowed marimba, the new consensus treats *the stroke itself* as the basic unit; the doing, not the resulting sound. In this view musical material is minimally interchangeable. For example, it makes little sense to speak of 'the same' sounding A♮4 across a family of clarinets (even acknowledging the timbral differences), since each instrument's affordances and the player's gesture-complexes that relate to the production of this 'same' pitch are so different. Each particular act of production, in its precious and irreducible complexity, is valued. Within this consensus, anything that implies otherwise, such as the choice to provide a 'score in C,' may therefore be a red flag for sloppy (or — worse — fatally abstract) thinking. The gaze of composers is drawn to real bodies in action (dirty and sweaty, or fragile and tremulous) and the ways they interface with instruments, and away from spectral analyses, the relationships between pitch-classes, and the like. While this is a flatteringly performer-focused approach — we could see it as the polar opposite of both the Friedmann-Wuorinen-Carter priority nexus and of the sometimes-chilly world of Grisey's writings, in which the sounds of performers' instruments are carefully examined but their bodies are notably absent — it is also one that poses obvious challenges to any creator of cross-project materials. In 2.2.1 I referred to Heather Roche and Scott McLaughlin's re-categorisation of Philip Rehfeldt's list of multiphonics for B♭ clarinet. While this might seem on first glance to be a technically specialised and proudly nerdy undertaking (and it was that too!) it was only part of a wider project:

> Instead of starting with notes or sounds and working out how to produce them, we start with the physical instrument and see what sonic results are more or less likely through exploration; especially when the starting point is off-the-beaten path or non-standard in some way. This might mean specifying some fingerings (arrangements of closed/open holes) to see what pitches, multiphonics, and timbres emerge from different ways of using the embouchure/mouth/breath/etc.[446]

'We start with the physical instrument': so speaks the gestural consensus. In Chapter 2 I identified a rich store of ISMs and a poor supply of — even an insecurity around the very notion of — NISMs. I suggested

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[445] In addition to the references to in 2.2.3 above (in particular, the texts that refer to 'cyborgs' and 'sensors'), see Enrique Tomás, Thomas Gorbach, Hilda Tellioğlu, and Martin Kaltenbrunner, eds., *Embodied Gestures* (Vienna: TU Wien Academic Press, 2022); and Giusy Caruso, Esther Coorevits, Luc Nijs, and Marc Leman, 'Gestures in Contemporary Music Performance: A Method to Assist the Performer's Artistic Process,' *Contemporary Music Review* 35, no. 4-5 (2016): 402-22.
[446] Scott McLaughlin, Heather Roche, and collaborators, *The Garden of Forking Paths* (2019-2021), accessed Jan 05, 2023, https://forkingpaths.leeds.ac.uk/resources/. Reference repeated from footnote 103 for ease of reading.

that one reason for this imbalance was that the production of ISMs had been enabled (literally, in the sense of attracting funding) by an academic climate that increasingly recognised the value of paying attention to detailed individual embodied experiences; favoured terms included 'the corporeal turn' and 4E cognition. Taking a birds-eye view of projects that have featured in recent editions of some festivals associated with new and experimental music (IMD Darmstadt, Wittener Tage für neue Kammermusik, Donaueschinger Musiktage, Huddersfield Contemporary Music Festival) it would seem that this is not only an academic preoccupation, but one shared by many creatives.[447] Hyper-performer-specific — and therefore minimally-translative — activity seems to be everywhere (see the discussion of *UTFLUKT* in 1.2.1). Giovanni Verrando calls this tendency 'the personalisation of instruments.'[448] In its most fully-developed form, heritage instruments are abandoned completely, along with their associated training pathways and goals (i.e. the pursuit of control, mastery, and virtuosity). Cathy van Eck has made music with everyday objects including apples and chairs; no performer enters such a collaboration as a virtuoso apple-ist.[449] The genealogy of this consensus may be summarised as follows (as ever, with numerous counterexamples in mind): Once it was possible to write a piece for 'violin', the score perhaps adorned with a few markings for dynamics and articulation, preferred fingerings, and so on. During the twentieth century, notational specificity accreted dramatically, most often in the form of instructions to execute the 'extended techniques' associated with the familiar *grand récit* about the liberation of timbre in the twentieth century, or what I more generally name the plasmic post-spectralist consensus: perhaps metal mutes were added, or clothespegs on the strings. As the century aged and turned, composers felt empowered to intervene in a performer's body, as well as their instrument, in quite intimate ways: we encounter the performance direction '2/3 asthma' (the saxophonist should simulate a moderately severe asthma attack.)[450] Around the turn of the millennium there was a brief vogue for monstrous tablatures — notation much more prescriptive than the Rădulescu example above — seeking to micromanage the minutest details of the performer's body: I encountered a work for prepared piano written on a twelve-line stave (one line for each finger's action, plus two feet), and notation for soprano that modelled the (supposedly) separately-controllable actions of the vocal tract (larynx, pharynx, lips, tongue) in multi-dimensional space and on individual staves.[451] These frantic notational approaches have largely been superseded by links to cloud drive folders containing video and audio demonstrations of a desired technique and its sound; while this removes intimidating detail, the

[447] It would be quite impractical to attempt a list here, so I give one representative example. The conductor Lin Liao writes: 'In Jesper Nordin's *Sculpting the Air* [2015], not only do I lead the ensemble, but I play with two bell trees arranged in front of me, and some of my gestures are tracked by two Kinect cameras, which control various effects (loops, delays, freeze) as well as an application developed by the composer: Gestrument.' Lin Liao, *Gestrument*, accessed Nov 3, 2022, https://gestrument.com/conductor-lin-liao-plays-gestrument-live-in-concert-while-simultaneously-conducting-the-basel-sinfonietta/.

[448] Giovanni Verrando, 'One work, one sound,' *Giovanni Verrando*, 2017, accessed 4 Nov, 2023, https://www.giovanniverrando.net/lutherie-composition/one-work-one-sound/. 'The title of this piece of writing derives from an interesting exchange of ideas with Daniele Ghisi, who, during the "Dialoghi sul comporre" of late 2016, asked me very astutely, "So, if we continue on this path towards the personalisation of instruments, will we arrive at the point of 'one work, one sound'?"' I do not see this position as an endpoint (after all, it is still talking about something as old-fashioned as 'sound'), but merely a step on the way to the gestural consensus.

[449] Cathy van Eck, 'Creaking Apples and Singing Chairs: On Composing with Objects, Actions and Sounds,' in *Embodied Gestures*, ed. Tomás et al., 3-10.

[450] Marc Andre, *durch* for saxophone, percussion, and piano (2004-05). Written for Trio Accanto (Marcus Weiss, saxophone).

[451] As before, where my examples imply impatience with a composer's choices, I have not given titles of works or the composers' names. Both composers in my 'monstrous tablature' examples, which date from 2000-2010, have changed their notational strategies significantly since that time.

score's underlying communicative approach may be no less prescriptive than the tablatures it superseded, even if the materials originated from the performer (as advertised) rather than the composer (as advertised). As we pass into the mid-twenty-first century, the score may look whiter than before, but the level of specificity is actually higher — instead of the word 'violin' before the stave we may even find the name of an individual performer — 'Clemens Merkel'! I recently encountered a score for ensemble where one player's part contained a series of empty bars, underneath which was written '[that mumbling thing you showed me over Zoom.]' The densest-looking twentieth-century scores by James Dillon or Claus-Steffen Mahnkopf cannot compare in specificity with these communicative approaches, which have passed through the black hole of maximum printed information density and into a singularity where the only advice is: *copy this!*

The reality is, of course, far more complicated than my birds-eye view. (I have passed over centuries of highly embodied and performer-specific compositional practice: Monteverdi, Handel, Bellini, Kagel, Dieter Schnebel, Meredith Monk…) Most alert composers acknowledge that the one-way street of demanding pure mimesis leads to a communicative dead end — or at least to some very bored performers dutifully replicating what they have seen on an instructional video, or demonstrated to the composer in a half-forgotten interaction a year previously. Consequently, there is a high level of activity and interest in exploring and characterising the nature and future of performer-composer collaborations, including a long-overdue focus on and openness about matters of consent (or at least, learning how to 'ask nicely'!) Sensitive composers whose scores still contain a high degree of information density (for example, the dialogues with historical practices encoded in Evan Johnson's intricate notation, or the gorgeously extreme excesses of Pierluigi Billone's) do not expect direct mimesis in the execution of their notation but understand that their scores are part of a rich communicative back-and-forth with their performers — these usually being a hand-picked bunch, more minded to appreciate the composer having taken pains than to resent the onslaught of information. These composers accept that their notation will be understood by performers as part of a cultural practice 'prompted by scripts' rather than 'texts' (to echo Nicholas Cook's influential formulation);[452] Johnson is quite clear that he is a creator of scores rather than sounds.[453] Alongside these figures, there are many significant composers who prefer other models of practice and/or for whom these considerations are less interesting (e.g. the examples given in 1.2.1, including Enno Poppe, Unsuk Chin and Francesca Verunelli.) At the risk of tangling the subject even further, we should note — not for the first time in this text — that what composers say and/or think they are doing (or seem at first glance to be doing) in this regard rarely corresponds perfectly to the experiences of the performers of their music. The

[452] Nicholas Cook, 'Between Process and Product: Music and/as Performance,' *Music Theory Online* 7, no. 2 (2001), 5. Cook's formulation has been widely adopted in the discourse, perhaps due to the definitional latitude it permits, since real scripts may themselves be either highly specific ('Any production of Endgame which ignores my stage directions is completely unacceptable to me,' as Samuel Beckett wrote in his legally-mandated programme insert to a 1984 production he detested) or quite open. In my experience almost no performer would object to Cook's characterisation, since it is so broad. As Cook hints, the extremely negative positions supposedly taken by Stravinsky, Schoenberg, and Leonard Bernstein (!) with regard to 'interpretation' may be better viewed not as characterisations of how they really desired practice to be, but rather as temporary rhetorical broadsides against interpretative sloppiness, launched in specific historical circumstances and with particular targets in mind. Cook asks how seriously we should take them; a response might be that we need not take them seriously as epistemology, but could try to understand why in each case the articulators of these viewpoints felt obliged to don such caricature-like masks.

[453] Evan Johnson, 'L'art de toucher: Whewell Lecture 2022,' (lecture, University of Leeds, Nov 22, 2022), accessed online Jan 3, 2023, https://www.youtube.com/watch?v=rOw-Epk-QF4.

distinction between notation-led and process-led working methods is not absolute. Many scores that seem to come with full sets of assembly instructions reveal themselves on better acquaintance to leave significant 'wiggle room'. Rebecca Saunders' highly personal writing for electric guitar seems on first encounter to be documented in her scores with ultra-specific precision. However, increasing familiarity reveals it also to be shorthand for an embodied devising practice; first-time players swiftly find themselves in need of face-to-face contact with one of a handful of initiates, and the nature of such initiation is not only 'stretch your hand like this', or 'try this model of effects pedal' but (for example) 'create a sounding gesture that seems to tear at your skin from the inside…[*demonstrating*]'.

Despite these communicative complexities, we can point to a broad prevailing climate with a characteristic set of priorities. If staged as a prize-fight between nineteenth-century heavyweights, in the current century the spirit of Berlioz (championing timbrally explorative, gesture-on-instrument-specific approaches) has soundly beaten that of Brahms (defending a notion of musical material that is more instrument-interchangeable and amenable to 'LEGO thinking'.) We have reached a point where some composers seem to have an even greater interest in the minutiae of a performer's actions on an instrument than do the performers themselves: such composers scrutinise and avidly incorporate anything enticingly liminal (such as tremulous slow low-pressure bowstrokes, or the appealingly unstable and broken portions of wind multiphonics) to a positively fetishistic degree. It was already a commonplace in the twentieth century to hear composers imploring players to dwell on techniques that the player's training had sought to exclude (the opposition of 'extended' versus 'normal' techniques), and there were plenty of precedents for this appetite for physical engagement, from Lachenmann's *Pression* for solo cello (1969) to Andrew Norman's *An Index of Peculiar Strokes* for string quartet (2011). In the current climate it is not unknown to hear composers expressing disappointment when something they had hoped would feel and sound extreme, liminal, or even (attractively) 'failed'[454] actually seemed comfortable (see 2.2.2 above on the changing status of the bassoon solo in the *Rite of Spring*.) I have even witnessed performers trying to please composers by simulating (perhaps 'acting out' would be a kinder term) the signs of limit-pushing effort or fragility. Lachenmann's dictum that 'to compose is to create an instrument' was a touchstone in composers' narratives around the turn of the century; comparably, Ferneyhough intended to write music that ensured 'that one could not imagine any other instrument playing the same material in the same way.'[455] These ambitions now seem quite modest, and have been sublated into something like *to compose is to instigate a (physical) interaction* — that is, no longer with anything as general as 'a violin' or even 'your violin' but with your whole violin-holding body, right here, right now. For a large set of composers, including those who identify with the notion of 'post-sonic music,' the plasmic parametric thinking of 4.1 is very old news — which it certainly is — and indeed an interest in musical materials feels outdated; in their view materials cannot be meaningfully separated from instances of practice and their social contexts.[456]

[454] See Mark Barden, 'The Body and Failure: Error as Compositional Material,' chapter in Mark Barden, 'Composing in and through the Body,' (doctoral thesis, Goldsmiths, University of London, 2017): 11-22.
[455] Quoted in Steven Schick, 'Developing an Interpretive Context: Learning Brian Ferneyhough's Bone Alphabet,' *Perspectives of New Music* 32, no. 1 (1994): 134.
[456] Aaron Moorehouse, Harry Matthews, and Oogoo Maia, 'Post-Sonic Perspectives on Socially Engaged Compositional Practices: Composing "after sound" and beyond music,' *Organised Sound* 28, no. 1 (2022): 1-9.

Where composers report that their practice is so contextually-dependent and so deeply interwoven into performer's bodies and the instruments they touch — where, in the words of one interviewee describing less-than-successful 'collaborations,' '*they* [I have redacted the names of the composers, none of whom feature elsewhere in this text] go up to us and move our arms around like fucking marionettes,' or where, in a more sophisticated and consent-aware formulation, a composer is interested in exploring 'levels of hapticity'[457] — what relevance could a project-independent, cross-instrumental, notion of musicianship possibly have?

To answer this, we should take a step back and note that the great majority of documentation in this area is authored either by composers or those performers who have developed intimate collaborative practices, and therefore may be seen as composer-like in this regard. The composer Cassandra Miller has described such paths to musical creation as 'process-led.'[458] Where the process is judged to be of particular interest, it is likely to be accompanied with lavish 'making of' documentation (such documentation being deemed as having its own artistic value.) There are, unsurprisingly, far fewer self-documentations written by the many professional performers who make their living moving from project to project, and who do not tend to use phrases like 'my practice involves…' These include many members of new music ensembles and orchestras, conductors, and singers. Despite their near-invisibility in the documented discourse, I think that the experiences and needs of these individuals should be attended to as carefully as those of the musicians who have chosen to describe their practice in words and who have found an academically- and/or financially-feasible way to do so.

One such interviewee (a string player, whom I will call Q) described their busy past fortnight, which had included teaching pupils in a secondary school and coaching the school jazz band, substituting at the last minute in a programme with a well-known European orchestra that had included a Tchaikovsky symphony, and rehearsing for the premiere of an ambitious and intricately-notated work for large ensemble by a composer working in extended Just Intonation. In addition to the obviously different social contexts and physical demands of these projects, each made different demands on Q's musicianship faculties. To consider only the parameter of pitch: each project presupposed a different set of pitch targets and different acceptable degrees of deviation from these targets (tolerances). The pitch reference structure for the work with the secondary school pupils was roughly chromatic equal temperament, and more precisely closeness to the pitches of an infrequently tuned upright piano; the tolerance zones were wide. The symphonic concert actually increased the number of pitch targets (being *not* in 12-EDO by default — see 6.2 below) but narrowed the tolerance zones. The extended-JI ensemble piece laid out a very detailed set of targets with exceptionally narrow tolerance zones. While it would be accurate to stress these differences, and in doing so note the remarkable ability of Q to adapt gracefully to each situation (and also that such adaptability, while common among players, generally goes *un*remarked) it was also the case that Q came to all the projects armed with a core set of pitch skills, and not merely the aptitude to be a chameleon. For example, Q had access to a broad-brush pitch memory structure (what is casually called 'absolute pitch' —

[457] Johnson, 'L'art de toucher.'
[458] Cassandra Miller, 'Transformative Mimicry: Composition as Embodied Practice in Recent Works,' (doctoral thesis, University of Huddersfield, 2018), 43.

see 6.3.2) which was particularly reliable around the open strings of their instrument. Q also routinely used the natural harmonics on their instrument's long fingerboard as reference points for some non-tempered pitches; both via direct checking (playing and listening) and as aural-sensorimotor memories. Q also had a couple of tuning apps on their smartphone. What I found most notable about the way Q described the way they dealt with pitch across these projects was that, while it was certainly linked to gesture, it was their own gestural vocabulary, rooted in interactions with their own extended instrumental practice (that is, including items that habitually formed part of their set-up, such as the tuning apps) that served as the main point of reference, rather than the gestures encoded in the particular scores encountered in that fortnight's work. Indeed, in the case of the ensemble piece, Q noted that their approach was quite distinct from the (well-documented) line of thought that the composer seemed to have taken — and was not simply a cruder version of it, such as deciding to round off all notated pitch-targets within a certain range. Although this particular fortnight had not included projects from composers especially associated with the 'gestural consensus,' Q had previously participated in several projects of this nature, and did not feel that they had needed to adopt a fundamentally different approach: as they put it, 'I'm still me!' Although Q was too modest to accept the term, their approach seemed a fine example of independent expertise and a useful model for musicianship thinking within NMPT.

Like Q, I have often found it helpful to adopt against-the-grain or corrective thinking, even to the extent that the closer a project's creative originatory conditions seem to the gestural consensus, the more I feel the need to hang onto some LEGO-like internal points of reference (such as the 'Swiss Army knife' in Chapter 6 and the tempo-towers in Chapter 7 below.) Sometimes having access to firm internal armatures of pitch and rhythm which might differ markedly from those that the composer had used to generate their musical materials is simply a matter of professional survival in contexts where there is no opportunity to delve more deeply into the composer's thinking: when workshopping a dozen student pieces in a single day, for example. In these cases too, the more I move between competing and contrasting compositional demands, the more I remain myself. A performer — even one who cherishes close collaborative relationships with a few favourite composers, and even one who participates in 'process-led' compositional workflows — will almost invariably be involved in many more different projects in a year than will a composer. (In this respect music differs from other performing arts; an actor or dancer may well spend an entire season attached to a single project.) An essential difference between these two activities, as the composer-conductor George Benjamin has noted, is their contrasting characteristic 'tempi.'[459] Consequently, they call for different training models and different conceptions of musicianship.

Why are the cross-project musicianship experiences of performers so rarely documented, while there exist so many detailed documentations of particular projects? In addition to the taboos identified in 2.4.2, I

[459] 'Composing is solitary, often very slow, vast amount of thinking – more than writing – imagining entirely between my ears, in my head. And in silence. It's so solitary, so slow as a process and so strange as a process. Whereas conducting is three or four days, and that's it. So, in terms of tempo […] they could not be more different. In a way, they are antipodes of each other.' George Benjamin interviewed by Jari Kallio, 'I wouldn't trust an easy procedure,' *Adventures in Music*, Nov 16, 2023, accessed Dec 4, 2023, https://jarijuhanikallio.wordpress.com/2023/11/16/i-wouldnt-trust-an-easy-procedure-interview-with-sir-george-benjamin/. It should be admitted that Benjamin's contrast of 'tempi' is particularly extreme; he is a notably slow, painstaking, composer.

suspect that there is a further taboo lurking here about performers not wishing to go on record as being less than fully-committed to the lines of thought and priorities that the headlined creatives brought to a particular project, and perhaps even an anxiety about being perceived as offering a 'girl-/boy-friend experience'-like service: that is, 100% committed… within the billable hours. Which performer wants to break the heart of their composer-client and admit that tonight, they had been convincingly 'faking it' — that is, their level of investment in this particular project — a little?

I think this taboo should be called out. As Montero notes in the quotation at the head of this section, for a performing professional it is often quite straightforward to 'know the dancer from the dance' — and furthermore, that such separation should not be a source of shame nor go undocumented. Montero's observation is made in the context of her critique of the connected notions of flow and the unified performer. In *Thought in Action: Expertise and the Conscious Mind* (2016) she diagnoses then annihilates these patterns of thought in the influential writings of Mihaly Csikszentmihalyi and Malcolm Gladwell, in the Nike slogan 'Just do it', in pop psychology notions of 'being in the zone,' as well as in a host of pedagogical exhortations — familiar to many music students — not to *overthink things* and to *be at one with the performance*. Montero distinguishes such 'just-do-it' thinking from her favoured 'cognition-in-action':

> **The just-do-it principle**: For experts, when all is going well, optimal or near-optimal performance proceeds without any of the following mental processes: self-reflective thinking, planning, predicting, deliberation, attention to or monitoring of their actions, conceptualizing their actions, conscious control, trying, effort, having a sense of the self, or acting for a reason. Moreover, when all is going well, such processes interfere with expert performance and should be avoided.[460]
>
> […]
>
> **Cognition-in-action**: For experts, when all is going well, optimal or near optimal performance frequently employs some of the following conscious mental processes: self-reflective thinking, planning, predicting, deliberation, attention to or monitoring of their actions, conceptualizing their actions, control, trying, effort, having a sense of the self, and acting for a reason. Moreover, such mental processes do not necessarily or even generally interfere with expert performance, and should not generally be avoided by experts.[461]

I find Montero's approach, in emphasising the value of conscious monitoring and on-the-fly self-interventions in a performer's practice, both a characterisation of good practice as I see it and pedagogically actionable: Chapters 6 and 7 are written in this mode. To return to the example of the bowed marimba, it may be that the stroke itself (perhaps even as executed by a particular player, on a particular occasion) will be conceived as a primary musical unit for a composer working within the gestural consensus. However, performers who have in mind the conception of musicianship in the sense of this text may see it differently. Even if the marimba player themself has no independent control in that moment over the parameters of volume and pitch-bend, their colleagues may well have good reasons to model them independently. For example, they may wish to make the amplitude of a portamento or a pitch vibrato in their subsequent phrase echo that bend, and therefore would need to understand it in non-gestural, cross-instrumental,

[460] Montero, *Thought in Action*, 35.
[461] Ibid., 38.

terms. This might mean recognising it as a descent of a sixth-tone in one particular case — but, as in the example of *Éclat* above, subject to change from performance to performance and requiring live adaptation. Alternatively, if they judge the pitch-bend as fitting poorly with the desired sounding harmonic context of a passage, they may choose to conceal it. This might be done by adding masking inharmonicity: a cello adding extra bow pressure, or a percussionist playing a tam-tam roll louder. Another possibility is that the colleagues may decide to take no adaptive action in this case, but to add the experience to their banks of expertise for applications in future projects. Noticing and trying to measure the degree of the pitch-bend is *sensitivity*; adapting appropriately (or choosing not to adapt) is *flexibility*. Even though they carry direct gestural implications for players, such acts of live recognition and adaptation are examples of portable, instrument-independent musicianship. Because they require performers consciously to intervene in their practice to a significant degree — few would characterise these adaptations as 'going with the flow' — they also confirm Montero's insistence on the value of consciously separating the identities of the performing individual and that which is performed: of 'knowing the dancer from the dance.' It might seem an obvious dereliction of a caretaker's duty to leave a trainee to discover this way of working by chance. However, in following an unexamined rehearsal-concert only model that omits direct musicianship training, this is exactly what the majority of courses do. Such approaches teach the dance but neglect the dancer.

Part II

Applications

Chapter 5: A caretaker's glossary

In the spirit of Montero's championing of 'knowing the dancer from the dance,' (4.2) and with the hope of NMPT developing a native conceptual vocabulary rather than importing its terms (3.1), I offer some musicianship terms for consideration by NMPT caretakers. Some of these have already featured in Part I. Minimal examples are given here; since Chapters 6 and 7 are attempts to demonstrate how they may be put into practice many examples may be found there. As is the case with almost all musical terms (e.g. high, sharp, soft), even if familiarity leads us to forget the fact, they are metaphors.

These terms are not offered in the spirit of taxonomy, but rather as invitations to practise. With apologies for invoking a cliché from self-help books, I suggest that they be treated as verbs and not nouns. Although I later document some of my own *scenarios* (for example), my reason for doing so is to provoke others to make and share their own; they are offered as grit around which instructors may build their own pearls. I do not envisage these terms entering the rehearsal studio or seeing much explicit use by instructors. Rather, they are offered as conceptual aids which, like Wittgenstein's ladder, may be climbed then discarded.

This glossary contains the following headings: **triage**, **tolerances**, **armatures**, **leaning**, **lostness**, **workzones**, **clocks and clouds**, **Swiss Army knives**, **rules of thumb**, **set-ups**, **frets and grooves**, **scenarios**, and **sensitivity and flexibility**. They are not presented in alphabetical order but rather describe a line of thought; terms are used in the definitions of subsequent ones.

5.1 Triage

Le mieux est le mortel ennemi du bien.

attrib. Montesquieu (c.1726)[462]

As the philosopher Jagger once said, 'You can't always get what you want.'

Hugh Laurie as Dr House (2004)[463]

When experienced new music performers approach a project, they adopt a stance that has similarities with the way the emergency department of a hospital functions. Patients cannot go straight to a specialist of their choice, however convinced they are that this would be the best course of action. First, they must pass through triage. In this process two determinations are made: 1) deciding which capabilities within the hospital need to be initially mobilised (this may be subject to later change according to the diagnosis), and 2) ranking the urgency of the patient's care needs within the chosen department's clinic (this too may change on further investigation). Triage is an essential first step in most musicianship contexts, and many

[462] Approximately: 'Better [in the sense of striving for perfection] is the mortal enemy of good.' Commonly attributed to Montesquieu in the loose anthology *Pensées*, but not found in *Le projet Montedite* (University of Caen), accessed Jun 2, 2023, https://www.unicaen.fr/puc/sources/montesquieu/texte.html. The quotation exists in multiple forms, including Voltaire's 'Dans ses écrits, un sage Italien / Dit que le mieux est l'ennemi du bien.' ['In his writings, an Italian sage / Says that the best is the enemy of the good.'] 'La Bégueule: conte moral' (1772) in *Contes en vers*, Œuvres complètes de Voltaire (Paris: Garnier, 1877), vol. 10, 51. Voltaire's source is his own *Dictionnaire philosophique* (1764): under the entry 'Art dramatique' the (anonymous) Italian saying is given as 'Il meglio è l'inimico del bene.'

[463] *House* (Fox), pilot episode, Nov 16, 2004.

instrument-specific ones too. Recalling that our definition of a composer is a person who makes musical demands of a performer (however these demands are conveyed), triage describes the ways that performers deal with these demands: sorting them by category (the internal faculties of dealing with each musical parameter resembling hospital departments, which are separate but nevertheless communicate) and assessing the urgency of their care needs within each category. As in a hospital, care is not (or should not be) apportioned according to how loudly or articulately the patient complains, but according to their underlying needs as assessed by experts. While a hospital is fully committed to care, its resources are finite; there is no contradiction between these two propositions.

It might be thought that in this metaphor the whole composer (at least, as manifest in the project at hand) is the presenting patient. This may indeed be the case in compositions which have an exceptionally high degree of internal consistency: works such as Alvin Lucier *Silver Streetcar for the Orchestra* for solo amplified triangle (1988), James Tenney *Postal Piece No. 10: Having Never Written a Note for Percussion* (1971), or Steve Reich *Clapping Music* (1972), for example, really do just 'do one thing.' Consequently, even if their demands on their performers may be extreme, they are simple and consistent across the whole project (meaning: preparation, rehearsals and performance.) No act of triage is likely to be necessary, or at least, any triage that arises will be straightforward; the patient may go straight through to the relevant department for specialist treatment. However, outside these monumental contexts, acts of triage are usually more granular and fleeting. The 'patient' may be a single phrase or something even smaller; it may be necessary to take several triage decisions in a few seconds of music.

The metaphor of triage can be applied to the performance of many repertoires, but is particularly germane when applied to new music. This is because, in embracing the conscious withdrawal or denial of care in specific circumstances, it offers a way for a performer to remain confident and feel in control in contexts where the clamour of competing demands threatens to become overwhelming. These contexts are common in new music, due in part to the definitional uncertainties resulting from the post-spectralist (4.1) and gestural consensuses (4.2) and the proliferation of notational practices that these consensuses have spawned. The simple identification of expressive priorities is the bread and butter of rehearsal interactions across many repertoires: *let's really go for the accents there; let's make this bit sound dreamy.* Triage focuses the picture by embracing the accompanying acts of sacrifice: *let's go for the accents — and, by adding inharmonicity, accept a loss of pitch clarity; let's make it dreamy — and accept a diminishment of entrainable pulse and ensemble unanimity.* The alternative to triage for a performer is mere mimesis (the *copy this!* communicative white hole of 4.2); since musicianship has no obvious relevance in contexts where a performer accepts such uncritical terms of engagement, I do not discuss them further.

The explicit acceptance of loss remains a taboo among training performers, since for years their teachers and assessors have encouraged them to try to do their best. I have observed a learning pattern among training players on side-by-side schemes with new music ensembles. Initially, the trainee is sometimes surprised to discover that in some passages the more experienced performer is not actually *playing all the notes*; they may even be disappointed and feel that the senior player is *faking it*. However, on reflection the ability to *fake convincingly* — as the skill is sometimes self-deprecatingly called — is revealed as part of

responsible triage. (The key word here is *convincingly*!) Because healthcare is more important than music, medical triage is an established field with competing models of good practice, dedicated academic journals, etc.; there is no room for secrecy or shame. This may be a productive point of comparison for NMPT instructors who take an inquiry stance (the term 'practice-based research' seems itself to have been borrowed from nursing.)[464] Although medical triage may involve the local denial or postponement of care, the act of triage itself is performed carefully, openly, and with reference to documented expertise.

Experienced performers, like attentive triage nurses, learn to notice small communicative signals that give early clues to help them select the appropriate care pathway: for example, a full score that is not 'in C' gives a hint that the composer is part of the gestural consensus (or, alternatively, that they studied in France during a certain era), while the presence of 'irrational' time signatures surely signals that subdivisional obstacles will lie ahead. An awareness of the wider context of any given passage is vital. The following example is indicative of the kind of everyday triage decisions made by performers of new music. Our long-suffering viola player (from 4.1) is now presented with the following notation:

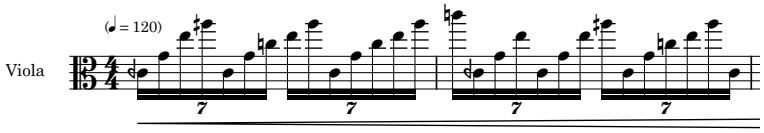

Figure 16: Matthias Kranebitter, *Encyclopedia of pitch and deviation* for ensemble (2020), movt. 2 ('256 Hertz'), bars 114-115, viola part only.

Taken out of context, this passage may seem alarming. If the player is relatively inexperienced — meaning that they are as yet unaware of the time-saving benefits of consulting the full score — they may worry about executing these pitch-demands cleanly. In context, the passage's expressive intention is clear, as is the appropriate prioritisation strategy for the performer:

[464] 'For sure [practice-based research] has a unique set of concerns and constraints, but those are no different to, for instance, the field of nursing, to which we owe the term practice-based.' Laura González, 'Mind the Gap! Working Papers on Practice-Based Doctoral Research in the Creative Arts and Media by Desmond Bell,' *Visual Studies* 32, no. 4 (2017), 397-98.

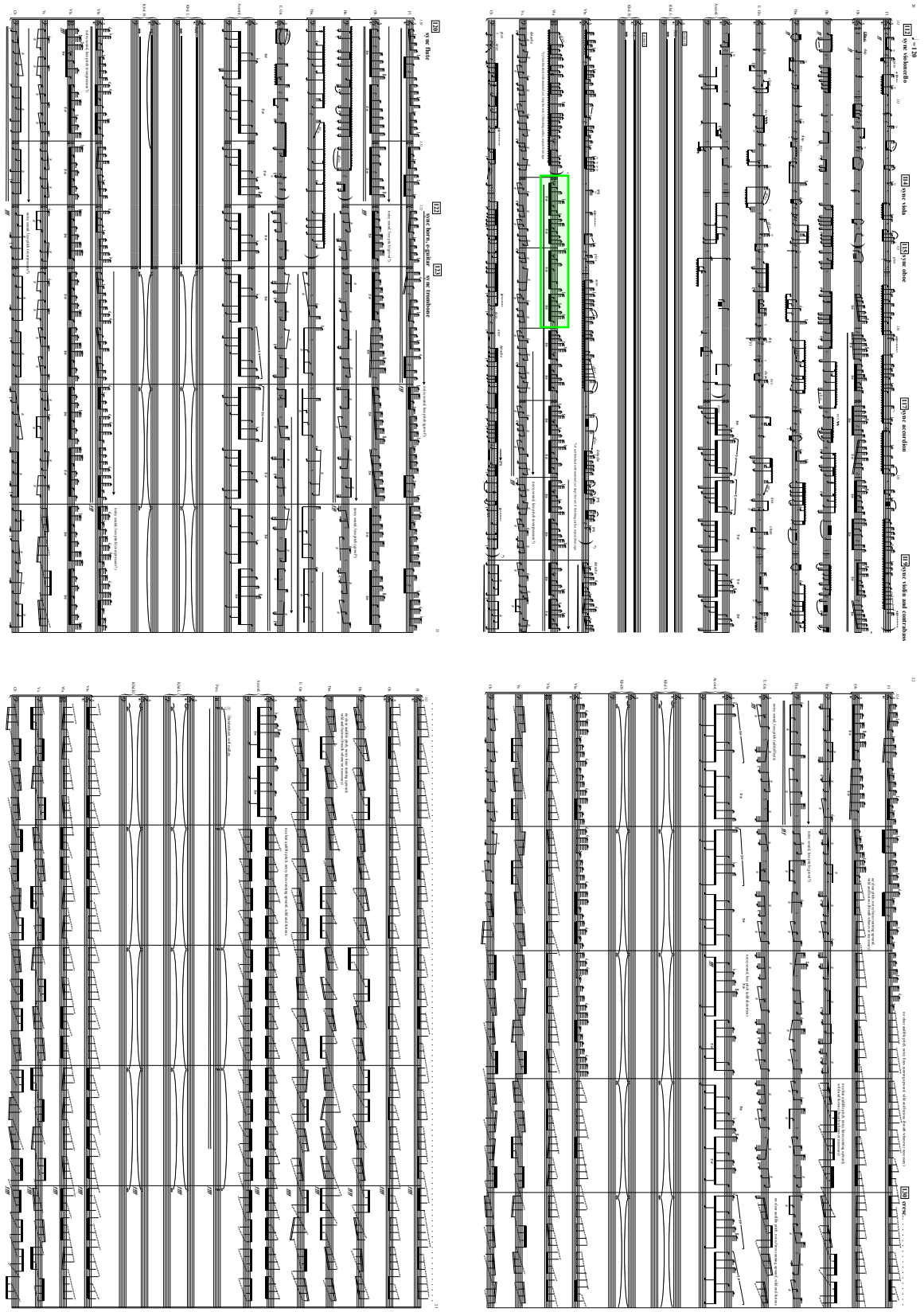

Figure 17: Zooming out: the same passage in context (bars 112-135). With triage in mind, fine details of notation may remain productively illegible for the purposes of this text.

Very obviously, in these bars our violist should prioritise playing the septuplet rhythms with furious and robotic insistence, ensuring they grind up noticeably against the surrounding contradictory metric layers. This will almost certainly involve sacrificing a few of the leapy pitch targets. It is also the case that the septuplets should be played with clear pitches and not in pitch-concealing hacking staccati, even if the resulting pitches are not quite the ones the composer requests, since noise resulting from overpressure is gradually added later. In this way the player can contribute to the slowly evolving aural illusion that is evident from the full score: while we would usually expect disorder to mount as noise increases (one definition of noise being spectral disorder), this expectation is countered here by the gradual transition towards rhythmic unanimity across the ensemble. (Such artful parametric play places the passage well within the post-spectralist consensus of 4.1, even though this composer would doubtless resist that old-fashioned label.)

The deprioritisation of pitch-targeting here will be familiar to every performer who has played the role of a grain of sand in a sandstorm in the many examples of hectic sound-masses in new music. Such situations often arise in contexts where the composer has derived their pitches from a procedure or algorithm of some sort rather than hand-picking them.[465] Abundant examples may be found in scores by Xenakis, Magnus Lindberg, Hanspeter Kyburz, and many others; however, it is not possible to give this as a general rule, since very different triage procedures may be appropriate for cases that superficially seem similar. Xenakis' notated third-tones, for example, call for careful treatment in *Medea-Senecae* for male chorus and small ensemble (1967), where they yield deliciously acidic sparse verticalities, while performers of his noisy and physically-taxing *Kraanerg* for large ensemble and tape (1969) have more pressing concerns than the microtonal accidentals. While it might not be helpful to suggest to the violist that 'the pitches don't matter' in the Kranebitter extract — because this casual formulation might lead to an overall relaxation of performing intensity that would be inappropriate — other factors clearly matter more in this moment. I chose this example from a nearly-endless pool of other options, because at other points in this work — as its title suggests — playing the narrowly-defined indicated pitches *is* vital for a successful performance. On the very next page of the score, the parameter of pitch reasserts its importance; the same player needs to aim to play with cent-specific accuracy:

[465] When it is known that pitches have been derived from such a hands-off procedure, it is usually not necessary for the performer to have an intimate understanding of the process itself. However, they may well find it helpful to understand the procedure's broad prohibitions. For example, the knowledge that a particular algorithm will never generate two pitches an octave apart, or anything outside a certain pitch range, would be very helpful in triage situations where the indicated pitches are impractical to execute and an informed on-the-hoof *ossia* is necessary. Performers who are digital natives (i.e. younger performers) are accustomed to the notion that unknowably vast flows of data might be swirling about somewhere 'under the hood' of a composition; they therefore seem to have less instinct to tilt at windmills in pursuit of total knowledge. Older, pre-digital, performer-instructors, who may carry fond memories of the satisfying feeling of having analytically 'solved' works in the past — perhaps via the LEGO-style identification of various serial-adjacent techniques in complex but eminently-analysable scores by composers such as Josef Matthias Hauer, Jean Barraqué, Ruth Crawford Seeger, Bill Hopkins, and Oliver Knussen, or via the (relatively) simple task of uncovering certain generative procedures employed by Stockhausen, Carter, and Grisey — seem more likely to regard the state of being content with an approximate level of knowledge as regrettable and even improper.

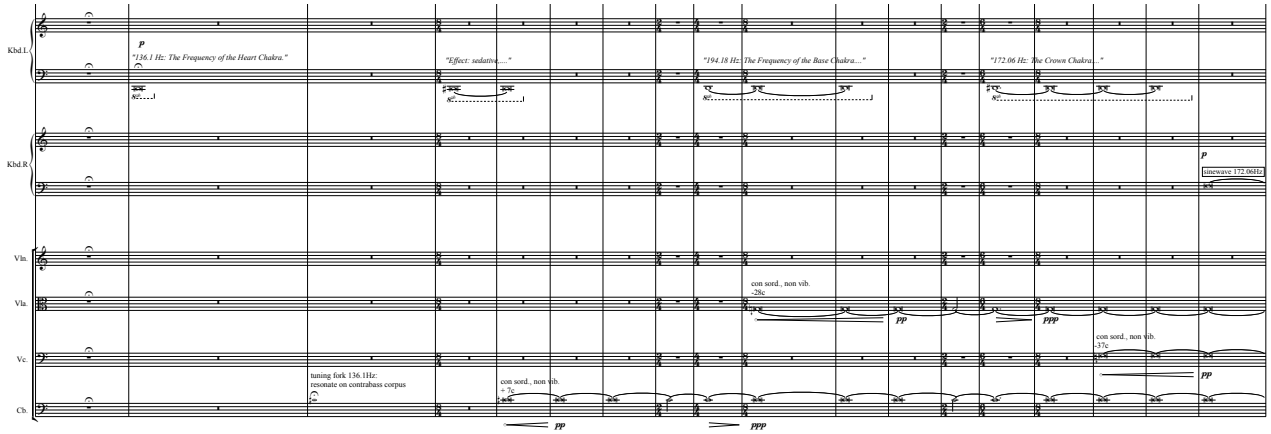

Figure 18: Kranebitter, *Encyclopedia*, movt. 3 ('Chakra Frequencies'), bars 136-153. ♩=55. Wind, brass, accordion, electric guitar, and percussion parts (tacent) are omitted.

This is a very simple example of a performer's need to take multiple triage decisions within a single project. As elsewhere in this text, I have given a deliberately slow-witted account of something that expert performers do rapidly and (seemingly) without conscious reflection; my intention is to prepare the ground for the more nuanced cases in Chapters 6 and 7.

The soprano Jane Manning (1938-2021), an iconic new music performer and instigator,[466] could be impatient with composers who expressed their demands fuzzily. When one composer remarked that the contour and gesture of a particular phrase was more important than the notated pitches, she trenchantly responded: 'If you don't want me to sing those pitches, which pitches would you like me to sing?' Manning's *aperçu* reminds us that a singer does not usually aim for a pitch-range (even if, as in the case of Maria Callas towards the end of her career, they might produce one) but rather for a specific embodied pitch target 'on the instrument' — and that a composer's acknowledgment of this should form part of a respectful composer-performer relationship. However, by distinguishing the dancer from the dance here, we may in retrospect partially absolve the composer of the sloppy thinking that Manning diagnosed, since just as a performer expects to undertake triage, a composer also can reasonably expect that their demands will be subject to triage. This was only in doubt among a small group of (highly articulate and technically brilliant) musicians for a brief period in the twentieth century: see, for example, discussions of the subject by Susan Bradshaw[467] and Marilyn Nonken.[468] Manning, who was justifiably proud of her pitch skills and her conscientious approach to score-learning, revealed herself through this comment as one of them. While we (NMPT instructors and trainees) may also strive to have high-quality pitch skills and to read scores carefully, we are not obliged to accept a concomitantly Parnassian default working model.

A performer's strategic refusal to meet some of a composer's demands in order to satisfy other competing demands is the most familiar direction of triage: such cases may be thought of as unprinted 'ossias'. With

466 Christopher Fox, Diana Burrell, Linda Hirst, Roger Montgomery, and Gráinne Mulvey, 'Jane Manning Remembered,' *Tempo* 75, no. 298 (2021): 78–85.
467 Susan Bradshaw, 'All Fingers and Thumbs. Can we "interpret" contemporary music, or do we just perform it? Susan Bradshaw investigates,' *The Musical Times* 135, no. 1811 (1994): 20-24.
468 Marilyn Nonken, '"La Notation Ne Peut Rendre Compte Du Fait": Performing Murail's *Territoires De L'oubli*,' *Tempo* 62, no. 244 (2008): 2-10.

reference to early Boulez scores, Bradshaw writes that certain rapid tempo markings are 'strictly for the birds'[469] — a sentiment with which the later Boulez concurred, as a comparison of his five career-spanning recordings of *Le Marteau sans maître* makes clear. To prioritise the production of true-to-print pitches over indicated tempi in early Boulez was (in Bradshaw's view, with which I am not wholly in agreement) as obviously appropriate as the reverse strategy would be in the first Kranebitter example. Comparably, labouring over the placement of the attacks within the triply-nested tuplets in the Ferneyhough passage in **Figure 1** would be deprioritised by virtually all players in favour of a focus on well-contrasted dynamics and articulation — a strategy which by no means applies to all of Ferneyhough's notated rhythms, even within that piece. However, there are also cases where this direction is reversed: a presenting patient may have more urgent care needs than they realise or can successfully articulate, and a passage may call for a higher level of attention and specificity than it seems initially to demand. Since such cases call for more creative thinking on the performer's part than cases of denial of care, they are more intriguing. We might call this process 'positive' or 'reverse' triage (*we're going to keep you in tonight for some more tests*) — or conceive such cases as perverse ossias which are more challenging than the main line of musical print.

Morton Feldman's idiosyncratic approach to notation provides the performer with numerous cues for such extra caregiving. That composer was well aware that his choice of enharmonic accidentals for pitches that would be considered equivalent in 12-EDO would provoke intonational variances to a sensitive player, even though they are not explicitly notated as microtones. Marc Sabat has aptly named these variances 'shadings in the chromatic field.'[470] In his commentary on an unpublished fragment for solo violin (1984) Sabat points to Feldman's notation of the opening double stops: B♭4-G♯4 followed by B♯4-G♭♭4 (!?):[471]

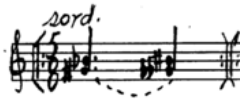

Figure 19: Morton Feldman, unpublished fragment of a *Composition* for solo violin (1984), bar 1.

[469] Bradshaw, 'All Fingers and Thumbs,' 24.

[470] 'In the words of Paul Zukovsky, who collaborated with Feldman between 1977 and 1985, "Feldman utilised a system where, for example, an e-flat is played sharper than a d-sharp, or to generalise, for any enharmonic pair, the higher pitch label always implies the higher pitch. In short, Feldman returned us to a world where double sharps and double flats have real and individual physical, musical and emotional meaning, as opposed to equal microtones, which simply present finer slices of equal temperament.'" Marc Sabat, 'Shadings in the Chromatic Field: Intonation after Morton Feldman,' (Online: Plainsound, 2012), 8, accessed Feb 2, 2023, http://masa.plainsound.org/pdfs/ShadingsED.pdf.

[471] In chess annotation, (!?) denotes an *interesting* move: according to Wikipedia, 'among the definitions are "interesting, but perhaps not the best move", "move deserving attention", "enterprising move" and "risky move". Usually it indicates that the move leads to exciting or wild play but that the objective evaluation of the move is unclear. It is also often used when a player sets a cunning trap in a lost position. Typical moves receiving a "!?" are those involving speculative sacrifices or dangerous attacks that might turn out to be strategically deficient.' *Wikipedia*, s.v. 'Chess annotation symbols,' accessed Nov 3, 2023. This moment has plenty of equivalents in Feldman's rhythmic notation; Kyle Gann points to 'one of Feldman's favorite rhythms … [in *Why Patterns?* (1978)]: two dotted half notes in a 5/4 measure with a "2" over it, notated more irrationally than it needs to be.' Kyle Gann, 'In Dispraise of Efficiency: Feldman,' (lecture, Seattle Art Museum, 'Morton Feldman Marathon,' Jan 27, 2008). Accessed online, Aug 3, 2023, https://www.kylegann.com/PC080129-Dispraise-of-Efficiency.html. Feldman also made expressive-looking enharmonic distinctions when writing for instruments which do not permit live intonation adjustments, such as the piano. In *triadic memories* for solo piano (1981), sharp and flat enharmonics are not semantically interchangeable, but since they cannot be fine-tuned in performance, other musical parameters (duration, dynamics, articulation) must proxy for intonational expressivity — as sensitive players of Schubert's piano music manage that composers' shifts to the mediant and submediant.

While this presents as a riddle calling for an answer, it rapidly becomes clear that a performer's search for an intonation solution imagined to be lurking somewhere within the work will not prove fruitful: the notation is more like a deliberately-frustrating Zen koan. This is particularly true when the enquirer may be judged, as in Sabat's case, to have greater intonational sensitivity than the original composer.[472] Feldman's awkward notation is a cry for extra caregiving; or alternatively, an invitation to co-compose. What Sabat calls his 'speculative interpretation' of the whole fragment, re-notated in HEJI accidentals, is a co-composition as well as an impressive act of care; in 6.2 below I describe a comparable pedagogical process with reference to Dvořák.

Acts of reverse triage may also be necessary where a composer has, doubtless with the best intentions, attempted to help performers by simplifying or rounding-off their materials. First-generation spectralist composers often employed digital-style quantisation (mapping continuous infinite values to discrete finite values) in their communicative processes. For example, pitches drawn from complex spectra might be notationally rounded off to the nearest quarter-tone or eighth-tone. The fact that Tristan Murail did not trust his players to be able to locate even the 5th or 7th natural harmonics 'in the wild,' for example (and that he had good reasons for such mistrust) has had the — presumably accidental — effect of rendering the moments that such simple harmonic intervals are desired more abstract-looking and more jangly-sounding than they might be. (The sound of the natural harmonic series rounded to 24-EDO is highly characteristic of 1980s new music; some, but not me, may find nostalgic appeal in this 'chiptune' effect.) I also found it necessary to undertake reverse triage to reconstruct some suppressed metric modulations in a work by Magnus Lindberg (see 7.1.)

Examples of the need for positive triage often arise in less rarefied contexts. The following example is adapted from a score for large ensemble submitted by a student composer for an ensemble reading session.[473] After a busy passage for full ensemble, the trombone plays almost alone, in the resonance of a tam-tam scratched with a triangle beater:

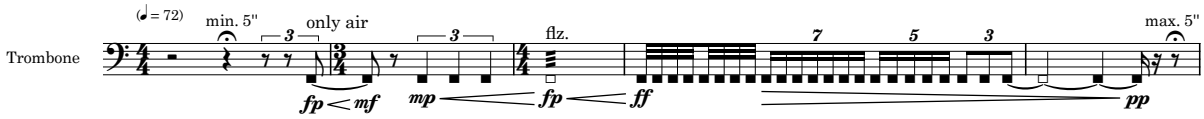

Figure 20: Trombone solo adapted from an anonymous student composition.

[472] Evidence for this speculative assertion may be found in Feldman's rather splashy comments on intonation, such as 'I don't like Pythagoras, it's too oriental. And mean tuning was for the West Coast,' Morton Feldman, *Morton Feldman In Middelburg – Words On Music: Lectures and Conversations* (Cologne: Edition MusikTexte, 2008), 457. As I observe in 1.1, composers' practical pitch skills are rarely put to the test, and Feldman is anyway long dead, so the question of whether he could actually reliably distinguish or personally replicate such tuning approaches will remain moot.

[473] See footnote 451 above regarding the anonymisation of composers whose decisions may be regarded as questionable; this is particularly important in pedagogical cases where no publication-like act has been made. The wider passage is typical of what might be called International New Music Default Style, or what an AI large language model might produce if trained on the set of recordings of new music festivals over the past few decades. The discussion of student works is virtually absent from the new music discourse; commentators naturally prefer to discuss interesting individual contributions. See 3.2.2 on 'common practice.'

If performed *com'é scritto* ('as written' — as Toscanini reportedly used to insist), the slowing groups of air-puffs in the fourth bar of this example sound pedantic and robotic, creating a rather comic effect that in the wider context is certainly inappropriate. It is obvious that a smoother quasi-logarithmic decelerando is desirable here, and also that the training composer had not yet acquired the technical skills to audiate and/or notate this more successfully. In the triage process here, responding to the first question (which parametric 'department(s)' to mobilise) is trivial: this is a clear case of rhythm emerging from the timbre of the fluttertongue in the third bar (and therefore also an archetypically 'new-musicky' moment (4.1.2.2)). A response to the second question (the urgency of care within each department) is more interesting: what had initially presented as an elementary and eminently sight-readable rhythm turned out to require extra careful attention, since performing a smooth but very steep decelerando and diminuendo without internal accents within the indicated metric framework is not so easy — whether attempted on the trombone, violin, woodblock, or in the mind of the reader (try it!)

In almost all examples in this text, triage is considered in relation to scores written in 'conventional' Western notation — that contentious term being understood in the latitudinous sense used by Donald Byrd in his entertaining web resource *Extremes of Conventional Music Notation* (a notational Guinness Book of Records, including Telemann's $\frac{24}{1}$ time signature, Ligeti's ***ppppppppp*** dynamics, Reicha's triple sharps, etc.)[474] This may give the misleading impression that triage is only relevant to conventionally-notated contexts — and in particular in cases where the notation leads to an obvious communication uncertainty. However, I have frequently witnessed and undertaken acts of triage with respect to composers' demands expressed vocally, by email, and so on, and in contexts ranging from the negotiation of black-looking scores to structured improvisations. I have chosen conventionally notated examples for ease of reference only.

Triage might simply seem like another word for *interpretation*, a term that evokes the idea of music 'coming off the page' and developing a *z* axis as it makes its leap into the world of sounds. However, the concerns of triage are characteristically more local than the loftier associations of interpretation. The latter term interweaves with the historical legacy of the work-concept, while the former is only concerned with local and often fleeting responses to demands. While a series of triage decisions might be judged as having added up to an overall characterizable interpretation of a work, I find little practical use of the term due to its post hoc status. (Characterising interpretations after the event is the province of the critic rather than the performer; when I perform, I do not find it helpful to follow 'my interpretation', although I do try to learn from my previous missteps.) Ian Pace has recommended that musical notation is better understood as a set of prohibitions rather than positive instructions.[475] Although this may seem to pose a metaphysical puzzle — while Pace has no truck with relativism, in his reading there is an infinite number of right ways to realise a notated triplet, and also plenty (presumably also an infinite — but larger! — number) of ways that would

[474] Donald Byrd and contributors, *Extremes of Conventional Music Notation*, Oct 2018, accessed Jan 5, 2023, https://homes.luddy.indiana.edu/donbyrd/CMNExtremes.htm.

[475] '…whilst in a sense it may be difficult to establish with any degree of certitude what a triplet *is*, we may be able identify what it is *not*. Similarly, there is an infinite number of different ways of playing *mezzoforte*, but a *mezzopiano* (let alone a *piano* or a *pianissimo*) such as would correspond closely to other occurrences of the latter symbol within the same piece or passage, would be strictly wrong — at least as the dominant dynamic for the passage marked as such.' Ian Pace, 'Notation, Time,' 154.

count as wrong, so, like Cantor, we find ourselves comparing different sizes of infinities — through vivid examples he demonstrates that this approach corresponds closely with existing (thoughtful, expert) performance practice. Pace's conception of notation fits well with the notion of triage, both being anti-positivistic.[476] My account differs from that of Pace more in emphasis than substance: while Pace writes from the point of view of a solo virtuoso player (but also one who, being a pianist, has relatively limited need to consider fine pitch distinctions), I am more interested in the experience of ensemble performers, and in particular those who would not yet be regarded as virtuosi. For that reason, in the situations addressed in this text the need for triage intervenes sooner and much more frequently than it seems to for the virtuoso Pace, who waits until a discussion of his approach to two fearsome solo monsterpieces — Stockhausen's *Klavierstück X* (1954-55, rev. 1961) and Ferneyhough's *Opus Contra Naturam* (1999-2000) — to highlight the need for what he simply calls 'prioritisation.'[477]

Why discuss triage (a process that concerns a performer's responses to specific compositional demands) in a text about musicianship (a general, cross-project notion)? I have done so with the hope of emphasising that musicianship teaching in NMPT contexts should be rooted in the day-to-day practical decision-making processes of the performer, or it will wither into irrelevance. The priorities of musicianship learning themselves are subject to triage. Where a teaching model may be judged to have failed to have enduring resonance, it may be because its authors had not sufficiently considered whether its goals were actually worth the expenditure of musical energy. A minor example of this was Hair et al.'s laborious attempt to teach a singer to sing in 19-EDO (2.3.2.2) which relied on the assumption that this was a goal worth pursuing[478] (Boulez's bland evocation of 'the demands of the music' (1.2.1) comes to mind.) The near-extinction of the Friedmann chromatic pitch-class training model (2.3.2.1) may also be ascribed to its failure to engage sufficiently robustly even with the priorities of its relevant repertoire: for performers negotiating the chromatic churn of a large-scale composition by Charles Wuorinen, identifying which hexachord their pitches belong to is much less pressing than (for example) solving problems of dynamic balance and articulation. Vanoeveren's and Reina's documented approaches (2.3.4.2) similarly demonstrate an absence of triage: their implication that every notated rhythm merits the same level of devotion on the part of the performer is almost the inverse of London's dismissal of the entire segment of repertoire (2.3.4.3), and comes with comparable problems. (I should make it clear that I am only criticising the published texts, and not the actual teaching approaches, of these musicians.)

One of the advantages of the notion of triage is that it reminds training performers that they possess valued expertise; although they are present to do a job, they are not servants but consultants. This feels desirable to stress in NMPT contexts due to a noticeable power-shift that accompanied the twentieth-century

[476] 'The whole historical construct I outlined above is, to my mind, founded upon an essentially *positivistic* view of the role of notation. By this I mean the notion that the score tells the performer in essence *what* to do, around which he can elaborate (through use of varying micro-dynamics, rubato, tempo modifications, etc.) depending upon the degree of notational exactitude,' Ibid., 152.
[477] Ibid., 180.
[478] This is not an isolated example; I selected it because the authors chose to document and publish the attempt. For ethical reasons I do not discuss other comparable initiatives I have been made aware of where no such documentation has been made, or where it is unclear whether a publication-like gesture has been intended (e.g. where the documentation exists in the grey literature, including university syllabuses and lecture notes.)

institutionalisation of the role of the composer (1.1) that led to the ad hoc performer-training model. Excoriating references in composers' narratives to arrogant performers (of whom conductors were usually the worst) who took 'unpardonable liberties' and the like are virtually extinct. The opposite situation prevails now: I have never felt able to propose to a composer, nor have I witnessed another performer propose, even a tiny cut in a score. This contrasts with playwright-director-actor interactions in the theatre world, which can be much more robust.

If we do not apply triage to our learning goals, we risk both procedural rigidity and disappearing down rabbit holes of personal obsessions, since to the person with a hammer the world looks like a nail (see, for example, the taste of 'xenharmonic' tuning theory in 2.3.2.2.) However, there is a taboo to be overcome here: instructors are structurally motivated not to promote the benefits of triage, since to do so involves admitting that a professor may not embody total mastery of every musical parameter. This should be overcome with communicative honesty about the limits of our capacities. If it is not, trainees will continue to be bounced from project to project at the mercy of the competing demands and priorities of specialists, each advocating for their unjustly-Cinderella-ed area of interest, and always fated to remain within the ad hoc NMPT model.

5.2 Tolerances

This part of ISO 4759 specifies a selection of tolerances for bolts, screws, studs and nuts with ISO metric threads and with product grades A, B and C and for tapping screws with product grade A. The product grades refer to the size of the tolerances where grade A is the most precise and grade C is the least precise.

International Organization for Standardization, *Tolerances for fasteners. Part 1: Bolts, screws, studs and nuts*[479]

… it is the mark of a well-educated person to seek precision in each type of thing only as far as the nature of the subject matter allows.

Aristotle, *Nicomachean Ethics*[480]

What qualifies as right or wrong (or: acceptable or unacceptable) for a performer is highly context-dependent. The evaluation of where a performed event falls on binary oppositional continua such as *in tune / out of tune* or *together / not together* should always be understood as accompanied by the phrase 'in the given context.' The notion of tolerances, a term borrowed from engineering and manufacturing to denote the limits of permitted variation in a given context, clarifies this qualification. Determining the appropriate tolerances that a musical situation demands is another way of framing the second question of triage (the urgency of care needs within a hospital department / internal musicianship faculty.) If a performed event falls within the zones of tolerance, it is (by definition) 'in tune,' or 'together.' Musicianship training aims to help performers achieve results that fall into these acceptable zones more reliably.

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[479] *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts*, ISO 4759-1:2000 (Geneva: ISO, 2000).
[480] Translation in Dominic Scott, *Levels of Argument: A Comparative Study of Plato's Republic and Aristotle's Nicomachean Ethics* (Online: Oxford Academic, 2015), 124.

An obvious question arises: in the absence of an ISO for music, who mandates the limits of these zones? Although in the positivistic working model characteristic of many twentieth-century new music performers the demanding composer is imagined to be the lawgiver, the reality is more complex. To recall the way Q worked with the parameter of pitch across the busy fortnight described in 4.2: in the piece in extended JI the composer had specified very narrow intonational tolerances and expected performances to be both highly accurate and precise; nevertheless, Q's working method did not entirely follow the composer's line of thought. The modern orchestra's approach to the Tchaikovsky symphony may likely have involved narrower intonational tolerances than those envisaged by that composer,[481] reflecting historical changes in professional orchestral standards (3.2.) In Q's work in the secondary school, an assessment of what counted as 'in tune' was highly dynamic, being judged differently in accordance with each student's learning journey. There was certainly no attempt to reconstitute the differing pitch-worlds of the composers of the pieces the students were playing; even for the most advanced of them, closeness to the targets set by the accompanying upright piano was more than enough. As they moved from project to project, Q's stance resembled that of an expert diagnostician, who listens carefully but critically to their patients' self-assessments of their conditions, and who — amid the clamour of competing demands — retains their own identity ('I'm still me!') A performer's selection of tolerances is not only a matter of discovering and managing a composer's demands, but also a consideration of the entire performing context: the aptitude and experience of their colleagues, the acoustics of the performing space, and (in contexts where the performer has sufficient autonomy to make this meaningfully actionable) the project-independent set of preferences that characterises the innate musicianship personality of the performer. Groups that possess a sufficiently strong identity too, may have such a personality. Ensembles such as the Ensemble Intercontemporain, the Berlin Philharmonic, the Arditti Quartet, or the Exaudi vocal ensemble, do not only adapt their tolerances, chameleon-like, from project to project, but also embody their own distinct 'house styles' — overarching sets of habits and preferences that include to a significant degree each ensemble's habitually narrow or wide zones of tolerance for what counts as in tune and/or acceptably together on their own terms.

From a pedagogical point of view, it would seem desirable for instructors and trainees alike to maintain an active awareness of the notion of tolerances itself. This notion is automatically accompanied by the insight that tolerances vary greatly between contexts (i.e. *sensitivity* to differences, and *flexibility* of application as contexts change.) The dawning awareness that musical goals that had previously seemed black and white (to play in tune, or together) are actually richly nuanced emerges from the documentations of many learning journeys; this is to summarise the conclusions of several recent practice research projects. Mira Benjamin, for example, discusses a sense of destabilisation that has been echoed, sometimes in a tone of ruefulness mixed with pride, by many sensitive experimenters in the field of pitch: *I thought I knew what 'in tune' meant.*[482] However, there is also danger here. If the direction of NMPT is modelled as an endless quest for tighter tolerances and greater refinement — as each successive Parnassus that a learner encounters and surmounts

[481] Insofar as can be judged from historical recordings of performers in Russia in the late nineteenth century, such as *The Dawn of Recording – The Julius Block Cylinders (1890-1927)* (various artists), Marston Records, 53011-2, 3 CDs (transfers from acoustic cylinder recordings.)
[482] See the discussion of 'improvement,' of intonation in Benjamin, 'Thick Relationality,' 108.

is revealed as only the foothill for the next — we risk the paralysis of connoisseurship. It is often useful to phrase instruction in terms that specialists have rejected, and even if the informed educator uses these terms with a clothespeg on their nose — or, in the language of deconstruction, *sous rature* ('under erasure') — it may not be helpful to allow doubt to creep into their voice. For example: if I am helping my younger son place his second and third fingers in first position on a violin's D string, I might say 'the F♯ and the G♭ ~~are the same~~.' It would not help if I sounded uncertain, or if I added a mystifying qualification that set me up as a fount of esoteric, yet-to-be-revealed, knowledge. I recall one of my own childhood teachers managing simultaneously to confuse, belittle, and intrigue me in this way by saying, 'Of course, when you're older, you'll learn that F♯ and G♭ aren't the same,' without ever making good on this promise of enlightenment.[483] The connected notions of triage and tolerances remind us that sometimes we should stop; the summit of Mount Parnassus may not be a peak but a mesa.

5.3 Armatures, leaning, lostness

An armature is a firm structure within a performer's aural-sensorimotor memory that provides that performer with internal support by offering discrete and reliable references. Examples of armatures include so-called 'absolute pitch' (6.3.2) or the equivalent memory for tempi that the 'tempo tower' method is intended to develop (7.2.2.1.)

Each armature concerns a single musical parameter. The 'arms' (constituent elements) of any armature are made of one class of material (i.e. only pitches, or only tempi.) However, not all arms will have equal supporting strength: in the example of Q above, even though they would casually be described as having absolute pitch, this pitch-memory was stronger and more reliable as a reference around the open strings of their instrument. It would be rare to find an oboist who could reproduce (off-instrument) an D♭5 as reliably as their trusty A♮4. In my tempo armature, the arms 60 bpm and 120 bpm are particularly strong because composers have defaulted to them so often; the fact that a feature ultimately derived from something as unmusical as the Babylonian calendar has become a core element of my musical being may emphasise how arbitrary the positions of these arms are. Like the gridlines on a map they exist for orientation only and are not inevitable; no-one is born vibrating at 1 or 440 Hz.

As with a Swiss Army knife (5.5) seeking to add extra functions (arms) is not always helpful. An example: in 7.2.2.1 I recommend that it is better to develop secure 'towers' (groups of related memorised tempi) at chosen points, deliberately leaving gaps in between to aid distinctness of recall: e.g. to learn the bpm towers 30/60/90/120/180 and 36/72/108/144/216 but not 33/66/99/132/198, even though tempi in the last group are encountered frequently.

[483] This absence of explanation was particularly vexing since it coincided with my first encounter with an insoluble-seeming intonation problem: placing my first finger on the open D string of my violin, I noticed that as I wiggled the resulting E♮, I could find a position that made the sound co-operate with the open G below, or the open A above, but not with both at the same time. Much later I found that Marc Sabat had had his early interest in intonation piqued by the same discovery. Since it is hiding in plain sight, it has doubtless been 'discovered' thousands of times over the centuries.

The simplest use of an armature is as a direct reference, as when tuning the A string of a violin to a remembered pitch when a reliable piano or electronic tuner is unavailable. When the arms of an armature feel sufficiently secure and distinct, they may also be 'leant against.' **Leaning** is a strategy that helps a performer reliably establish and maintain fine distinctions. In Gerald Barry's *Feldman's Sixpenny Editions* for ensemble (2008-09) the composer asks for some passages that contain very similar musical material to be played at tempi that increase incrementally. Due to the similarity of the material, it is no use relying on a loose notion of the 'natural' speed of these passages. To meet the composer's demand, I push upwards against my secure ♩=120 very slightly to produce a reliable ♩=122, and then a little more to produce ♩=124. Without the arm of this armature to support me, I would overshoot these tempo changes. This would spoil the intended effect, which is a depiction of the gradual build-up of suppressed hysteria. Leaning may also be used to modify the jumps between the levels of a tempo-tower: when moving from ♩=72 to ♩=104 I might represent this to myself as a laggy [←♩$^{\overset{3}{\neg}}$ = ♩→] (because 104<108.) In this case, even though the tempo increases, I 'think slower,' pushing down on my armature's arm. (I think of a small upwards push as a sip of espresso, and a small downwards one as a sip of wine; performers employ other bodily metaphors, such as 'a hair' or 'a touch' faster / slower.) When performing Stockhausen's *Zeitmaße* (1955-56) I also relate the indicated tempi to different degrees of lean against my tempo armature. Performers of this piece face an extra challenge: as well as moving between fixed tempo-targets very quickly, they must also rapidly adapt to colleagues' passages which are to be played 'as fast as possible' — a factor that differs between instruments and individual players. Although the piece demands a very intensive preparation process for all participants, a conductor cannot prepare the whole score in advance in the conventional manner (i.e. attempting to audiate an ideal version of the totality, practising the tempo changes alone, and then attempting to communicate the result of this process to the players) but rather — as in the example of *Éclat* above — needs to be ready to make numerous live adaptations. The players must do likewise, since the tempo changes in this piece are so sudden and rapid that the work is not solely 'led from the front' (there is rarely time for the conductor to give conventional preparatory upbeats, for example) but brought into being through a complex network of signals, with the conductor's signalling responsibilities being *primus inter pares* at most (see 7.1.) In such situations, all participants having access to a reliable, context-independent tempo armature that may be consulted on the hoof is particularly useful, since it is not possible to work mimetically — for example, by programming the tempo changes in Click-Tracker, and learning them through simple repetition. Comparable uses of leaning in pitch contexts are provided in 6.3.3.

Acts of leaning are examples of the use of blocky LEGO-like thinking in the service of smooth, finely varied outcomes. Taking a wider view, they are also confirmations of the value of 'knowing the dancer from the dance.' Because each case of leaning calls for two entities to be considered instead of just one, it might seem to risk overcomplication. In practice it does the opposite. Would-be taxi drivers learning the roads of London for the famed memory test 'The Knowledge' do not try to learn the whole map at once, or even sector-by-sector, but rather learn a series of 320 defined long 'runs.' The locations of small roads are memorised with reference to these fixed routes and their memorable waypoints; to plan a route from one small road to another entails selecting the appropriate run, then working out how to get to that run and where to leave it. The arms of an armature resemble these runs. Arriving at ♩=122 directly (at the default

standard of precision I expect of myself) without going via the main road ♩=120 would for me be quite impossible: I would feel **lost**.

Although armatures are acquired through and honed by experience, their defining feature is that, being experienced as internal bodily structures, confident performers bring them to projects rather than waiting for each project to call for the construction of its own armature. In almost all performing contexts, there is no time for this. Where a project genuinely demands a new armature, it will require a significant investment of extra preparation time and energy (care). While composers' self-descriptive narratives often suggest otherwise (3.2), for experienced performers these situations are very rare. Even where the creation of a new armature is indicated, the old ones are not discarded; a performer is by no means obliged to follow the priorities of the composer in this respect. This was the case in the pitch_43 project described in the Preface (newly commissioned pieces for the Partch instruments playing alongside orchestral instruments.) Although in Partch's account his choice of 392Hz / G♮ as the reference 1:1 ratio of his tuning system seems to have been arbitrary (it receives almost no discussion in *Genesis of a Music*)[484] the fact looms large for a performer approaching his instruments who has some degree of reliable pitch memory, and is absolutely key for a player duetting on an orchestral instrument. Partch's 1:1 remains for me a G♮ and his 11:7 as a sour D♯, even though I know that that composer would have regarded my categorical identifications as a gross misunderstanding — or in his term, which carries a nasty whiff of racial essentialism, an undesirable 'xenogamy' of systems.[485] As in Q's diagnostic stance in 4.2, while I was delighted to devote my energy to that stimulating project, I and my colleagues also needed to retain our professional viability in other ones. Performers-for-hire such as myself do not dissolve completely into the project at hand.

Armatures are simpler than scenarios (5.9) and require less conscious conceptual intervention. Being felt as lying closer to the core of a performer, they are also less closely connected to the particularities of the music at hand. Indeed, they may be used in contexts which would not normally be regarded as musical, such as when comprehending the pitches of the stretched spectral sweep of the pneumatic doors of a Eurostar train, or when monitoring a fevered baby's changing heartbeat.

Temporary collapse of an armature leads to the undesirable condition of **lostness**. This does not describe the condition of losing one's place in the score (although this may occur at the same time) or even the sounding result diverging unwarrantably from the composer's demands (although this too may happen) but rather an inner sense of loss of performer confidence that results from being unable to rely on an armature. Lostness may happen to exceptionally gifted musicians who have nevertheless failed to perform adequate triage and mobilise their armatures appropriately. Although I do not wish to dwell on this, since I share the taboo I identify in 2.4.2, documented examples are all too easy to find. The 1994 performance of Stockhausen's *Gruppen* by the Berlin Philharmonic Orchestra conducted by Claudio Abbado, Marcus Creed, and Friedrich Goldmann, recorded for the prestige label Deutsche Grammophon (and therefore serving as the first and only encounter with this work for many), must have contained numerous such awkward

[484] His earliest sketches used C♮ as the 1:1 instead. See Brian McLaren, 'The Evolution of Harry Partch's Tuning System,' (Online, n.d.), accessed Dec 1, 2023, http://www.tonalsoft.com/sonic-arts/mclaren/partch/evolution.htm.
[485] See footnote 211. From Ancient Greek ξένος (xénos, 'stranger') + γάμος (gámos, 'marriage').

moments, since it is otherwise hard to account for the gulf between the supreme musical abilities of the conductors and players (as amply demonstrated elsewhere) and the incoherence of long passages of this performance.[486]

The arms of an armature are located within a performer's **workzones**:

5.4 Workzones, clocks and clouds

Workzones are the areas in which instrument-independent musicianship operates most readily. They are located in the 'middle register' of each musical parameter and away from the extremes, and so might also be called comfort zones. While the boundaries of these registers differ between musicians, there is a great deal of instrument-independent overlap at the centre: the regions 60-120 bpm and A♮3-A♮4 are uncontroversially regarded as non-extreme for musicianship purposes by tubists and piccolo players alike, even though the pitch region is rather high for tuba and unplayably low on the piccolo. These zones closely coincide with the regions identified by researchers in psychoacoustics and rhythmic perception (2.3.4.3) as offering the maximum opportunity for the perception of fine distinctions.[487] However, we can draw a distinction between these modes of enquiry; this project's area of interest is practical musical cognition (with an overall direction of movement from inside the performer→outside) and not perception (outside→inside.) While noting coincidences as they occur, we need not derive the notion of workzones nor the locations of their boundaries from the psychoacoustic literature, but rather from our own experience. To do so by appeal to external authorities would be to put the cart before the horse. Summaries of research on the workings of the auditory system, as routinely employed by self-reporting musicians to bolster the validity of their experiences, have here been dispensed with. I take Diana Taylor's exhortation to take embodied expertise seriously (2.2.3) as a starting point, and invoke the philosopher Tyler Burge's *acceptance principle* in this respect.[488]

As in the taxi analogy, a task that seems difficult may be eased by translating it into familiar terms: this is called *bringing it into the workzone*. This may be as simple and effective as deciding to work on the intonation of a very high passage two octaves lower. Where rhythmic obstacles present themselves, some demands that initially seem extreme may similarly be eased by refashioning these demands in easier terms. The example of my re-working of London's *Subtle Etude* above (which I notated for this text, but which I would perform mentally if encountered in practice), and the more sophisticated examples given by Talgam, indicate that these activities should not be primarily understood in terms of physical re-notation, even though our attention as score-consuming musicians is naturally drawn to the traces that such acts of re-

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[486] Karlheinz Stockhausen, *Gruppen für drei Orchester*, with Kurtág, *Grabstein für Stephan*, op. 15c, and *Stele*, op. 33, Berliner Philharmoniker, cond. Friedrich Goldmann (orchestra 1), Claudio Abbado (orchestra 2), Marcus Creed (orchestra 3), recorded Dec 1994, Deutsche Grammophon DG 447 761-2, CD, reissued in 2012 on Deutsche Grammophon 001708102. This strongly contrasts with a crystalline and roughly contemporaneous recording of the same work, which is harder to source: *Tanglewood 75: Anniversary Celebration: From the Audio Archives 1937–2012*: Tanglewood Music Center Orchestra, cond. Oliver Knussen, Reinbert de Leeuw, Robert Spano, recorded Aug 25, 1993, BSO Classics TWD 7531072001, FLAC file.

[487] E.g. London, *Hearing and Time*, 46.

[488] 'A person is entitled to accept as true something that is presented as true and that is intelligible to him, unless there are stronger reasons not to do so.' Tyler Burge, 'Content Preservation,' in *Cognition Through Understanding: Self-Knowledge, Interlocution, Reasoning, Reflection: Philosophical Essays*, volume 3 (Online: Oxford Academic, 2013), accessed Mar 3, 2023, 237.

notation leave. Rather, they are acts of bringing problematic demands into our workzones. The decision to re-notate is a common consequence of this, and also may be employed as an intermediate step in complex cases. However, musicianship-relevant questions may be conceived of and investigated without leaving any notational trace at any point. For example, I might check (with the help of a metronome for initial reference and a stopwatch) if my internal faculty for thinking in rapid groups of 7 isochronous pulses is helped by mentally grouping them as 3+4 or 4+3, or perhaps by alternating these groupings to maximise consistency (3+4, 4+3, 3+4, 4+3…?)

A robust notion of performers' workzones and their limits is particularly relevant to new music — a repertoire in which extremes of all sorts have been probed: the familiar ones of tempo, pitch register, and dynamic range, and also some less-obvious ones (e.g. of endurance and concentration, and/or of reacting to and reproducing fine distinctions between musical phenomena that are not in themselves extreme.) Generalising from Ligeti's (or possibly Nancarrow's) well-known formulation,[489] I call the moment that a musicianship task leaves the workzone and feels unmanageable the **clock→cloud transition point**. Clocks — manageable and understandable objects comprised of discrete components — are located within the workzone; clouds — unknowable, uncountable, unmanageable collections — are outside it. Delaying this point, and thereby expanding the workzone in question, is one goal of musicianship training.

When Talgam shared a sample of his re-notational activities on social media in 2022,[490] in relation to the score of Ligeti's *Continuum* for harpsichord (1968) in which a dizzying number of notes are connected with a single beam, he received much admiration but also some some criticism. The act of imposing 'clocky' thinking on what certainly sounds cloud-like was seen as 'changing the [composer's intended] gesture.'[491] We should reject such attempted prohibitions outright, since — although this was not explicitly mentioned in the social media discussion — they raise ethical red flags about performer consent. An empowered performer, while always considering a composer's notationally-mediated demands seriously and maintaining an adventurous and playful attitude, may refuse any elements of them that go beyond their hard limits. In contexts that clearly concern bodily limits, this area has been explored by experimental practitioners,[492] and also on occasion by sufficiently confident performers in contexts involving

[489] As is well documented, Ligeti adapted the opposition of 'clocks' and 'clouds' from Karl Popper. See Karl Popper, 'Of Clouds and Clocks: An Approach to the Problem of Rationality and the Freedom of Man,' in *Objective Knowledge: An Evolutionary Approach* (Oxford: Clarendon, 1972 and 1979), 206-255. The Conlon Nancarrow reference is to his *Study for Player Piano* no. 20, 'Cloud' (1965).

[490] Imri Talgam, 'Transcribing Ligeti's Continuum,' *Facebook*, Apr 28, 2022, accessed Apr 28, 2022, https://www.facebook.com/imri.talgam/posts/pfbid0JBAtGSkhtQfcry5DoHzDXYmXAaThTLmwnRDzTfWn4XH4CsdDx2Qy4KitB9TmwFcTl.

[491] Ligeti used a different and more pungent metaphor to describe the genesis of this piece: 'I thought to myself, what about composing a piece that would be a paradoxically continuous sound […] but that would have to consist of innumerable thin slices of salami?' György Ligeti, *György Ligeti in Conversation with Péter Vàrnai, Josef Häusler, Claude Samuel and himself* (London: Eulenburg, 1983), 22.

[492] For example: 'In [Trond Reinholdtsen's] percussion solo within *Institute for Post-Human Performance Practice*, the end of the piece is notated as a long accelerando of computer generated drum patterns that culminates with a relentlessly repeated fury of cascading blows racing down the drums over and over again. In the score, this repeated material is accompanied with the instruction "Repeat until close to fainting or until fainting." Whether this instruction is a joke or not (and who can really know?), it does leave the performer asking, what's the difference between performing losing control and actually losing control? In other words, if I'm not prepared to black out on cue (who isn't?), how real can I/should I make this crisis?' Torrence, 'Quick Now-'.

conventional notation: one soprano especially admired for her extreme high register declared that, since she was able to produce only a finite number of these demanding pitches in her career, each composer who wrote for her was permitted a maximum of two per piece. In relation to these kinds of boundaries, discussions of matters of consent arise naturally. Less discussed are those contexts which threaten to trespass the boundaries of a performer's musicianship thinking. While *Continuum* might pose physical problems to a performer (the risk of tendonitis, for example) it also poses musicianship problems that require particularly robust solutions. In this case, this involves a threefold process: 1) noticing that the piece should sound maximally continuous (not a profound insight, since Ligeti signals this with his usual repetitive vehemence — in the title, the beaming, and his exhortations to the player); 2) understanding that meeting this demand is impossible for a player without drastic against-the-grain intervention in the form of dividing the stream of notes into semantic chunks (bars), the performer always looking for areas of repetition that may be summarised in shorthand; and finally 3) re-assembling the chunks into a continuum and hiding the joins. If this act of distancing the performer from the 'intended' gesture is discouraged or forbidden (such prohibition being the nasty underside of the gestural consensus), even if it is undertaken in the ultimate service of the gesture,[493] an empowered performer should feel free to reject the composer's demands, since they would place the performer in an invidious position — they would risk becoming **lost** on stage. The reason this is a musicianship concern is that the situation is neither specific to the work nor the instrument. Similar obstacles arise and are surmounted similarly in a large sector of *moto perpetuo* new music in which clocks threaten to evaporate into clouds, including other compositions by Ligeti (e.g. the *Sonata for Viola* movt. IV, the *Concerto for Piano* movt. III, and the *Chamber Concerto* movts. I and IV), many works by Donatoni and Aperghis, and swathes of IRCAM-adjacent virtuoso repertoire composed around the turn of the millennium such as Philippe Manoury's *Passacaille pour Tokyo* (1994). The novelty of Talgam's approach is less his problem-solving process itself, which is a highly-developed application of group knowhow among pianists in particular, and more the impressive degree of openness and self-reflectivity with which he brings to light methods which others have either guarded as trade secrets or (wrongly) seen as unworthy of documentation.

The performer's initial position in all such contexts may be compared to the plight of Alice in *Through the Looking Glass* when interrogated by the Red and White Queens:

'Can you do Addition?' the White Queen asked. 'What's one and one and one and one and one and one and one and one and one and one?'
'I don't know,' said Alice. 'I lost count.'
'She ca'n't do Addition,' the Red Queen interrupted.[494]

A performer who has an active awareness of the location and limits of their workzones will intervene as necessary to avoid the risk of such lostness. With this in mind, the desirability of expanding musicianship workzones in NMPT contexts — for example, by increasing the capacity of trainees to work with ever-

[493] That is Talgam's approach. Discussing his approach to *Automne à Varsovie*, he writes '… I propose to clarify the aesthetic effect Ligeti seeks precisely by contradicting his own rhythmic notation.' Talgam, 'Performing Rhythmic Dissonance,' 15.
[494] Lewis Carroll, annotations by Martin Gardner, *More Annotated Alice:* Alice's Adventures in Wonderland *and* Through the Looking-Glass and What Alice Found There (New York: Random House, 1990), 298.

larger semantic chunks in *Continuum*-like contexts, or by increasing the fineness of perception and accuracy of reproduction of microtonal passages — must be balanced by the awareness that such expansion will inevitably reach limits, even for the most gifted trainee (and instructor). While we might generally agree with Easley Blackwood, who responded to criticism of the perceived difficulty of working with microtonal tunings by declaring that '[l]earning music is the art of turning the seemingly impossible into the familiar,'[495] our capacity to perform such feats is not infinite. All participants in such a learning process should feel empowered to voice their limits openly and expect them to be respected.

5.5 Swiss Army knives

> Whatever is simple is always incorrect. Whatever is not is unusable.
> Paul Valéry, *Mauvaises pensées et autres* (1942)[496]

A Swiss Army knife is a tool that strikes the right balance between applicability and portability. Although such knives have multiple handy functions, after a point adding functions does not increase usefulness.[497] While a Swiss Army knife is not the best tool for every job, it is good enough for many, and has the benefit of being ready-to-hand as it is carried from project to project.

A great deal of detailed knowhow goes into the design and forging of these tools. Nevertheless, the tools themselves can be described quite simply. In 6.3.3 I describe the creation of a Swiss Army knife for microtonal audiation, which I have found useful for numerous projects. Despite its complicated gestation — which mostly involved permitting myself to discard excess material — it can be summarised in twelve words. Nevertheless, a Swiss Army knife retains its secrets (its functions) until they are unfolded; for that reason the notion is impossible to convey adequately until an example has been given.[498]

A Swiss Army knife is only applicable to a single musical parameter. For this reason, these tools are LEGO-like and not plasmic (4.1); they can only be used in cases where parameters may be separated to a high degree.

Swiss Army knives, by definition, are not the only tools a performer might use. *Flexible* musicianship entails understanding when a project calls for their abandonment in favour of more specialised tools. For that reason, they should be worn lightly and without any claims of universal applicability. They arise from and are applicable to specific repertoires but are never dependent on a single project.

A Swiss Army knife is not unique to a particular musician; it can be passed on. However, it is still necessary to learn how to cut. The term is related to

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[495] Quoted in William Allaudin Mathieu, *Harmonic Experience: Tonal Harmony from Its Natural Origins to Its Modern Expression* (Rochester, NY: Inner Traditions, 1997), 31.
[496] 'Ce qui est simple est toujours faux. Ce qui ne l'est pas est inutilisable.' Paul Valéry, *Oeuvres*, Tome II (Paris: Gallimard, 1960), 864. In the study of complex systems this is known as Bonini's paradox.
[497] See, for example, the thousands of spoof Amazon.com reviews for the (real) foot-long, 87-function, Wenger 16999 'Swiss Army Knife Giant.'
[498] My use of this term has no connection with the metaphor as used by theorists of mind in approaches based on Jerry Fodor's *Modularity of Mind* (1983).

5.6 Rules of thumb

These are defeasible experience-derived approximations for default use by musicians — that is, they may be used until counterexamples are encountered. In any rule of thumb the copula *to be* (italicised in the three examples below) should always be understood in this heavily-qualified, temporary, sense. Since rules of thumb are rarely ascribable to a single author or discoverer, the given authorities are not the actual authors of the insight. Rather, they are prominent musicians who have found particular uses for or have become associated with these examples of group knowhow.

Example 1: The intonational spread of a professional string section playing a sustained pitch in the middle register in unison without vibrato *is* about a twelfth of a tone. (G.F. Haas)[499]

Example 2: Sixth-tones *are* the smallest intervals that may easily be perceived as melodic steps rather than enharmonic re-tunings. (Busoni, Wolfgang von Schweinitz)[500]

Example 3: The threshold at which a succession of individual sounds starts to be perceived as a continuum *is* about eighteen per second (Ligeti)[501] (or: about twenty per second (Grisey)).[502]

Unlike Swiss Army knives, rules of thumb are limited to a single area of application and are not multi-function. They may be highly instrument-specific (e.g. 'flutes crescendo sharp, other winds crescendo flat' (Preface) / 'the timpani should not be placed near the horns' (2.3.3) but need not be ('slow septuplets are hard' (2.3.4.1, 7.1.)) Being very limited in scope, their heuristic efficacy may be more amenable to direct testing than Swiss Army knives; some arise from or resemble findings in the psychoacoustics literature.

5.7 Set-up

A more complete description of the equipment that performers use than 'instrument.' A set-up comprises the apparatus that a performer brings to a project, including the principal instrument as adjusted to the particular requirements of the player (e.g. a quarter-tone key added to a trumpet, or a double-bell euphonium), any obvious extra sound-producing items such as e-bows, mutes, effect pedals, polystyrene blocks, mallets, etc., and also pieces of equipment that are only for the performer's use, such as electronic tuners. Over the course of habitual use (for example, the now-common use of bassoon reeds on the horn)

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[499] Personal communication, Aug 2014.

[500] 'The sixth-tones, which were already promoted by Ferruccio Busoni more than 100 years ago, seem to be the smallest intervals that can easily be perceived as melodic steps, whereas yet smaller intervals tend to create the impression of an enharmonic retuning of the previous pitch.' Wolfgang von Schweinitz, programme notes to *Plainsound Etudes* for violin solo, op. 58 (2013-14).

[501] 'A harpsichord has an easy touch; it can be played very fast, almost fast enough to reach the level of continuum, but not quite (it takes about eighteen separate sounds per second to reach the threshold where you can no longer make out individual notes and the limit set by the mechanism of the harpsichord is about fifteen to sixteen notes a second.)' Ligeti, *Ligeti in Conversation*, 23.

[502] Gérard Grisey, 'La musique: Le devenir des sons,' [Music: the becoming / coming-into-existence / taking-state of sounds] *Darmstädter Beiträge zur Neuen Musik*, 19 (1984), 16-23. This rule of thumb is particularly approximative and tentative since there is no agreement on what counts as an individual 'sound.' See, for example, the discussion in Chelsea Douglas, Jason Noble and Stephen McAdams, *Auditory Scene Analysis and the Perception of Sound Mass in Ligeti's* Continuum, *Music Perception: An Interdisciplinary Journal* 33, no. 3 (2016), 287-305. The authors make use of the cross-parametric term 'sound mass' to describe 'a type of auditory grouping that retains an impression of multiplicity even as it is perceived as a perceptual unit,' (287); I could have added this to the list of attempts to create a 'plasmic' vocabulary in 4.1.1 above.

items become incorporated into an expert performer's set-up and are no longer regarded as external: they move from 'present-at-hand' to 'ready-to-hand'.[503] My set-up includes red and blue pencils and a ruler, two basic Korg electronic metronomes (to check tempo changes without adjustment time), two inexpensive electronic keyboards stacked vertically with a 1cm horizontal offset and tuned a tempered quarter-tone apart, and the Just Tune iPad app.[504] The fact that I do not bring any of these items on stage in a performance does not alter their status as elements of my set-up, since for the purposes of musicianship thinking there is no sharp distinction between solo preparation, group rehearsal, and performance. Similarly, the in-ear monitor that a singer may use to supply reference pitches discreetly is part of their set-up, even if they use it decreasingly through a rehearsal process and by the performance minimally or not at all. All performers resemble cyborgs in this sense; the definitional boundaries between their set-up and their armatures are fuzzy.

5.8 Frets and grooves

I have been unable to discover when the humble fret (as found on the fingerboard of a lute discovered in Xinjiang and dated to the 3rd century CE,[505] for example) started to take on wider metaphorical meanings relating to the pitch affordances of instruments. Mira Benjamin provides a detailed history of the metaphor's application to the pedagogy of violin intonation, contrasting a 'projected fret' model (i.e. assorted sophisticated physical and conceptual versions of the stripes of fingerboard tape familiar to all beginner string players) with her favoured 'relational' one.[506] Metaphorical frets may be encountered in adjectival or verbal forms (*fretless*, *de-fretting, unfretting*)[507] and may even be detected in the patterns of thought encoded in a computer programme, as in Khyam Allami's 2019 manifesto *Microtonality and the Struggle for Fretlessness in the Digital Age*.[508]

In this text, **fret** means a point on the performer+set-up actant where a pitch can be produced with relatively little audiative effort. A fret is an area of rest or comfort where a player feels able to consult, or cling on to, their instrument as a reliable reference. If the full glissando of all possible pitches is imagined as a mountainside, frets are ledges and handholds where the pitch-finding climber (or 'scaler') may temporarily rest and relieve the strain on their projective pitch faculties. In this way, frets can replace or stand in for arms of the performer's pitch armature. As fine instrumentalists play, they dance rapidly and gracefully between these two complementary support structures. When something intervenes to disrupt these well-rehearsed interactions — a composer demanding the use of a microtonal scordatura on a cello, for example — the 'fingers' (the learnt fret structure) and the 'ears' (the armature) contradict each other, and a confident player can swiftly be reduced to a quivering jelly of lostness.

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[503] See footnote 68 on Heidegger and tool use.
[504] See 6.3.3.4 below.
[505] This is the earliest evidence for physical frets that I am aware of. British Museum object number 1907,1111.90. Field collection by Sir Marc Aurel Stein, Niya, Xinjiang, China, acquired 1907, accessed online, Jun 4, 2023, https://www.britishmuseum.org/collection/object/A_1907-1111-90. 'When whole, the lute would have been similar to those painted on the mural paintings found in the Dingjiazha Tomb No.5, of the Northern Liang kingdom period (384-441), located in Jiuquan, Gansu province.'
[506] Benjamin, 'Thick Relationality,' 76-84.
[507] Cubarsi, 'Unfretting the violin.'
[508] Allami, 'Microtonality and the Struggle for Fretlessness.' See footnote 216.

Although fret patterning and density varies dramatically between instruments and instrument families, there is no such thing as a fully-fretted nor an entirely fretless instrument. Because frets are located on the actant and not only on the physical instrument, an actant develops new frets as they gain experience. Indeed, this inter-fretting process is central to the fusion of human and instrument into an expert 'demi-natured' actant. For a beginner violinist, the only frets are the open strings and perhaps the harmonics at the octave; after a while the placement of fingers in first, then third, positions acquire the status of frets. This process of fret acquisition continues well beyond early childhood: as an oboist on a NMPT programme practises a quarter-tone fingering they have found in Veale's *Spieltechnik* (2.2.1) this may eventually become a fret. Microtonal fingerings on wind instruments in particular confirm the extent to which frets are located on the performer side, rather than 'on' the instrument. If a quarter-tone fingering (as listed in an ISM, for example) is new to even a professional player, it will no more yield the indicated pitch automatically than a conventional fingering does to a beginner, if they are not accompanied by audiation of the target pitch. Neither yet counts as a fret; in both cases the fingering is merely a gate-keeping exercise, serving to exclude great swathes of definitely undesirable pitches above and below. Once these exclusions have been made (this is referred to in Chapter 6 as 'blunt pitch-finding') the fine pitch-finding can begin and frets can be developed.

Like the arms of an armature, frets differ in their load-bearing capacities. Exceptionally strong and reliable frets which demand the least cognitive work for the player (e.g. pressing the keys of a modern pipe organ's 8' stop) may provide ledges on which to bivouac for the night,[509] moderately reliable ones (e.g. the first few harmonics of the harmonic series on a natural horn) are like solid footholds, while certain stratospheric natural harmonic positions on the contrabass resemble tenuous finger-holds that afford support only to the most nimble free-climbing players. None of these examples physically resembles the frets of a guitar. Indeed, the *anjok* (bridges) of a Korean *gayageum* (zither), or the *pardā* (frets) of a sitar, although they are fret-like in appearance, would not count as strong examples of frets in the sense of this text because they are habitually moved from project to project and even in the course of a performance; players of these seemingly highly-fretted instruments rely heavily on their pitch armatures instead.

As the arms of an armature may be leant against, so may frets. One of Q's pitch-finding strategies when rehearsing the extended-JI work was to relate a pitch demand to a known natural harmonic point on their fingerboard (the seventh harmonic of the open D string.) Since that harmonic counted as a fret for Q, the composer's pitch demand could be met quite precisely by gently 'bending' this fret downwards. While we may instinctively associate frets with the symmetric grids of equal temperament, and imagine microtones as deviations from this grid (as in the common practice of notating cent deflections from tempered pitches), I found it striking that in this case neither the composer's pitch target nor the reference fret were tempered. My description has once again been cumbersome, as is perhaps inevitable when attempting to describe expertise. What Q had actually said was simply: 'that's [*pointing at score*] a bit lower than this [*touching fingerboard*]'.

[509] Or even for 639 years, as in the case of the Halberstadt performance (2001–ongoing) of John Cage's 1987 composition *ORGAN²/ASLSP (As Slow as Possible).*

We can identify a pattern in new music's supply-and-demand model: as composers have sought to de-fret, performers (actants) have responded by re-fretting (that is, increasing fret density). As composers and performers alike chafed against the grid of the twelve notes of the tempered chromatic scale, two practical options emerged: either 1) to turn away from Western orchestral instruments, all of which exhibit engineered-in tempering to differing degrees, in favour of purpose-built instruments (e.g. the work of Partch, Daniélou, Dlugoszewski, Smetak, and the generalised / isomorphic keyboards of Bosanquet, Wicki, Fokker, and the more recent Lumatone), or 2) to seek to find ways of implementing intonational flexibility on orchestral instruments. The radical option 1) sidesteps the problems of engineered-in tempering, and places new frets on the full 'glissando' wherever desired. Since this text is intended for use by NMPT caretakers who have roles in existing structures in which the governing notion of a principal orchestral instrument remains central (conservatoires, summer courses, etc.) we will retain that emphasis; accordingly, option 1) is not discussed further here. In option 2), the historical legacies of engineered-in tempering are addressed on an instrument-by-instrument basis. Vast amounts of energy and expertise have been devoted to this task, and seemingly every instrument has been taken to pieces and re-built with this goal in mind (see the list of such projects in 2.2.3.) All of these may initially seem to be motivated by a desire to de-fret the instrument in question. However, all of them are principally re-fretting projects, because mere de-fretting — messing things up, moving towards greater entropy — is trivial. What players seek is less flexibility *per se* than the reliable, low-effort reproducibility of pitches that frets offer, since the reality is (with a few exceptions, mostly in the low ranges of woodwind instruments) that players of almost all *un*adapted orchestral instruments can already match almost any pitch stimulus they encounter through direct mimesis. However, to apply this approach in musical contexts without recourse to new frets would swiftly leave the performer in a state of affordance-free lostness, haplessly clutching the air like a beginner on the theremin.

As the paragraph above implies, frets are usually useful things, and a NMP trainee would normally desire to acquire more of them. However, they may also lead to distortion and trouble. In Allami's critique, frets are points of rest (or defaults) within digital tools. Allami convincingly argues that the way commercial audio products have implemented digital frets re-inscribes Western cultural hegemony. They do so not simply by defaulting to 12-EDO or even 24-EDO[510] (a critique almost as old as keyboard instruments themselves)[511] but more insidiously, by offering all-you-can-eat menus of ready-made tunings implemented in tokenistic ways:

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[510] Although they do this too. In Allami's view, and my own, rounding-off the tunings of Arabic music to 24-EDO is particularly lamentable (he calls it 'horrendous.') If rounding is really necessary, it might be better to use 12-EDO — which the informed ear can understand as a proxy for other tunings — than tempered quarter-tones. In this case we may echo Cage's remark about equally-tempered microtones: 'When the apple is rotten, cutting it in half does not help.' (Cage to Zukovsky, quoted in Sabat, 'Shadings,' 8.)

[511] For example: when Alexander Ellis read his paper 'On the Musical Scales of Various Nations' to London's Society of Arts in 1885, a detailed report was given in *Nature* (Anonymous, with contributions from Alexander Ellis, 'Musical Scales of Various Nations,' *Nature* 31, no. 804 (1885): 488-490.) It was reported that 'On the whole, Mr. Ellis considers his work has only commenced an investigation which will have to be pursued for many years, principally by physicists with a slight knowledge of music, not by European musicians, whose thoughts are biassed by the system of music in which they are accustomed to think.' (490). The instruments built by Alain Daniélou and his followers (the Martenot-Daniélou keyboard, the Shruti Venu, and the 'Semantic Daniélou,' by incorporating insights from non-Western tuning practices, are physical manifestations of this critique. See also Alexander Rehding, 'Wax Cylinder Revolutions,' *The Musical Quarterly* 88, no. 1 (2005): 123-60, for a hair-raising tour of racist views on 'native' tunings. Rehding records how theorists including Hugo Riemann

Yes, that's right: it is possible to auto-tune your next trap hit using the Werckmeister III tuning, Indonesian Slendro, or Wendy Carlos' Alpha …[512]

Allami's title does not do his powerful argument justice, since he is not striving for mere fretlessness but for the freedom for intonationally-sensitive musicians with backgrounds in different musical traditions to set their own meaningful fret-structures when working with audio technology, and for the voices of these musicians to be taken seriously by the companies that produce the technology.

In the Preface I proposed that musicianship should be conceived as something that is maximally instrument-independent. Why then discuss frets here? Because the concept offers a powerful way for a performer to understand how colleagues from *other* instrument families 'do' pitch — this being a prime musicianship concern. Sherlock Holmes could 'tell a weaver by his tooth, or a compositor by his left thumb.'[513] Although I hesitate to compare myself to the great detective, who had the unfair advantage of being fictional, I would bet a modest sum that I could tell an expert hornist from an oboist without their instruments by asking them to sing a few pitches: the seventh and eleventh natural harmonics above a given fundamental (I would expect the hornist to do this better) and a scale in tempered quarter-tones (the oboist will do better). The weaver's tooth and the oboist's quarter-tone are examples of what the French punningly call *déformation professionnelle* (i.e. the reverse of *formation professionnelle* — professional training — and also the indelible distorting marks that an occupation leaves on a person, which may pervade their private life: the teacher talks too loudly at the dinner table, and the librarian too quietly.) Some degree of such *déformation* is surely inevitable, and indeed may be desirable, since it would be dull if all musicians conceived pitch in the same way. However, as in the 'transitions' exercise in 3.2, the musicianship meta-skill that marks out the finest ensemble players is not merely the depth of understanding and level of control of the frets of their own instrument that they exhibit (say, the ability to play a rapid scale in sixth-tones) but their ability to adapt meaningfully to the fret-structures of others. I suggest ways a NMP trainee might helpfully think about the frets of their colleagues in 6.4.

A **groove** is physically the inverse of a fret. Consequently, in the spirit of Schick's cross-parametric analogies (4.1), it is hard to resist pointing to connections between these two familiar musical metaphors. Both frets and grooves are zones which demand relatively little cognitive intensity — less will to intervene — on the performer's part. This may seem like a curious claim, since playing in a rhythmic groove is very often physically strenuous and athletic, and grooves may exhibit a high level of internal irregularity and demand arduous and lengthy preparation. Nevertheless, grooves have an underlying quality of pleasurable relaxation; because we delight in playing together (3.1), they exert a gravitational pull which we gladly fall into. Although we might approvingly call the sounding results 'tight' or 'in the pocket' (terms describing

and Abraham J. Polak committed real acts of cultural violence in the form of wilful discarding of musical information via brutal simplifications (intonation being only part of the picture), both through their writings and their 'arrangements' of non-Western music. For Riemann, 'it was self-evident that the strange sounds that emanated from the phonograph could be nothing but a consequence of the lack of musical training of the non-Western musicians' (132.)

[512] Allami, 'Microtonality and the Struggle for Fretlessness,' 58.

[513] Arthur Conan Doyle, 'The Adventure of the Copper Beeches,' *The Strand Magazine* no. 18, vol. III (Jan-Jun 1892), 614.

narrow tolerance zones) playing grooves does not make us *feel* tight. Indeed, the effort of not doing so, or, what is worse, *almost* doing so (as in the 'auto-correct' examples in **Figure 8**, and as in the many examples in new music where composers have demanded that players resist the impulse to play together, such as feathered attacks, hockets, and so on) can feel stressful.[514] Latour's notion of the actant is once again useful in determining where frets and grooves reside: as a fret is located 'on' the player+set-up actant, a groove is located 'on' the (player+set-up)+(player+set-up)+(player+set-up) (…) actant (i.e. the ensemble.) From the individual performer's point of view, both frets and grooves can serve as references. Although we grab on to the former and fall into the latter, both may be usefully leant against: once we are in a groove, an individual may opt to diverge by rushing or dragging. In both cases, intervening to implement such divergences involves the expenditure of performing energy: it takes energy to push against something.

The notions of triage, workzones, frets, and grooves remind us that the budget of musical energy available to expend on active musicianship interventions such as finding unfamiliar pitches or picking tempo changes out of the blue is limited. We will happily fall into, or grab onto, anything that reduces our workload. NMP musicianship training should aim to help trainees understand when it is appropriate to make use of these aids and when their use should be resisted.

5.9 Scenarios

'Scenario' is used here as one might say: *that is a familiar scenario; I know how it will play out*. It is the recognition of a musicianship situation the like of which has been previously encountered on multiple occasions and whose obstacles successfully negotiated. ('Successfully' negotiated means here: done to the performer's own satisfaction.) When a situation has been successfully negotiated, the strategies that were used are committed to memory, as rewarding and intense experiences tend to be. Over time, situations that called for similar strategies become grouped in the performer's memory as a single scenario. These sets of strategies resemble the pre-arranged 'called plays' in American football.[515] They are employed according to the the dynamically developing demands of the situation, and so are never identical in execution (or 'playing-out'), even when repeating a performance of the same work, but nevertheless are eminently rehearsable. Indeed, their aptness to be worked on in some degree of isolation is a defining feature.

A scenario is meaningfully nameable. Such naming should best be done by each individual performer rather than being imposed by instructors, since to name something is to exert power and affirm ownership. In

[514] All pieces that require more than one conductor, such as Harrison Birtwistle's *Theseus Game* for large ensemble (2002-3) fall into this stressful category.

[515] American football plays and their accompanying calls can be highly intricate. For example, in Bill Walsh's 'West Coast Offense,' the call 'FB West Right Slot 372 Y Stick' means: 'FB West Right Slot' is the formation. FB indicates that the fullback is playing out of his normal position. West Right indicates that the fullback would line up immediately to the right of, and one step back from, the tight end, who is lined up on the right. Slot indicates that the flanker, who usually plays on the same side as the tight end, but split wide, is instead lined up on the left, in the 'slot' between the split end and left tackle. In '372', the '3' indicates that the quarterback will make a shorter, three-step drop rather than the standard five-step drop. The '7' is one of a numbered series of passing plays, all based around using the halfback to block on the weak side (away from the tight end). The '2' indicates a blocking scheme, giving each blocker his assignment. 'Y Stick' describes the pass route to be run: the 'Y' receiver (the tight end) will be the primary receiver and run a stick route: he will run forward, fading slightly towards the center of the field for six yards, and then depending on the coverage, he'll suddenly change course, breaking either back towards the quarterback or straight for the right sideline.' *Playbook Exchange*, n.d., accessed Feb 2, 2024, http://www.playbookexchange.net/playbooks/Offense/01130301-WestCoast.pdf.

respect to pitch-finding in new music mine include **dosing dirt**, **braindead**, **tartining**, **wobble-dosing**, and **look-it-up** (Chapter 6), while my rhythmic scenarios include **jumpcut**, **speed camera** and **wah-wah** (Chapter 7). These peculiar names are not intended to be abstracts of the fundamental characteristics of the scenario, nor are they comprehensible without further explanation. They only need to have sufficient connection to those characteristics to work as a label or headnote and be rapidly retrievable in moments of high body-cognitive arousal — as when a quarterback calls a play. People dealing with complex systems have long found quirky and vivid names to be useful as memorisation and differentiation aids. Frances A. Yates, in her iconic 1966 book *The Art of Memory*,[516] records that the technique of marking parts of a complex passage that are to be remembered with artificially vivid or grotesque mental labels was well understood in antiquity. Yates notes that the anonymous author of the textbook on rhetoric known as *Ad Herennium* (c.86–82 BCE), when describing the *loci* method of building the 'artificial memory,'[517] advocated mentally ornamenting such a label 'with crowns or purple cloaks,' 'stained with blood or soiled with mud or smeared with red paint,' 'so that its form is more striking.'[518] Suitably updated, this remains good advice. Over time an experienced performer may amass multiple scenarios, distinctly and vividly named, that may be thought of as an internal playbook, library, memory palace, or even a trophy room of headnotes commemorating vanquished foes (their bodies — multiple musical performances and their preparatory work — having been previously consumed by and incorporated into the performer.) To paraphrase Gilbert Ryle, this library is a 'knowing-that' of 'knowing-hows.' We might simply call it conscious expertise. Because there is more common practice in new music than composers are structurally motivated to admit (3.2), a performer can expect to consult this library frequently when preparing future projects. It is the real existence of such transmissible expertise that makes the paradoxical-seeming notion of training specialist performers of new music — training musicians to specialise in something that (at least partially) does not yet exist! — less implausible.

I describe individual scenarios in Chapters 6 and 7 below; for that reason I do not attempt to characterise them in depth here. I can, however, list some things that a scenario is not: scenarios are not parts of a composer's sound-world, style, nor language, nor are they intended as taxonomic elements in the analysis of a musical work. Although a particular scenario may be habitually used in contexts that sound similar, scenarios are strictly for the performer's use and do not attempt to describe 'the music.' Like the vivid labels used internally by the ancient rhetorician, their use is habitually hidden from public consumption. As in the case of leaning on the internal armature-arm ♩=120 to yield a sounding ♩=122, we are not obliged to 'show our working' (although there is nothing to stop us doing so, if we choose to.)

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[516] Frances A. Yates, *The Art of Memory* (London: Pimlico, 1994)

[517] 'The artificial memory is established from places and images.' Ibid., 22. An image (something we want to remember) is assigned to a specific pre-existing place, or niche, in the memory.

[518] 'We ought, then, to set up images of a kind that can adhere longest in memory. And we shall do so if we establish similitudes as striking as possible; if we set up images that are not many or vague but active [*imagines agentes*]; if we assign to them exceptional beauty of singular ugliness; if we ornament some of them, as with crowns or purple cloaks so that the similitude may be more distinct to us; or if we somehow disfigure them, as by introducing one stained with blood or soiled with mud or smeared with red paint, so that its form is more striking, or by assigning certain comic effects to our images, for that, too, will ensure our remembering them more readily.' Ibid., 25-26.

Since identifying and naming scenarios requires an investment of effort, in the spirit of triage we may ask: why should a performer bother doing so? Self-knowledge for its own sake might be a goal for a self-designated practice researcher but may be seen by other performers as an unnecessary indulgence. For the latter class of trainees, the main use of scenarios is to increase their speed and efficiency: of recognition of an obstacle, of its placement in a class of previously-surmounted obstacles, and of selecting the most appropriate strategy to deal with it. The scenarios I identify all relate to obstacles and difficulties of various sorts. They characteristically concern musical demands that fall outside everyday human scale and pace (our *workzones*); they may demand unusually rapid, slow, precise, or loose musical thinking. The use of well-differentiated scenarios is particularly relevant in contexts that ask us to move rapidly between frames of reference (*flexibility*). Such rapid adaptation is intrinsically effortful. It strikes me as self-evident that a NMPT caretaker should seek out such areas of difficulty, since there seems little purpose in revisiting what feels natural and familiar.

5.10 Sensitivity, flexibility

These are the key goals of the model of NMPT musicianship proposed in this text. Despite, or because of, their importance they are not directly teachable: the exhortations *be more sensitive!* or *be more flexible!* are not actionable and may even be construed by a trainee as a discouraging slight. Rather, these qualities emerge from the appropriate application of the other terms in this glossary. The final goal is the emergence of a justifiably confident performer who feels empowered by their musicianship skills.

A note on this glossary

If an expert performer who has had the patience to read this far feels that I have said nothing new but merely laboriously described what they already do (and doubtless with more swiftness and grace), then I have achieved my aim. These terms are nothing more than organisational headings that aim to codify good practice as I see it — a task I have attempted to ease the conceptual burden on NMPT caretakers.

A note on what follows

Performers who author practice research projects are generally expected to include examples of their practice — recordings, videos, teaching slides, etc. — as elements of their submitted project. For good reasons, these examples are often of solo work or involve small groups of informed participants. Due to the nature of my professional work as a conductor, this is not a practical option.[519] To include the documentation of a single rehearsal interaction, for example, I would have had to seek retrospective permission from every member of an orchestra, and in most cases where I have worked with large groups of conservatoire students (in workshops, masterclasses, etc.) the participants will by now have dispersed internationally. The materials of the next two chapters are drawn from multiple interactions of this type. I felt it would be much less informative to pick over a small number of examples in the interests of this text resembling existing practice research projects. Furthermore, as I have repeatedly attempted to demonstrate

[519] Nor would I wish to claim that my impact on large documented projects has been so significant that they could be cited as representing the essence of *my* practice. Although my name is found on some CDs, for example, the contributions of others (the composers and the other performers) in all cases far outweigh mine.

(2.2, 3.1, 3.2, 4.2), an emphasis on individual interactions in new music's discourse has hampered the creation of useful general materials.

For these reasons, I have cast Chapters 6 and 7 as dialogues between two composite figures. The first (**A**) is a NMP trainee, and the second (**B**) is a NMPT caretaker and **A**'s musicianship instructor. **B** is the author of the text so far, which **A** has read. While it may seem presumptuous to write in the single voice of an imaginary trainee, since real trainees are highly diverse, this is effectively what course directors already do when they curate a NMPT curriculum. The alternative is to wait and try to get to know each trainee, then attempt to tailor tuition to their needs. That seductively-plausible individualistic approach is the composition-teaching default (2.1), which led to the problematic ad hoc NMPT model (1.1) and the skill-gaps identified in 3.2. It also poses significant problems of timetabling and project management. These problems might be surmountable in courses that focus on the 'creative performer' (1.2.6), with their characteristically small-scale outputs. However, they would severely hamper the planning of programmes with larger numbers of participants and would be fatal in short-term contexts such as summer academies where the experience and abilities of individual trainees cannot be known in advance. In any case, as may be clear by now, I think most of the trainees who have chosen a 'creative performer' direction are already in excellent hands — and if they are not, it is probably too late to do much about it, since they are unlikely subsequently to re-enrol on a course whose teaching focus seems less 'advanced.' The status of NMPT in wider conservatoire contexts is much less healthy — as evidenced by the scarcity of bridging materials between the two training models described in 3.1. Consequently, this is the envisaged point of intervention of the dialogues. **A** has been trained so far in a 'normal,' non-repertoire-specialised, conservatoire context; **B** is a new music specialist, but also one with a knowledge of older musical practices. **B** wants to help **A** apply and adapt their existing expertise in older music to new music. **A**'s journey from old to new reflects the usual route (1.2, 4.1) towards a specialism in new music performance. However, I have been deliberately unspecific about **A** and **B**'s institutional positions, since in this text *trainee* and *instructor* represent stances subject to change and not levels on a hierarchy. A course leader of a large NMPT programme described to me a project that they hoped one day to implement — a nomadic NMPT academy that would be invited on a consultancy basis to help professional orchestras with specific repertoire challenges. In this case there would be a distinction between instructor and trainee, but the former would not have hierarchical superiority to the latter. Indeed, that situation might more closely resemble a star tennis player employing a less well-known coach to address a specific limitation in their game. **A** might also plausibly be an orchestral musician who mostly plays older music but is curious about new music.

Both **A** and **B** are, of course, also versions of me — for in a discourse that has long ago abandoned the phony objectivity of some twentieth-century writings on music, how could it be otherwise? **B** is me now (more or less), and the examples of practice they refer to are mine, shorn where appropriate of details that would identify others. **A** is me roughly twenty years ago, transported magically to the present day. **A** is familiar with the musical highlights of the previous few centuries and is beginning to gain some awareness of new music. **B** hopes to help **A** avoid some of the mistakes and misunderstandings they made, and so to find a meaningful learning pathway through the thickets of new music practice.

Chapter 6: Conversations about pitch

6.1 The pitch landscape in new music

A: Can you say some simple and clear things about pitch in new music? I read section 2.3.2 and feel even more confused than I was before.

B: I'll try! After all, although I certainly don't know everything about the subject, I know enough to know that no-one else does either. And if you've read this text so far, you might also agree with me that it's time to stop prefacing every point with qualifications like 'not all composers / performers…' We both know that there's a wide world out there.

A: I'll still pick you up if I think you're generalising too wildly.[520]

B: Fine. The first thing I'd say is that pitches that you can't easily match on the piano are everywhere in new music these days. We find them in the form of non-sounding compositional demands, such as exotic notated accidentals,[521] and also as sounds. Sometimes those sounds are the responses to these written demands, but sometimes they're not — they might result from improvising on acoustic or electronic instruments or come from fixed media. From the performer's point of view, the production of these pitches usually involves an interrogation of the performer-instrument actant's fret structure. This characteristically involves placing new frets after an initial de-fretting process.

A: That's not simple. You and I both know you mean that new music has loads of microtones, and they're often hard for performers to realise. Just say what you mean!

B: I think you have already noticed that hardly anyone likes the words 'microtones' or 'microtonal,' and for good reasons. Back in 2005 Bob Gilmore noted that 'microtonal' was beginning to sound 'past its expiry date.'[522] When Julián Carrillo — starting in the 1910s! — made music by salami-slicing intervals until he felt the need to build a 97-key piano with the range of one octave, you might reasonably call those *micro*-tones.

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[520] As will the author of the footnotes in Chapters 6 and 7. In the interests of flow and clarity of the dialogue, some material that would be included in the main text of a conventional thesis (including most details of tuning theory) has been banished to the footnotes.

[521] The dizzying profusion of microtonal accidentals can be sensed by browsing the list of glyphs of the SMuFL ('Standard Music Font Layout'). Thanks to the labours of Daniel Spreadbury at Steinberg, the W3C Music Notation Community Group, and Thomas Nicholson, the SMuFL includes: 'Stein-Zimmermann' accidentals (i.e. what have become the conventional quarter-tone accidentals, as used in this text), unspecific arrows (as recommended for quarter-tones by Elaine Gould in *Behind Bars: The Definitive Guide To Music Notation* (London: Faber Music, 2011)), the complete HEJI specification, the accidentals of Ivan Wyschnegradsky, Alois Hába, Ezra Sims, and Ben Johnston, the Arel-Ezgi-Uzdilek accidentals for traditional Turkish art music, accidentals for Turkish folk music, the Persian *koron* and *sori*, George Secor's complete Sagittal system, and an assortment of others (from scores and treatises by Penderecki, Tartini, Bosanquet, Bussotti, Taverner, and others). From a performer's view, this bestiary resembles Jorge Luis Borges' *Book of Imaginary Beings* (1957) in that it mixes the 'real' (i.e. signs that performers habitually use without cognitive friction, such as the Stein-Zimmermann set), the 'real imaginary' (historically-significant signs that might spark interesting learning journeys for performers, such as the Johnston set) and the 'imaginary imaginary' (signs that certainly will remain on the written page, such as the 'Magrathean Sagittal extension (insane precision) accidental diacritics'). Daniel Spreadbury, ed., 'Standard Music Font Layout (SMuFL) v.1.5,' *Github*, Jan 4, 2023, accessed Jan 24, 2024, https://w3c.github.io/smufl/latest/.

[522] Gilmore, 'Downfall', 5.

Carrillo was trying to replicate musical contours at a succession of increasing scales, zooming in with his microscope from whole tones through to sixteenth-tones. But that's an exception. Since we can't seem to shake off spatial metaphors here, we can say that most of the other ways that composers and performers have mapped and navigated the smooth and infinitely-divisible 'pitch space,' placing markers as it pleased them — according to what Clarence Barlow, in a scrupulous but doomed effort to find a neutral term, called the 'judicious placement of frequency'[523] — make reference to pitch-structures that are not 'micro' at all. The most obvious example of these structures is the natural harmonic series — or at least its first few harmonics. That famous shape appears in various guises — in differing quantizations and tolerances — across Western music history like a cosmogonic folk myth. The series starts in large, memorable leaps, but around the point the gaps have narrowed and we enter the micro-scale (after the 12th, or perhaps the 16th, harmonic) it is hard to sing and even recognise. (Hard to recognise, I mean, if you only play from the 12th to the 20th harmonics, for example.) Comparably, there is no such thing as 'Harry Partch's 43 tone scale'; talking that way is to confuse the artist's paintbox for the painting. I've worked with Partch's instruments, and have played the Chromelodeons from bottom to top several times, and I can't sing or reliably recognise any such scale — but I certainly can recognise many of the arpeggiated chords and melodic patterns he habitually used, which are gappier and, of course, contain far fewer pitches.

A: And musicians outside the Western classical tradition use plenty of pitches that aren't playable on the tempered piano. It doesn't seem appropriate to call any pitch that we can't play on the piano microtonal, does it?

B: Certainly not. In fact it might even be seen as a cultural micro-aggression in that it casts tempered pitches as Home and non-tempered pitches as Away. As a musician in Seoul's National Gugak Center put it to me recently, as we were discussing how that institution might notate non-tempered pitches for archival purposes:[524] why don't *you* make transcriptions of your performances of Mozart with the cent deflections from my *gayageum* tunings? (Although they were joking, I thought this sounded like a good idea — the only snag being that I rarely perform Mozart.) But leaving cultural politics aside, it's certainly possible to say that most non-tempered non-Western scales (and Western ones, of course) have many fewer steps than Carrillo used, and don't sound 'micro.' Alain Daniélou proposed the following rule of thumb:

> Within one octave we cannot discern more than twenty-two groups of sounds having distinct expressive qualities, and all twenty-two divisions cannot be used simultaneously in a mode: at the most twelve, and at the least three.[525]

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[523] Clarence Barlow, 'On Ramifications of Intonation,' *KunstMUSIK 16* (Cologne: World Edition, 2014). Barlow's attempt at a general formulation, which comes closer than any other formulation I have found and is quoted approvingly by Mira Benjamin, is thwarted by the word 'judicious,' which implies a judge (Latin: *iudicium* - judgment / *iudex* - judge) and therefore laws to guide such judgment, since an arbitrary judge is no judge at all. There seems little point in attempting to move further in the direction of neutrality. When it comes to pitch, every musician has skin in the game, since dealing with pitch is our defining superpower — we can agree to share gesture and even rhythm with other artforms, but pitch belongs to *us*.

[524] Personal interaction (summarised, not direct quote), Sep 2023, interlocutor gave consent for interaction to be documented but preferred anonymity. Korean traditional musical notation is tablature-like and does not encode absolute pitch targets. The institution already archives its vast collection in many forms, including historical recordings, film, facsimiles of manuscripts and early printed volumes, and preserved instruments. See 'Archive,' *National Gugak Center*, accessed Feb 2, 2024, https://archive.gugak.go.kr/portal/main.

[525] Alain Daniélou, *Music and the Power of Sound: The Influence of Tuning and Interval on Consciousness* (Rochester: Inner Traditions, 1995), 247. Translation of Alain Daniélou, *Origines et Pouvoirs de la musique* (Paris and Pondicherry: Editions Kailash, 2003).

While Daniélou's declaration that the possible number of meaningful pitches in a scale is limited to twelve seems a touch over-restricted, it is uncontroversial to propose that there is a (fuzzy) limit to how many pitches we can treat categorically: that is, to give them names and do things with them. (I'll come back to what I mean by that later.) When practical musicians like the composer and ear-trainer Julia Werntz propose the use of high-number EDOs (i.e. very micro-tonal structures),[526] they do so with the hope of finding ways to work with the wonkier and gappier contours and verticalities that they want to hear. They do not expect people to work with the fine grid itself. Alternatively, like James Tenney,[527] they are motivated by the ambition to write their own intellectually satisfactory peace treaties to resolve the ancient battles between equal temperaments and JI-type approaches. But that is the province of theory…

A: And can we please assume that I've already read *loads* of tuning theory, so we don't need to go over it?[528]

B: Gladly. One last point about 'micro-tones' though — when I think about the most memorable moments in new music where pitch plays the main expressive role, they are not 'micro' at all. Among new music fans, the heart-stopping descending three-quarter tones in the fourth movement of Grisey's *Quatre chants pour franchir le seuil* (1998)[529] have become as iconic as Mahler's 'Ewig… ewig…' in 'Der Abschied' (*Das Lied von der Erde,* VI.) I can't think of a memorable micro-tonal moment that comes close.

A: Maybe not in new music as you've defined it. When Kelis sang that tight descending line 'My milkshake brings all the boys to the yard' in *Milkshake* (2003) she created a truly microtonal earworm.

B: A little before your time, no? Anyway, although it's true to say that the word microtone has its problems, it's a useful shorthand when we're pointing to general trends like the remarkable proliferation of microtonal accidentals in recent scores. Looking over my conducting work from the past decade (2013-2023), of the scores dated within five years of the performance fully 107 out of 148 (72%) contain accidentals that weren't even mentioned in my formal training. Of course, that's not representative of the state of composition worldwide. I've mostly worked with ensembles in continental Europe and Asia, and have conducted a lot of compositions by young composers. If I'd spent more time with symphony orchestras or in opera houses, particularly in the UK and the USA, I'd certainly have encountered fewer exotic accidentals. Nevertheless,

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[526] Werntz, *Steps to the Sea.*

[527] See footnote 214 above.

[528] Artificial intelligence, in the form of large language models, offers a new way of assessing how entrenched or worn-out a debate is. Because these models are trained on vast datasets, the susceptibility of a question to provoke cogent and bland responses is a good marker of an entrenched debate, since it implies that the positions have previously been summarised and brought into opposition numerous times. Given the prompt 'Compare equal temperament and just intonation' in January 2023, ChatGPT generated the following impressively-balanced overview: 'Equal temperament and just intonation are two different tuning systems used in music. Equal temperament is a system of tuning in which all semitones (the interval between two adjacent notes on a keyboard) are of equal size. This allows for all keys to be played in without any noticeable change in the tuning. This system is commonly used in modern Western music, and is the standard tuning for pianos and most other keyboard instruments. Just intonation, on the other hand, is a tuning system in which the frequencies of the notes are based on whole number ratios. This results in intervals that are more in tune with the natural harmonic series. However, this system has the downside that the tuning of each key is different, so a piece of music that is in one key will not sound the same when played in another key.'

[529] See **Figure 46** below for the complete passage.

my impression is that, in the current century, microtones have gone mainstream. And by mainstream, I mean that their mere presence doesn't require special pleading, even in many orchestral contexts,[530] and that music with microtones is — as Gilmore repeatedly pointed out — increasingly being regarded as just music, after all.

A: Your 'impression'?!

B: Well, if you want more objective-seeming evidence I suppose you could train a future version of ChatGPT to trawl through all the score-follower videos on YouTube to scan for exotic accidentals and cent deflections. But even then you'd have a heavy selection bias. And a bigger problem would be that, in focusing on glyphs alone, you'd miss an important point about musical practice — that the experience of working with different tunings does not put musicians on a one-way street towards ever-greater notational refinement. Plenty of composers move back and forth between writing scores that 'have microtones' and those which 'don't.' Christopher Fox and Julian Anderson, working in quite different ways, have produced scores which have no microtonal accidentals *after* ones that do. That certainly doesn't mean that in the works 'without' microtones that those composers suddenly became less pitch-sensitive, nor even that those pieces automatically pose fewer intonational challenges to the performer. I don't think it is plausible to undo the aural hybridisation that is the result of the shaking-up (*solicitation*) of pitch categories and structures that had previously seemed secure. People who have worked with a variety of tuning approaches seem to remain fundamentally hybrid in perpetuity, even if they later may choose to work within a single system, as did Easley Blackwood in his 'post-microtonal' period, or choose less fussy notational options. It really does seem to be a case of 'after such knowledge'…

A: Are you going to echo your old boss and declare that 'Any composer (or performer) who has not experienced the necessity for ~~the dodecaphonic language~~ — sorry, microtonality — is USELESS'?

B: *I* wouldn't dare, but others might.[531] Anyway, I was hoping to take a break from listening to composers' voices. Some of the most sensitive recent comments about pitch have come from the voices of performers

[530] Between 2007-14 I worked annually with the London Philharmonic Orchestra, conducting new music programmes and workshopping scores by young composers. Even in that short period I noticed a significant normalisation of many aspects of new music notation and techniques, including a growing acceptance of microtonal accidentals, which was certainly not the result of my influence alone.

[531] In 2021 the composer Georg Friedrich Haas issued a stinging public rebuke on social media to 'various cultural organisations in Graz.' That city's Musikprotokoll festival had advertised the performance of works by two of his composition students as follows: 'Composers from […] Columbia University who, under the influence of Georg Friedrich Haas, have developed a special sensorium for microtonal sound-structures …' ('Aus […] Columbia University stammen Komponist*innen, die unter dem Einfluss von Georg Friedrich Haas ein besonderes Sensorium für mikrotonale Klangstrukturen entwickelt haben.'). Haas noted that 'this statement is untrue' ('diese Aussage ist unwahr'). What was true was that 'the two composers […] understood microtonality as a self-evident constituent part of their musical language (like 99% of all young composers who are to be taken seriously)" (my emphasis). ('Wahr ist, dass die beiden Komponistinnen […] Mikrotonalität als selbstverständlichen Bestandteil ihrer Musiksprache verstehen (wie 99% aller ernst zu nehmenden jüngeren Komponist*innen)'). And they 'didn't, and still don't, need me [Haas] to develop a special sensorium for the purpose' ('Sie haben mich nicht gebraucht und sie brauchen mich nicht, um dafür eine besonderes Sensorium zu entwickeln.'). After this robust defence of his students' originality, Haas could not resist a parting shot: 'Side note: I am a COMPOSITION PROFESSOR and not – as I have been assumed to be in Graz for decades – a TEACHER OF MICROTONALITY' ('Randbemerkung: Ich bin KOMPOSITIONSPROFESSOR und nicht – wie mir in Graz seit Jahrzehnten unterstellt wird – MIKROTONALITÄTSLEHRER.') Georg Friedrich Haas, 'Leider musste ich gerade eine

— although we can't ignore that fact that as these performers gain experience, knowledge, and confidence (and institutional positions — see 1.2), their voices increasingly resemble those of composers. Those kinds of performer are liable to present us with an improvisation or a devised composition with shared authorship. And conversely, the practices of composers such as Catherine Lamb embrace live-sound pedagogy, and therefore start to look a lot like performances. You could say the same about historical composer-performer-researchers like Vicentino or Biber, for that matter. Every informed participant understands that there's no sharp definitional distinction between the notions of microtonality and intonation. That's an insight as old as the subject itself, and one for which there's concrete historical evidence — the grand 'instruments of music theory' like Vicentino's archicembalo, and the many humbler enharmonic instruments like split-key harpsichords that were built to give good-enough fixes for the pitch problems that arose in the music of their time.[532] All those are evidence for a strong historical awareness of the fusion of microtonality and intonation implied in Kirnbauer's useful term *Vieltönigkeit* (2.2.1) — an awareness that became marginalised, but never quite disappeared, in the compositional-stylistic clamour of the twentieth century. In recent writings *microtonal* is usually located on the demand side (i.e. in the composer's domain) while *intonation* is on the supply side (in the performer's). However, the two notions interact and have therefore inspired practically-minded composers too. Georg Friedrich Haas' *limited approximations* for six micro-tonally[533] tuned pianos and orchestra (2010) is an example of the many cases where an awareness of these interactions has borne rich creative fruits: the composer writes down things that sound like the micro-adjustments characteristic of the intonational habits of sensitive performers, which are then placed in the hands of sensitive performers… I don't want to start listing composers and their various approaches, though, or we'll be here all night.

A: You seem to be implying that we shouldn't approach the subject from the point of view of what's written in scores or theoretical texts.

B: I think that we should resist the use of individual composer-authored texts or scores as starting points for conceiving NMPT musicianship, and be particularly wary of accepting statements like *this piece does x*, or *explores y* at face value. That's not to question their value for other purposes; we're only thinking about how performers best should learn skills of pitch and avoid the dreaded sense of lostness. One trouble with proceeding from individual scores, for example, is that a microtonal accidental in score X might represent the endpoint of an arduous journey of listening and learning and was chosen with great care, while the same sign in score Y might imply a casual de-tuning. So we need to apply triage.

A: You could say something similar about any musical sign.

Richtigstellung … verschicken,' *Facebook*, Sep 30, 2021, accessed Oct 2, 2021, https://www.facebook.com/GeorgFriedrichHaas/posts/pfbid0B8qQq95aPq9qTKAN3Fs7f9ZwKkUQKaiBvHPtkPEqSpwrQdYZKuDqzgQAa2hdsfael. As one respondent put it, 'tell 'em, prof!'

[532] Barbieri, *Enharmonic Instruments and Music*.

[533] The meaningful hyphen is the composer's own. While Haas understandably abhors being reduced to the status of a tinkering 'microtonalist' (see footnote 531 above), in that epic work — and in the more recent *11,000 Saiten* for 50 microtonally attuned pianos and chamber orchestra (2023) — micro-intervals are indeed palpably present.

B: True, but the situation is more acute with microtonal accidentals due to the extremely lumpy distribution of knowledge and experience in this area. Some musicians (composers and performers) embody incredibly deep awareness of this subject, while others treat it with incomprehension or dismissiveness. That latter attitude is usually restricted to the *visual* aspects of microtonality — it's rare to find a musician who is truly casual about the sounding pitches they make or want others to make. In the case of scores X and Y we will need to apply triage, because other aspects of score Y might demand a lot of care. And then we risk expending so much energy triaging composers' care needs that we neglect our own: this has led directly to the ad hoc NMPT model. Such an outcome would help no-one — not even X-type composers who set tight pitch tolerances, because they'd thereby lose access to the fanatically-devoted performers with carefully-maintained pitch armatures on whom they rely. Alternatively, those devoted performers would abandon projects that imply looser pitch tolerances and become more and more wedded to the music of a small group of composers. I don't think either is a healthy or sustainable approach, and I'd feel uneasy about encouraging a trainee to go down either route.

A: But if we don't start with scores and theoretical texts, where should we start? Recordings of performances are hard enough to cite, and live ones just disappear.

B: If we are serious about improving our skills of pitch, I think we should try to discover and interrogate existing habitual musical procedures in ourselves and our colleagues, and try to put our declared allegiances (as composers, improvisors, or performers) temporarily to one side. That is a challenge, because we construct our professional selves out of these allegiances. I'm not proposing — as seems to be the goal of some recent texts and training programmes[534] — anything so grand as to heal a practice riven by the supposedly-artificial historical separation of composer and performer. That's far above my pay grade, and anyway I feel secure in my identity as a performer and not a composer, and so do plenty of other performers. It's just a training stance.

A: That's a pretty vague mission statement.

B: I'll try to do better. We might start by recasting the terms *intonation* and *microtonality* as different aspects of the internal experiences of 'doing pitch', or 'pitching'.[535] Because we are thinking about inner experience, we want to avoid framing the words in terms of supply and demand. We also want to avoid the loss of meaning that would result from the complete merging of the two, because that would reduce the richness

[534] For example, Mieko Kanno writes: 'The global [sic] dissemination of equal temperament around the turn of the eighteenth century had little effect on the playability of the instruments of the violin family. The four strings of the violin remained unchanged, having the intervals of a perfect fifth in between them. But the effect on performance practice was considerable: gone was the ritual of tuning and playing instruments to different temperaments depending on the musical and practical constraints. […] Pitch became an abstract commodity while intonation became a practical topic. The vital link between composition and performance was broken. Intonation became an issue of performance practice alone.' (emphasis added) Kanno, 'Thoughts on How to Play in Tune,' 36. Kanno's words convey a palpable sense of loss and a desire to heal; many figures associated with the 'creative performer' notion have expressed to me a sense that things were generally better in the Baroque period.

[535] Attempts to probe this rather ineffable territory often seem to employ (putatively) meaningful verbings of nouns and nounings of verbs; thus Christopher Small's coinage *musicking* has attracted much Anglophone attention, although it is hardly a novelty to German speakers familiar with the standard verb *musizieren*.

of our vocabulary and not reflect real-world practice. So we could think as follows. *Microtonality* could describe the inner experience of '**bending**' a pitch, not with a crude tool like the pitch-bend wheel on a synthesiser but rather in tiny known degrees of push, upwards or downwards, but nevertheless without a known final goal, like a caterpillar creeping along a branch. (The caterpillar knows how far it travels in a single 'ooch' of its body, but can't see the end of the branch.) *Intonation*, on the other hand, could describe the experience of locating a pitch with reference to a '**root**' pitch that is likely to be a good leap lower, and with reference to our pre-existing knowledge of its sonority (i.e. our categorical perception).

That may sound like the familiar distinction between vertical and horizontal, or even harmonic versus melodic intervals. For new music veterans, my description of **bending** might make you think of playing the music of Giacinto Scelsi, whose scores constantly ask for little upwards and downwards pitch inflections of this sort, often set against a sounding drone in the middle register. And my description of **rooting** might evoke the experience of locating a secure *Natursept* — the 7th natural harmonic — against a bass note when performing a composition by Georg Friedrich Haas. And indeed we might use them in these performing situations. But this is to put the cart before the horse. For a performer, thinking in terms of a microtonal-feeling 'bend' — even though it is a linear, inflective, gesture — might be helpful when locating a single pitch within a complex verticality. And an intonational-feeling 'rooting' approach might help when locating an isolated or melodic pitch in cases where the reference 'root' is not actually sounding but resides in our pitch memory (our armature) — so it might sound like a pitch bend. When we consider real instruments, bending uses nearby frets as the main reference — a desired pitch might be a touch higher than a neighbour violinist's open A string, for example — while rooting is more likely to make use of frets which are quite distant, as when we place a pitch with reference to a low note on a contrabass.

Marc Sabat and others have attempted to discover and list recognisably 'tuneable' intervals by the quality of their sonority: these can be described adjectivally as purring, roiling, ringing, static, rough, and so on. We'll come back to that approach later. That approach to pitch-finding is of the rooting variety because it relies on the fixed identity of the target dyad: to tune the ratio $p : q$ (i.e. to find q) first you must be given a reference p. Bending also refers to a reference, but to a more gestural one. JI advocates consider bending to be intrinsically less precise than rooting because it points outwards towards the unknown (*a bit higher / lower than*…) while rooting is an attempt to replicate a sonority we have in our memory, and so focuses inwards onto the target. I think that in practice both strategies are useful and complementary. But they feel like quite separate activities to me.

A: When you talk about 'pitch-finding' that still sounds like a performer's response to a compositional demand or challenge — like a treasure hunt where the composer has hidden a pitch under a heap of notation, and we need to find it.

B: Well, very often things do play out in that way from the performer's point of view. However, I think that this kind of cognition goes on prior to individual use-cases, and that there is a core set of pitch skills that musicians (imperfectly) share, and which later might come out in the activities of composing or performing. So when I say 'finding' a pitch, that might mean a composer groping for a pitch (slowly at their

desk), an improvisor choosing a pitch (more quickly), a performer responding to a composer's demand, or a person who hasn't yet selected their professional identity for the day turning over an earworm or humming in the shower. I'm aware that I'm perilously close to making claims about 'basic musicianship,' which I promised not to do. Let's call it 'shared' instead, while noting that it's similar to Oliveros' conception of basic musicianship in the 1970s (3.2.) No-one is claiming that there are general rules to uncover here, though. Even W. A. Mathieu, in his vast and eccentric book *Harmonic Experience: Tonal Harmony from Its Natural Origins to Its Modern Expression* admits that he is 'led forward by … ephemeral feelings of longing and aversion' rather than the natural law that his title implies.[536]

A: This has become quite abstract. I am getting hungry for pitches not words.

B: Me too. One last observation before we get to an example, though. Although in this conversation we will mostly discuss fine pitch distinctions, we shouldn't forget that blunt pitch skills are also vitally important in the real world. Although the microtone/intonation area has been lavishly documented, plenty of new compositions still ask performers to undertake the kind of leapy chromatic pitch-finding that people like Friedmann and Edlund were trying to help with. In fact even very fine contexts often demand the use of blunt pitch-finding as a starting point. It may be little use being able to recognise and name six intonational flavours of the major third above A♮4 if you can't jump rapidly enough to that reference pitch, or near enough to it in the context. The reason I don't discuss blunt chromatic pitch-finding here is not because it's not important, but because I think it's eminently self-teachable. In contrast to Friedmann's composer-aligned, 'with the grain' approach, I think the best way for a performer to approach these contexts is to look — without shame — at the contour for anything that resembles a familiar tonal procedure (a major triad, a cadence, a pedal point) and to mentally amplify and hang on to that reference. Even the most fervent devotee of *Werktreue* (see the social media spat noted in 5.4) couldn't complain that this distorts the composer's intended sound-world, since these scaffolds fall away by the time of the performance. I've coached singers in this against-the-grain way, supplying supporting major triads and drones on the piano that often have nothing to do with the final sounding musical context. They are used as confidence-building references in the practice room, helping the singer get the blunt shape of the phrase 'into their voice' before zooming in on fine details. Anyone with a left hand and a piano can usefully do the same. Because in these contexts the tolerances are so wide, the piano doesn't even have to be particularly well in tune.

A: Time for some new music please.

[536] Mathieu, *Harmonic Experience*, 4.

6.2 Pitching, fast and slow

B: Certainly. Here is the beginning of the second movement of Dvořák's 'New World' Symphony:

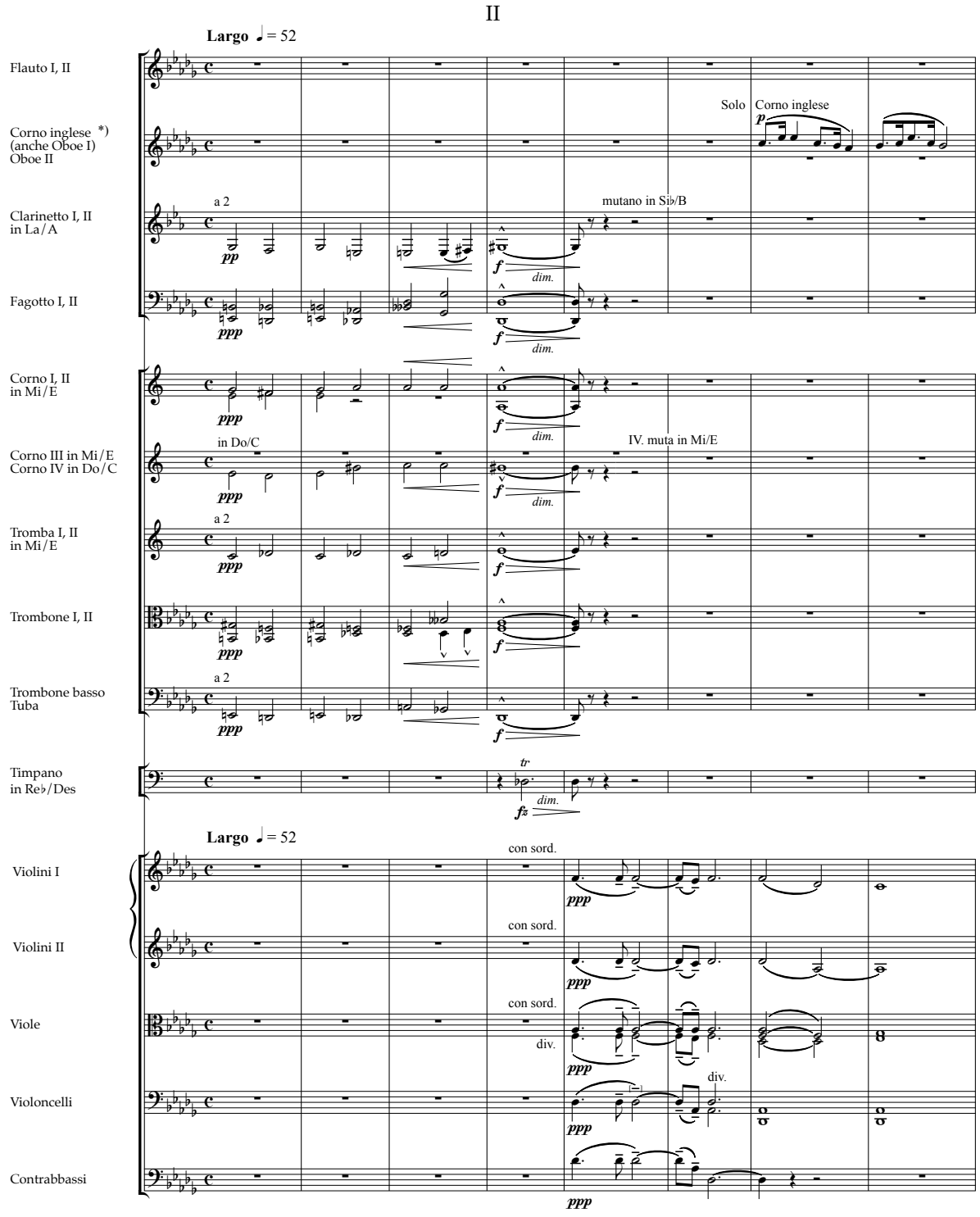

Figure 21: Antonín Dvořák, Symphony no. 9 in E minor 'From the New World' op. 95 (1893), movt. 2, bars 1-8. Edition 'Bärenreiter Urtext,' edited by Jonathan Del Mar (2019). © 2019 Bärenreiter-Verlag Karl Vötterle GmbH & Co. KG, Kassel. Reprinted with kind permission.

B: (*continuing*) The first movement has just ended in a blaze of E minor shot through with plagal flashes of C major. The first E major chord of the brass chorale enters in this resonance, and probably also in a flutter of suppressed applause and coughing. The chorale's main job is to get everyone to settle down before the famous cor anglais solo. To that end its own melodic profile is relatively anonymous. To put it in ABRSM-approved terms, the chorale also modulates from E major to D♭ major, although it does so in a rather curious way, since it reaches the supposed arrival point already on a notionally weak beat in the second bar, after an excursion to B♭ major — a chord that is neither 'home' nor 'away.' Later in the movement the material will be used two more times, also to book-end melodic passages (bars 22-26 and 120-123). In these cases it is harmonically straightened so that it starts and ends on a chord of D♭ major.[537] What matters for our purposes is that this is regarded by orchestral musicians as a tricky passage to play in tune. I've heard a brass player call it 'a bit of a pig.'

A: I know the piece, and I think can see where this is going, so can I take it from here? Most slow, exposed passages with held triads call for special intonational care. But the reason this one is particularly a 'pig' is that, because of the modulation, it isn't obvious what overall tuning strategy to take. To speak 'in C,' should every A♭ equal G♯ and every D♭ equal C♯? And if not, what should they do? People who get ideas about intonation from their eyes and not their ears tell us that this kind of music is the reason why equal temperament 'won.' And they could show convincing-looking evidence for 12-EDO being the right call for performers here. They might point to Dvořák's promiscuous approach to enharmonic notation, here and elsewhere.[538] That comes across in his hurried treatment of transposing instruments: the fourth horn is written in C rather than E for no obvious reason, and later in the movement, as Jonathan Del Mar observes in his commentary to the 2019 Bärenreiter Urtext edition, the trumpets also 'switch, apparently randomly, between in E and in C'[539] — a point not picked up even by the score's proofreader *de luxe*, Brahms. In the manuscript and all editions, the clarinets in A are notated 'wrongly,' with three flats in their key signature rather than the expected four sharps, presumably to save writing an extra signature on the change to B♭ clarinets in bar 11 (the instruments having obviously been retained only to play the low written

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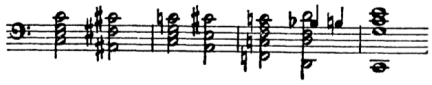
[537] This the order of events in the final score. However, the passage had a complex genesis. John Clapham, in his study of Dvořák's sketches, gives the following chronology: the slow movement's main theme was originally conceived in the D♭ major of the final version, although it is given to the clarinet. Subsequently, 'following [Dvořák's] normal practice, he changed the key when sketching the movement, probably regarding D-flat as too extreme a key to turn to after E minor. He chose instead C major.' (Clapham, 176) It was at this C major stage that the melody was assigned to the cor anglais (!), and that the chords discussed here make their first appearance in the sketchbook. They seem to have been originally conceived in their *unmodulating* form, similarly to the way they appear in bars 22-26 and 120-123 of the score:



The question of how to start the movement came later; Dvořák's solution was to re-use this filler material with a minor tweak: apart from the alteration of the crotchet B♭ to A♮, and the transposition of the passage, only the final chord required changing to create our 'magical modulation' (Clapham, 178.) The status of this as a relatively late-stage decision should not affect our assessment of its significance. A comparison could be made with another transition between a symphony's first and second movements: that of the Symphony no. 5 of Sibelius. The inevitable-seeming *accelerando* passage was added at an even later stage (after the first performance.) John Clapham, 'The Evolution of Dvorak's Symphony "From the New World"' *The Musical Quarterly* 44, no. 2 (1958): 167-183.

[538] E.g. in a piece composed in the same year as the 'New World' Symphony — the String Quintet no. 3 op. 97, movt. 3, variation I. Here, the first violin is offered the unenviable choice between reading six flats or an *ossia* in five sharps, both certainly being intended to sound identical.

[539] Jonathan Del Mar, *Antonín Dvorák, Symphony no. 9 in E minor op. 95 'From the New World': Critical Commentary* (Kassel: Bärenreiter, 2019).

E.) And within the concert-pitch instruments there are several simultaneous enharmonics that might trip up even a seasoned score-reader at the piano, including the B𝄫s against A𝄮s in bar 3 (bassoon 2 and trombone 1) which give the sounding A major chord an odd look, having no written C♯s. And, by the way, we know that Dvořák was happy to demonstrate this piece on the tempered piano on his lecture-tours, and that he very often transposed material between his sketches and final versions — the famous cor anglais solo spent a while in C major! So even from a HIP perspective,[540] all the clues seem to indicate that if you play this in 12-EDO, everything will be fine…

B: Case closed — and yet I think we both agree that the idea of a professional symphony orchestra actually playing this passage in strict equal temperament is highly unlikely. Not because, as Martin Vogel claimed, 'on brass instruments … equal tempered intonation is unattainable.'[541] In fact brass sections can come very close if the players want to. But they won't want to here. The sheer amount of fizziness that would arise from holding these long major chords in equal temperament makes that approach virtually inconceivable. It's a safe bet that the major thirds of some of these chords will slip downwards towards the more static-sounding low-number ratios of the just major triad. It's unlikely that any of the players will have a tuning theory book on their stands, consult an electronic tuner, or attempt to apply any historical theories in this moment.[542] They will be too engaged with playing 'inside' the sounds of their colleagues, and not running out of breath in the effort of maintaining a blended ***ppp***. Being able to blend in a wind or brass section is seen as a key orchestral skill, and fine control of intonation is a major part of this. When a trialling player is rejected with the comment that 'their sound didn't quite fit' (with the polite implication that it might elsewhere), *their sound* encompasses the player's approach to intonation as well as timbre — and without definitional sloppiness, since 'fit' and 'blend' are located at that parametric intersection. Blend means situating one's sound inside the sound of one's colleagues — usually with reference to those playing a lower pitch — so that always implies some kind of non-tempered tuning. The spectral signature of a tuba isn't tempered, so you if need to play a higher note and want to melt into the tuba's sound, your main pitch won't be tempered either.

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[540] Dvořák's own intonational skills and preferences, and the contemporary orchestral practice that informed his tolerances are, of course, finally unknowable. The New York Philharmonic was first recorded in 1917 — 24 years after they gave the premiere of this symphony — clustered around a horn instead of a microphone. The clues referred to here are no more than tantalising hints. Neither **A** nor **B** is trying to make a historical effort, like Flaubert in *Salammbô*, to 'resuscitate Carthage,' since they know that their ears have been irrevocably altered by the music of the intervening century. Unlike Dvořák, they have had the opportunity to hear the aural illusions of Diana Deutsch and Jean-Claude Risset, comma pumps played by a computer, and Auto-Tuned pop music. Even if they attempted such a task, and by some astonishing effort or fluke produced 'the same' audiated pitches as did Dvořák thirteen decades earlier, they would not truly be identical. Like Borges' Pierre Menard, who set himself the task of writing *Don Quixote* from scratch (not simply writing-out Cervantes' text): 'Cervantes' text and Menard's are verbally identical, but the second is almost infinitely richer. (More ambiguous, his detractors will say, but ambiguity is richness).' Jorge Luis Borges, 'Pierre Menard, Author of the *Quixote*,' in *Labyrinths* (New York: New Directions, 1964), 42.

[541] Quoted in Reinhard Kopiez, 'Intonation of Harmonic Intervals: Adaptability of Expert Musicians to Equal Temperament and Just Intonation,' *Music Perception: An Interdisciplinary Journal* 20, no. 4 (2003), 408. Vogel pioneered re-tuning the valves of brass instruments in accordance with just ratios during the 1970s.

[542] Although they might — and not always to good effect. Some players voice strong views about intonation which derive from folk-myth understandings of just intonation (e.g. that the major third of a triad must always be played flatter than 12-EDO, and if it is not, it is by definition 'out of tune.') A representative example is Ory Schneor, 'Ory's Flute Tips,' *FluteInWien*, accessed Sep 2, 2023, https://www.fluteinwien.com/practice-intonation-part-2/. [**Note**: to be redacted before online publication, not in Works Cited.] Such extreme positions recall the words of Alexander Pope: 'A little learning is a dang'rous thing; / Drink deep, or taste not the Pierian spring: / There shallow draughts intoxicate the brain, / And drinking largely sobers us again.' (*An Essay on Criticism:* Part 2, lines 215-218.)

A: I agree that this passage won't be played in 12-EDO. That proposition is really two separate ones. Firstly, I think that the result won't sound 'in' (meaning, close enough to) 12-EDO. That might be put down to mere intonational scatter, or error. Secondly, I don't think the pitch targets that the players are aiming at are those of 12-EDO. The first proposition might be empirically testable by listening to a lot of performances, while the second is less easy to present evidence for — but is surely more important from a musicianship perspective.

B: Yes, it would be nice to be able to point to some evidence here. Maybe you know about Tidhar et al.'s remarkable 'Big Data' project 'The temperament police'?[543] Armed with a dedicated software system that analysed over 2000 recorded tracks, the authors went in search of 'ground truth' about harpsichord tunings in recordings of seventeenth- and eighteenth-century music, being sceptical — rightly, as it turned out — about the reliability of the claims about temperament advertised in the CD sleeves.[544] No comparable survey has been attempted for intonation in orchestral recordings. This may partly be due to the technical difficulty of the task,[545] which would demand impossible-seeming tasks like extracting — from a set of historical recordings! — the first trombone's initial G♯ from the bass trombone's and tuba's E♮,[546] with which it will be spectrally fused to a high degree. But the more fundamental problem would be deciding which yardstick to use. Tidhar et al. could place their harpsichord recordings into categories to which the sounding pitches came closest: Vallotti, quarter-comma meantone, Lehman, Neidhardt, Kirnberger, etc., and evaluate their trueness to their advertised category accordingly. But fixed 'temperaments' don't apply in orchestral practice, do they? Nothing is being tempered away here — there are no pesky commas or dieses to divide up when instruments can dynamically re-tune in an instant, between and indeed during notes. If we were to interrogate the vast number of recordings of this piece,[547] we would certainly discover a lot of sounding pitches that are far from 12-EDO (and don't sound obviously wrong in the context), so while we might

[543] Dan Tidhar, Simon Dixon, Emmanouil Benetos, and Tillman Weyde, 'The Temperament Police,' *Early Music* 42, no. 4 (2014): 579-590. The work was undertaken as part of the collaborative AHRC project Digital Music Lab — Analysing Big Music Data (DML) https://dml.city.ac.uk/.

[544] Their results were highly instructive, both as a document of real trends in temperament preference — for example, they found that the popularity of equal temperament really did nosedive in the 1980s as the HIP movement emerged, then regained some popularity in the following decades — and also as a reminder that there are often significant differences between what we performers claim (or imagine) we are doing, intonationally speaking, and the reality. As they conclude, 'CD sleeve notes are a questionable source of "ground truth."' Ibid., 587.

[545] The 'Temperament Police' project was already working at the limits of the possible, and required the creation of entirely new software tools, since 'although there is a vast literature on frequency and pitch detection, […] many approaches are not suitable for analysing our harpsichord data set, as they are based on assumptions that do not hold in our case' (Ibid., 581.) These common assumptions were that the music is monophonic, the signal is stationary, and each tone is harmonic; furthermore, there were few precedents for frequency estimation to the required resolution of single cents. The task of accounting for the inharmonicity of the harpsichord strings alone merited a separate publication. Harpsichords are, of course, much more timbrally uniform than orchestras, and they do not change their reference pitch mid-note.

[546] Del Mar notes that the tuba, which only plays a doubling role, seems to have been a late addition. It was possibly added after the premiere.

[547] Consulting the CHARM meta-discography (AHRC Research Centre for the History and Analysis of Recorded Music, https://charm.kcl.ac.uk/discography/search/search_freetext.html, accessed Jan 14, 2023) the search string "dvořák AND "new world"" yielded a mighty 254 results. Because this is a catalogue of catalogues, incorporating the data of Alan Kelly, Michael Gray, and F. Clough and G. J. Cuming's *The World's Encyclopedia of Recorded Music*, the search results contain some duplication. The search string "new world" was used due to changes in the numbering of Dvořák's symphonies over time: the symphony was originally described as no. 5, and subsequently no. 8, before Jarmil Burghauser's catalogue established its current status as no. 9 (and B. 178). Whatever the true number of recordings, this symphony is certainly one of the most recorded works of all time.

clearly exclude them from that category, it would be very hard to find meaningful ones in which to put them.

A: And, in any case, no such exercise could answer my second point. We can't reconstruct what was going on in the players' heads and ears in the hope of recovering what they were *trying* to achieve.

B: In lieu of empirical evidence, then, maybe we could try a Dewey-style 'deliberation' (see footnotes 372 and 373 above), offering up different tuning models and strategies to our inner imaginary orchestras? For simplicity let's not discuss how the players physically implement the tuning adjustments, except to note that all the adjustments discussed below are possible, and mostly without major technical interventions in the form of pulling bits of tubing out or shoving things into bells. Ears, not hands and embouchures, are guiding us here. In the interest of readers who, like me, struggle to read in C, A, and E simultaneously, here is the chorale in reduced form — remembering that this involves a significant sacrifice of enharmonic and timbral information, and that our discussion should always be understood as referring to the full score and not to the reduction. I've labelled the chords 1-7, ignoring the passing note for now:

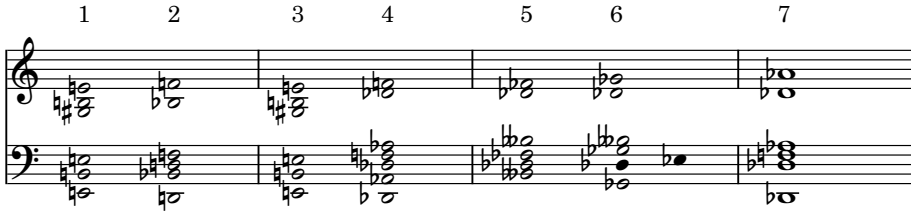

Figure 22: Bars 1-4 of the previous example, pitches only.

A: OK. We've rejected 12-EDO as the target frame, because the major chords sound too active, and we've noticed that the major thirds of the triads — at least, those of the chords in root position (1, 3, 4, 5, and 7) — want to sink. What now?

B: We can clear the decks by briefly imagining two absurd versions, both in naïve JI with a fixed 1:1 — i.e. yoking (five-limit) JI principles onto a twelve-note octave.[548] When James Murray Barbour did likewise in *Tuning and Temperament*, Ross Duffin reasonably took him to task for perpetrating an unhistorical misunderstanding that unfairly consigned just intonation 'to the dustbin of history.'[549] The first uses the starting point, E♮ as 1:1, and the second uses the end-point D♭. The first version is a journey from stasis to chaos, and the second is the reverse. I haven't provided deviations in cents for these examples, for three reasons: 1) such numbering would reinscribe the idea that 12-EDO is the default and anything else is deviant, 2) it would force us to make phenomenologically-questionable pre-judgments about what counts as 'home' and 'away' pitch-centres in a 'modulating' passage (and indeed the assumption that there needs

[548] More precisely, using Ptolemy's intense diatonic scale as extended to the chromatic by (among others) Kyle Gann. This employs the following ratios (ascending in semitones from the tonic, with diatonic scale degrees underlined): 1:1, 16:15, 9:8, 6:5, 5:4, 4:3, 45:32, 3:2, 8:5, 5:3, 9:5, 15:8, and back to 2:1. There are many other possible ways of making twelve-tone scales in JI: see https://en.xen.wiki/w/Gallery_of_12-tone_just_intonation_scales.
[549] Ross W. Duffin, 'Just Intonation in Renaissance Theory and Practice,' *Music Theory Online* 12, no. 3 (2006), 1.

to be a home at all), and 3) they are boring to read. Instead, I give them as a subjective perceptual heatmap. Cool blue means that the chord seems static and unsurprising; hot red means that it is uncomfortable or startling, and purple is something in between:

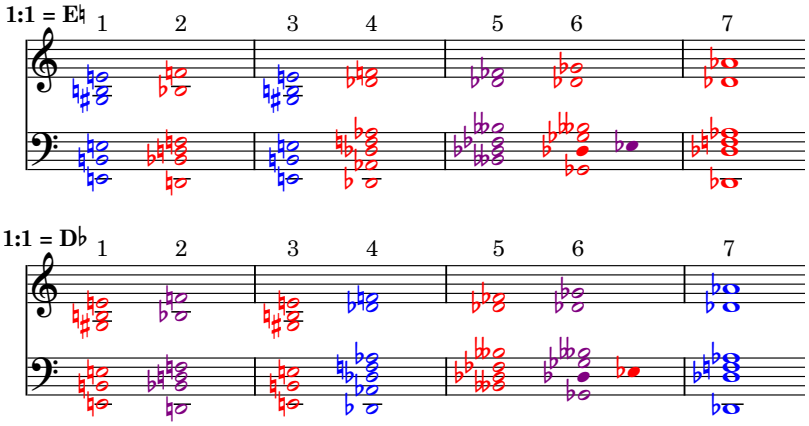

Figure 23: The same passage: two unusable tuning options.

These versions are non-starters for two reasons: the first (and clinching) one being that the 'red' triads beat furiously in both examples, setting off our visceral 'out of tune in tonal performance practice' alarms, and the second is that, when we intervene to fix the problem, the pitch reference of the overall passage will drift. The second reason doesn't matter much in this case, because the timbre change in bars 4-5 of the timpani roll and the entry of the strings is great enough to cover any resulting shock. (But it is an important part of what 'being in tune' means in other contexts — particularly choral ones.)[550]

A: And, of course, there's no practical route that would enable players to achieve either of these versions, even if they wanted to.

B: Yes, but let's not let that hold us back too much, because we're running a thought experiment; we'll come back to real-world tuning later. The naïve-JI versions simply confirm that non-keyboard players

[550] Comma pumps, which demonstrate this phenomenon dramatically, have recently gone from being arcane amusements for Renaissance theorists to online mini-sensations. Adam Neely's 2021 YouTube video *Benedetti's Puzzle (mathematically impossible* [sic] *music)* (https://www.youtube.com/watch?v=TYhPAbsIqA8) has had over 845,000 hits as of January 2024. Art Samplaski has worked out the implications of these effects for singers: Art Samplaski, 'Is It Possible to Sing the Prologue to Orlando di Lasso's *Prophetiae Sibyllarum* in Tune?,' *College Music Symposium* 53 (2013), n.p. He offers an attempt at a formal definition of 'being in tune': 'We can now formally define being in tune. The intuitive concept is, "Sing/play the pitches of the tuning system without going sharp or flat." To formalize that, we need to define more formally "pitches of a system." Here is one possible definition: Let R be a pitch of arbitrary fixed frequency, and O be the fixed pitch an acoustically pure octave higher. A standard tuning system is: 1) a set of N+1 pitches consisting of R, O, and N-1 additional fixed pitches with frequencies between R's and O's that collectively partition the R-O octave into N intervals; and 2) pitches whose frequencies are outside the referent 8ve belong to the system if and only if their frequencies are related to frequencies of pitches in the R-O octave by some power of two. This definition is completely generic: there are absolutely no restrictions on the frequencies of the pitches within the referent octave. It is merely that given a pitch of the system in the referent octave with frequency *f*, the pitches at frequencies 1/2*f*, 2*f*, *ad infinitum* are also members of the system. Thus, JI, 1/4-c MT, Javanese slendro, and a scale containing seventy-three pitches with spacings determined by rolling Dungeons & Dragons dice are equally legitimate…' Samplaski declares, essentially, that anything is in tune that has not drifted from its declared reference frame. Although his definition is internally consistent, it diverges so far from musicians' practice that it stretches the term beyond practical application. Jocelei Bohrer, in 'Intonational Strategies in Ensemble Singing,' (doctoral thesis, City University, London, 2002) came to a different conclusion. Bohrer dares to suggest that intonational drift during an *a capella* performance might not be so catastrophic after all; locally-appropriate choices may trump the imperative for C major at the beginning of a performance to be the same as C major at the end.

actively adjust intonation during a passage. To show that vividly enough we could have chosen any passage that shifts to the mediant or submediant — take your pick from the music of Schubert, Mahler, or John Coltrane. Dealing with these problems on keyboard instruments — all of which ultimately arise from what Kyle Gann calls the 'cosmic joke'[551] — is why temperaments were invented. Thanks to technology we could now play the passage on a synthesiser in any imaginable temperament,[552] if we wanted. But that doesn't help here, of course.

A: So we seem to be talking about some kind of adaptive just intonation…

B: I'll note as an aside that, in coming to that conclusion, you've raced through about three thousand years of tuning theory. (Sabat and Nicholson, in 'Fundamental Principles of Just Intonation and Microtonal Composition,' offer a more sober historical treatment.) But yes, it might seem to call for adaptive just intonation — a tuning strategy where the 1:1 reference moves dynamically. And once again, technology offers to ride to the rescue. Researchers at the University of Würzburg have developed sophisticated software that allows the performer 'to play music in just intonation in any key' by 'continually [solving] a system of linear equations, rather than relying on sequences of conditional if-then clauses,' while finding 'reasonable compromises for self-contradicting chords such as the diminished seventh that cannot be tuned consistently in just intonation.'[553] The software is directly playable as a plugin for a keyboard, but could be readily adapted to provide in-ear references for live instrumentalists — an orchestra playing this chorale, for example. Since the authors put so much effort into solving exactly the kind of problem that we have identified, I hope you don't mind if I quote them at length:

… the system of equations may be viewed as a resistor network or as a mechanical network of springs representing interval sizes. Roughly speaking, each spring prefers to relax into a state where its length corresponds to the natural size of a pure interval and it will do so whenever possible, producing a chord in just intonation. If the spring network is so complex that it is impossible for all springs to simultaneously be situated in their tension-free state, the system will approach a nontrivial state under tension, representing a tempered harmonic compromise. This happens

[551] Gann, *Arithmetic of Listening*, 9. To put it more formally: music that is both chromatic and triadic falls prey to '… the fundamental mathematical problem that multiplication and prime numbers are incommensurate in the sense that powers of prime numbers never yield other simple prime numbers […] Mathematically speaking, the concatenation of just musical intervals (by multiplying their frequency ratios) is an operation that does not close up on any finite set of tones per octave.' (Stange et al., 48.)

[552] Quarter-comma meantone sounds inoffensive enough to me, but theorists are always at hand to propose improvements. Paul Erlich, in 'A Middle Path Between Just Intonation and The Equal Temperaments,' *Xenharmonikôn* 18 (2006): 159-99, offers 'a variety of 2-dimensional temperaments': meantone-like temperaments that fall between the single dimension of any equal temperament ('each of its intervals being constructible by repeatedly stacking the smallest step') and the three-or-more dimensions of JI ('a set of at least three basic intervals (such as the prime intervals 2:1, 3:1, 5:1 […]) is needed in order to be able to construct any interval of the system.') All such attempts seem to be motivated by the assumption that JI is invariably the grail, and that the only problem is the quest is arduous. As Duffin sternly puts it, 'any choice of meantone temperament is a trade-off between musical quality and convenience' (Duffin, 'Just Intonation in Renaissance Theory and Practice,' 5) — i.e. get off that food delivery app and go scrub the greens from your allotment!

[553] Karolin Stange, Christoph Wick, and Haye Hinrichsen, 'Playing Music in Just Intonation: A Dynamically Adaptive Tuning Scheme,' *Computer Music Journal* 42, no. 3 (2018), 47. The article provides a comprehensive historical overview of the many previous attempts to implement dynamic just intonation using technology. The team's app is simply called *Just Intonation*. Karolin Stange, Christoph Wick, and Haye Hinrichsen, 'Just Intonation Documentation,' *Just Intonation*, accessed Dec 2, 2022, http://doxygen.just-intonation.org.

automatically, without making any explicit conditional decisions and may resemble the way in which musicians find the best possible intonation.[554]

A: What an technical achievement — and what a claim! From the way you read it out, I'm guessing you added the emphasis.

B: Well, yes. I tried the software with the Dvořák chorale (using a few different synthesised instrumental choices) some chromatic passages from Bach's 48, and a few of my favourite shifts to the mediant and submediant in Schubert's *Impromptus*. I heard a succession of sweetened chords in the foreground, while in the background the pitch reference was moving against my armature in a seemingly arbitrary way that after a while made me feel quite seasick. Since I couldn't predict or aurally keep up with the changes, the overall effect resembled a digital blur applied to my playing:

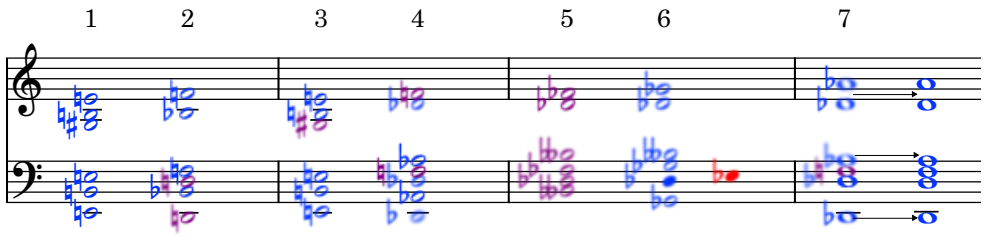

Figure 24: The same passage: technology to the rescue. Psychological impression of horizontal/vertical tuning decisions made by an algorithm. Tempo choice: ♩=48.

Three centuries ago, Christiaan Huygens had warned about this exact problem:

For if you ask any of our Musicians, why two or more perfect fifths ['perfect' meaning here the ratio 3:2] cannot be us'd regularly in composition; some say 'tis to avoid that Sweetness and Lushiousness which arises from the repetition of this pleasing Chord: Others say, this must be avoided for the sake of that variety of Chords that are requisite to make a good composition; and these Reasons are brought by Cartes [Descartes] and others. But an Inhabitant of Jupiter or Venus will perhaps give you a better reason for this, viz. because when you pass from one perfect fifth to another, there is such a change made as immediately alters your Key, you are got into a new Key before the Ear is prepared for it, and the more perfect Chords you use of the same kind in Consecution, by so much the more you offend the Ear by these abrupt Changes.[555]

The superior 'inhabitants of Jupiter or Venus' had evidently read up on their theories of categorical perception! They had recognised that it is the *speed* of changes that 'offend[s] the Ear' (we might say 'inhibits the formation of perceptual categories'), rather than the changes themselves. While we can't know the exact threshold point at which Huygens' ear took offence (the moment his ear became **lost**) in the hope of comparing it to our own, we can be confident that some such threshold is a common feature of our audiative experience — or indeed any activity where our ability to categorise, then act on the results of that categorisation, is put under time pressure. Huygens is describing a **clock→cloud transition point** (5.4).

[554] Ibid., 51.
[555] Christiaan Huygens, *Cosmotheoros* (1695). Originally in Latin. Text given is the anonymous English translation of its first publication (London: Timothy Childe, 1698), vol 1, 88-89. Accessed online at R. H. van Gent, ed., *The Cosmotheoros of Christiaan Huygens*, accessed Mar 2, 2023, https://webspace.science.uu.nl/~gent0113/huygens/huygens_ct_en.htm.

The constant, unpredictable moves of the algorithm had accordingly clouded my clock and robbed me of the chance to make expressive sense of the instrument. I couldn't transform it from 'present-at-hand' object to 'ready-to-hand' equipment (1.2.8.) Whatever exactly was going on under the hood of the app, it certainly didn't reflect how this particular musician finds 'the best possible intonation'…

A: So the software's temporal window of reference is like its short-term intonational memory. I imagine that they used empirical studies on intonational memory to inform the width of the window, then?

B: Naturally.[556] The wider musical context wasn't considered, but then how could it be?

A: Back to our real imaginary orchestra then. How about a compromise version that needs less maths? Let's embrace the xenogamy that Partch rejected and tune the roots of all the chords in equal temperament, then stack just triads on top of them. After all, we always like to tune to the bass, and here the root is in the bass, except in chord 2. If we drew this as a heatmap, every chord would be blue, but there'd be some red marks of discomfort between the chords:

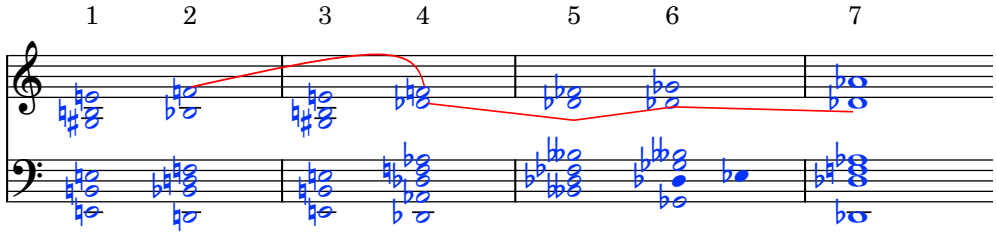

Figure 25: The same passage: xenogamy.

B: I think that corresponds quite closely to default orchestral practice in these contexts,[557] if only by eliminating intonational drift and so allowing the players of the bassline to rest on their (engineered-

[556] 'We perceive combinations of tones as "in tune" or "out of tune" if they are played simultaneously, but we are also aware of the intonation of sequentially played tones, as long as the intervening time between successive pitches is not too long (see, e.g., Milne, Laney, and Sharp 2016). It is apparent that our sense of hearing is able to memorize sounds and their spectra for short periods of time. In empirical studies it was found that this psychoacoustic intonational short-term memory is characterized by a typical time scale of about 3 seconds (Wittmann and Pöppel 1999; Lehmann and Goldhahn 2016).' Being aware of the risk of giving a fixed value to the app's window of reference, the team added calculations that attempted to incorporate the imagined recognition time of a pitch, ascribing greater intonational influence to longer notes and less to shorter, faster ones. They propose, without evidence, that 'Among musicians […] it seems that values in the vicinity of 1 second are a reasonable choice.' In fact, in the advanced settings of the app the reference window may be adjusted. However, once the setting has been chosen, the selection of the reference material is henceforward undirected by expressive intention. This is the source of the 'digital blur' impression; once the diameter of the 'blur brush' or memory window has been pre-selected (a short selection window resembling a narrow brush, and vice versa) no further live intervention is possible. In its fascinating and useful failure, the app elegantly demonstrates that the live selection of this window is a defining feature of expressive tuning.

[557] In the interests of simplicity I make no reference in the dialogue to yet another meaning of 'in tune / out of tune': whether our imaginary orchestra achieves (or wishes to achieve) *internal* vertical intonational agreement within a particular pitch-class. For example: should all simultaneously-sounding G♯s correspond? I have assumed in the Dvořák example that they should, but this is not at all always the case (see the Mahler example below.) The expectation of vertical agreement is also yet another largely-unexamined assumption about what constitutes good (or, professional) orchestral practice. The assumption also holds for the performance practice of other instrumental groupings. For example, Jeffery Kite-Powell rails against doubling of pitch-classes (such decisions in Renaissance music often falling to the performers, rather than to the composer): 'In a large recorder ensemble … players are often required to play a line that is being played by at least one other player. This is rarely very rewarding for anyone involved, except perhaps for the pedagogical assistance a lesser player may receive by doubling a more accomplished player. Tuning problems are inevitable, articulation is difficult to coordinate, and the playing of rapid passages is often unclean—and these are areas that are difficult enough when there is only *one* player on a part!

tempered) **frets**. It sounds OK to my mind's ear, but, as you say, it does have some awkward spots. The most prominent problem is in the top line. In any orchestration this would sound to the foreground, and the melodist Dvořák gives this line extra attention by scoring it for two unison trumpets — ***ppp*** please! The difference between the top line's F♮s in chords 2 and 4 is a very noticeable 16 cents (about a twelfth-tone.) That isn't a problem in itself. What bothers me is that the F♮ in chord 4 is *lower* than the one in chord 2. And that contradicts the overall expressive direction of the melody, because the E♮-F♮-E♮-F♮ alternation in bars 1 and 2 isn't mere noodling but rather a pulling-back of the arrow string to unleash the glorious crescendo that follows. That's what that strange initial motion to B♭ major is doing — ratcheting up the tension. And with that in mind, our treatments of the E majors of chords 1 and 3 shouldn't be assumed to be identical, because chord 3 is heard 'after the knowledge' of the B♭ major. Following the expressive direction of the melody, the F♮ in chord 4 actually seems to want to push *higher*…

A: That's an example of the well-known conflict between vertical and horizontal priorities in intonation. All detailed tuning resources (e.g. those by Christine Heman[558] and Kurt Sassmanshaus[559]) address this. For example, Sassmanshaus recommends that violinists play melodies with a 'Pythagorean' flavour (i.e. making a big difference between major and minor thirds, and playing leading notes high) but double-stops in JI. And it's well understood that there are many occasions where you can't take both approaches and you have to either choose one, or take some kind of middle path. Many teachers do likewise — one of mine did — even if they don't phrase it in those systematic terms. This conflict is the reason these resources and teaching approaches were created; if it didn't exist we could put stickers on our fingerboards and move on.

B: Yes. Although I'd note that the examples in tuning manuals — which are almost invariably written by flautists for flautists, or by guitarists for guitarists and so on — usually show the conflicting pitches as being consecutive rather than temporally separated, as they are here. Notwithstanding the intervening chord, I hear the F♮ in chord 4 of the 'xenogamy' version not only as unduly doleful, but also too obviously 're-tuned.' I don't think this passage should sound like a lecture on tuning! There are other linear problems with the version, but they are easier to surmount: the clarinets would need to adjust the intonation of their lowest note (not easy to achieve, although the clarinets will surely never call the shots in this passage), and the seemingly meaningless intonational meander of the four consecutive D♭s/C♯s in the first horn in chords 4-7.

A: OK, so what's the answer?

Doubling a player at the same octave by the same instrument in a performance situation just is not a sound idea and should be avoided at all costs. It is highly unlikely that parts would have been doubled in this manner in the Renaissance, and it is not necessary that it be done now either' (my emphasis.) Jeffery Kite-Powell, 'Large Ensembles,' in *A Performer's Guide to Renaissance Music*, ed. Jeffery Kite-Powell (Bloomington: Indiana University Press, 2007), 250. These prejudicial terms — 'problems,' 'difficult,' 'unclean' — bear witness to the assumption I have identified. Kite-Powell is clearly immune to the sonic charms of large groups of doubled performers playing in near-unison, such as the deliciously thick texture of performances by the UK's National Youth Orchestra (which habitually doubles many of its brass and wind lines) and the fascinating stochastic buzzing of massed Suzuki-method violinists playing *Twinkle, twinkle, little star*.

[558] Christine Heman, *Intonation auf Streichinstrumenten: Melodisches und Harmonisches Hören* ['Intonation on string instruments: melodic and harmonic listening'] (Basel: Bärenreiter, 1964).

[559] Kurt Sassmanshaus, 'Which System?,' *The Sassmanshaus Tradition for Violin Playing*, accessed Sep 13, 2023, https://www.violinmasterclass.com/posts/152. This and Heman's text are discussed in Benjamin, 'Thick Relationality,' 92-94.

B: I think you've worked out that finding *my* favoured tuning strategy for a few chords of Dvořák isn't the point of this discussion! If you feel frustrated not to get an answer, here's a version that I like — i.e. one of many possible right answers. I've abandoned colours in favour of a 'recipe' approach to the tuning of each chord; that is, I give a sense of what I'm aiming to achieve, and some (necessarily incomplete) pointers on how this might be done.[560]

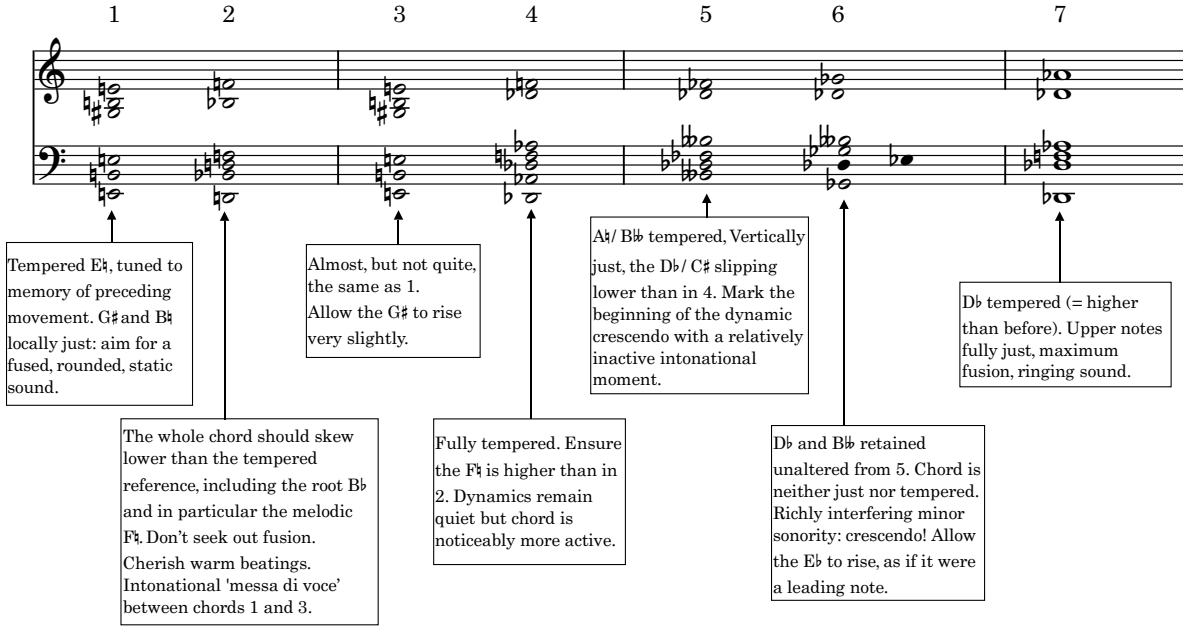

Figure 26: The same passage: one more time, with feeling.

There's nothing earth-shaking about it; it's essentially the 'xenogamy' strategy you suggested with a tweak to smooth out the melodic problem. I've also inserted a couple of 'slices of wolf'[561] (inspired by the versions in naïve JI) like an intonational crescendo to relieve the boredom of too much low-ratio 'Sweetness and Lushiousness.' I've used them to align my tuning strategy with the overall expressive direction of the chorale as I see it — to make the intonation play nicely with the dynamics and the harmonic logic.

A: So what is your point then?

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[560] And what happens after our few chords? The rules of the game change: a cloudburst of percussive inharmonicity breaks out with the ***fz*** timpano roll, and from it emerges a hazy shimmer of strings — some muted, others not, the violas (Dvořák's instrument) richly doubling the third of the chord in ravishing divisi. The roll is an orchestrational masterstroke, functioning like a ripple dissolve in film editing to move the strings' position, as they emerge onto our mental soundstage, to 'far away and long ago' — and incidentally to conceal any awkwardness resulting from potential differences in intonation between the wind and brass and the strings. Haas' 'twelfth-tone spread' rule of thumb is here a minimum: in this case, in ***ppp*** with a discreet vibrato, the contact point of bow on string tending towards *sul tasto*, on a rich chord of D♭ major that finds little supportive confirmation from the natural resonances of the string instruments, I would expect and welcome a wider spread. Certainly, by the time the cor anglais enters, considerations of ensemble intonation are largely behind us; a very obvious solo-accompaniment situation prevails, in which the cor anglais player — in splendid isolation — will probably cleave to 12-EDO or may even push their major thirds (the sounding F♮s) a touch higher still (this will most likely be perceived as a warming or smiling effect, rather than, say, a 'local adoption of Pythagorean tuning.')

[561] Charles John Smyth commenting on Kirnberger, quoted in van Eck, 'A good servant,' 36. The full quotation is: 'When we hear an organ tuned in this manner [meantone temperament], we may consider ourselves at a feast, in which there are dishes of various qualities; while in M. Kirnberger's feast of exquisite viands, but eight dishes are very palatable, and those who are fond of sour crout and olives, and, like many of our best composers, have no objection to a slice of wolf, though they would not choose to dine entirely upon that outlandish animal, have an opportunity of gratifying their peculiar palates.'

B: I think we can draw an initial conclusion, which has some wider implications. By exhausting the available reach-down options (including the hi-tech dynamic tuning 'solution') we can conclude that tuning is always an expressive act: that is, it's *expressive by obligation* to sensitive musicians, because the alternative is to be insensitive. (I should have added that we've already done **triage** and determined that the careful placement of pitch is a clear priority in this context.)

A: What do you mean by 'expressive'?

B: By expressive I don't just mean local deflections from a fixed frame of reference. That line of cognition-in-action was developed by Pablo Casals and many others. When Casals talked about 'la justesse expressive' he was justifying a soloist's right to diverge from the tuning of an accompanying piano. He told his students, 'Don't be scared if your intonation differs from that of the piano […] It is the piano that is out of tune.'[562] Casals was addressing a twentieth-century audience and clearly expected (and indeed received) resistance from equal-temperament diehards and sceptics who felt he was justifying wayward behaviour. In the microtonal-intonational soup we swim in today, that's less of an issue. We have the opposite problem of not having an assumed reference frame from which we can expressively deviate. My notion of expressive tuning does include Casals-like deviations from a fixed frame, but might also involve the expressive interaction of systems themselves.

A: You've lost me there.

B: Understandably. Here's an example from another 'new world'-like moment — the beginning of Mahler's Symphony no. 1, marked *Wie ein Naturlaut*:

[562] Samuel and Sada Applebaum, *The Way they Play*, vol. 1 (New Jersey: Paganiniana Publications, 1972), 272. The intrinsic tension identified by Casals may underly this statement by Stravinsky: 'For many years I had taken no pleasure in the blend of strings struck in the piano with strings set in vibration with the bow.' Igor Stravinsky, 'Some Ideas about my Octuor', quoted in Eric Walter White, *Stravinsky: The Composer and His Works* (London: Faber, 1966), 372.

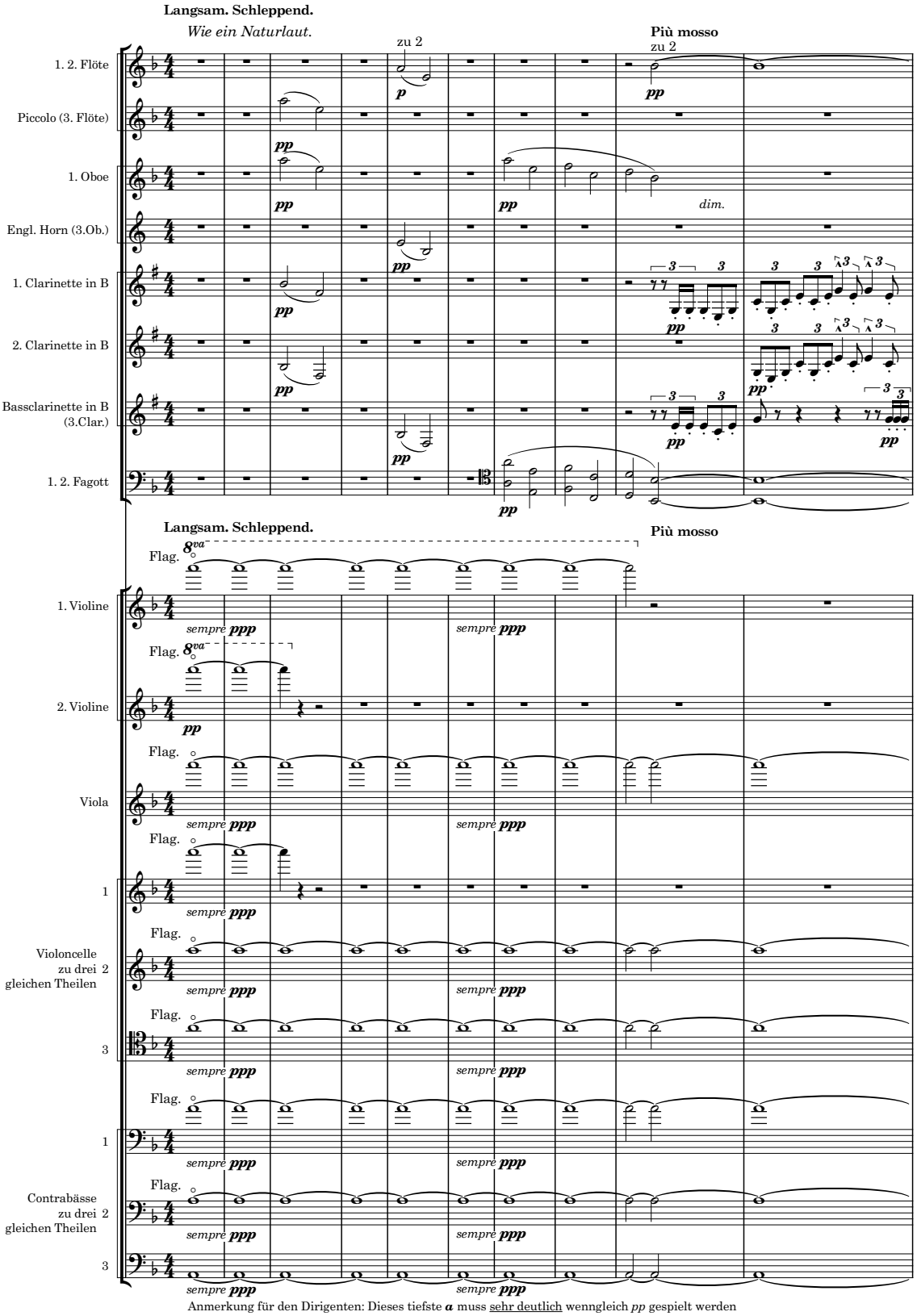

Figure 27: Gustav Mahler, Symphony no. 1 (1887-1888), movt. 1, bars 1-10.

According to the conductor and blogger Kenneth Woods, this is 'possibly the most difficult passage for intonation not only in all of Mahler's output, but in all the symphonic repertoire.'[563] Describing the difficulty wind players encounter in locating the E♮, which is approached melodically as a fourth that descends from and yet is held within the stack of A♮s in the strings, Woods sees the string background as posing a daunting intonational challenge — and not one whose solution is found in 12-EDO:

> Mahler has created a pedal point of As several octaves deep, completely without vibrato, which creates something like a mile-high wall of overtones - each A not only contains its fundamental pitch, but every note of the overtone series above it, most strongly Es. That means that all those resonant pitches want to lock in in all those octaves. He has us aiming for an extra small target.

Both the A♮ and the E♮, Woods declares, 'must perfectly match the pitch in the pedal — the E in the winds must be the same as the overtone E in the strings.' The pitch targets are indisputable: you hit them or miss them.[564] I'm not so sure. Unlike in the Dvořák chorale, which cried out for blend, here I am not desperate for the E♮ or even the A♮ of the winds to dissolve into, or emerge from, the string sound. In performances where players do 'nail it' in this way, the subsequent F♮s, C♮s, and D♮s (which are less derivable from the overtone series of A♮) sound overly alien — a status I would prefer to reserve for the shocking B♭ in bar 9.

A: Ahem… you were talking about 'the expressive interaction of systems'…?

B: Yes! I mean that I'd like to hear the wind playing in strict 12-EDO here, rubbing up ever so slightly against the spectral background of the strings. I want to experience the phrase as it recurred in my dreams as a teenager: a symmetrical, hypnotic Jacob's Ladder with seemingly infinite potential to fall and rise. (And I don't want the wind players to creep in, cautiously matching their pitches to the strings, but to enter with serene assurance on their tempered frets.) Nor do I hear the strings as a static 'mile-high wall.'[565] On stage or sitting in the hall — not when listening to a recording — I hear constant micro-fluctuations glinting from every corner of the string section. Mahler has tried to evoke a zero-sound of raw potential here (a real initial A!), and physicists tell us that Nature at its zero-point is comparably a shimmering vacuum frothing with particles coming in and out of existence, which somehow locks within it vast potential energy. Or, if you prefer a different kind of field, the glinting intonational differences are like the sparkling dewdrops in the *Feld* described in Mahler's poem, the setting of which provides the main theme of this movement.[566] In

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[563] Kenneth Woods, 'Performer's Perspective- Mahler 1, a challenge,' *Kenneth Woods*, 13 Jan, 2010, accessed 20 Feb, 2023, https://kennethwoods.net/blog1/2010/01/13/performers-perspective-mahler-1-a-challenge/.

[564] Nevertheless, he shows mercy; the failure of 95% of performances (in his experience) to 'nail it' is evidence for a deliberate preference for fragility ('the fragile first shoots of green after a long winter') on Mahler's part as an experienced composer-conductor. This is an intriguing view of Mahler as member of the Wandelweiser collective *avant la lettre*.

[565] Even if the written pitches alone were imagined to be sounding and not their overtones, the extremity of the registral span (from A♮1 to A♮7, or roughly 55 to 3520 Hz) takes us outside our **workzone** and far into psychoacoustic bandit country. These are the areas in which — to give an example of disagreement among intonation professionals — piano tuners differ in their use of stretched octaves to compensate for the inharmonicity of a physical string. The empirical Railsback curve implies a potential perceptual disagreement of as much as 30 cents between A♮1 to A♮7.

[566] 'Und da fing im Sonnenschein / Gleich die Welt zu funkeln an; / Alles, alles, Ton und Farbe gewann! / Im Sonnenschein!' An over-literal translation: 'And then began, in the sunshine / at once the world to sparkle / All, all took on tone and colour / In the sunshine!' Schoenberg's *Farben* (1909) from the *Fünf Orchesterstücke*, op. 16 seems very close at hand; we are trembling at the brink (*Schwankungen am Rand*) of new music.

any case, the details of the differences between how a couple of conductors approach a passage don't really matter. What matters is that difference is possible, and that intonation is one of the tools we can use to turn these differences into sound.

A: And that you might make an *expressive* choice to play in 12-EDO![567] Not simply default to it out of expediency.

B: Yes. This conception of systemic expressivity is not at all like what notation programmes do when they offer to 'humanise' playback by adding deviations to an existing grid (whether of tempo or of pitch.) We might make the expressive choice to be *more* rigid and machine-like in our performances. We might choose to make our pitches or our rhythms 'snap to grid.' That kind of choice often feels appropriate in new music, as we'll discuss below. But any such choice should always be made with the consciousness that alternatives exist. This is a matter of informed consent (3.1, 4.2., 5.4): I *choose* to restrict myself in a certain way.

A: You talked about the 'wider implications' of this notion of systemic expressive intonation…

B: Composers have already put different tuning systems into expressive opposition. For example, in Sarah Nemtsov's *running. out of tune* for two harpsichords and electronics (2013) the composer asks for one harpsichord to be tuned in equal temperament, and the other in meantone. In that case the compositional material grows from the fissures between these systems (there's some extra detuning, too). Performers can do likewise, if we see fit, but our interventions are likely to be more local, dynamic, and adaptive. To return to the Dvořák — when we were weighing up the pros and cons of different tunings, we were avoiding an elephant in the room: *tempo*. The choice of tempo in the chorale has profound implications for the choice of a tuning strategy. Broadly speaking, the slower you go, the more you hear the vertical aspect, and so you'll probably favour the chords sounding (locally) just and static. If you go faster, you'll tend towards a more tempered solution that smooths the top line and makes the major chords sound fizzier and more active. In almost all orchestral contexts this is not a matter of conscious choice but rather a reflex. You can hear this at work in the Dvořák in a very rapid and very tempered online lecture-performance by Gerard Schwarz and the All-Star Orchestra.[568] The composer Donnacha Dennehy writes, in his programme note to *Grá agus Bás* for singer and ensemble (2006-7), '[b]asically, it [the piece's harmonic language] is usually equal-tempered when it is harmonically mobile, and just-tuned when it is harmonically static.' Dennechy has written down and 'composed-in' something that is a general performing tendency. In the Dvořák it would be quite implausible — but I suppose, possible — to cross over those expressive-parametric directions and play a fast JI-flavoured version or a slow 12-EDO one.

[567] A fully 12-EDO version of Mahler's *Naturlaut* may actually be heard thanks to a software engineer for Daimler Trucks, Reinhold Behringer, who expresses his love for Mahler by creating computer 'renditions' out of single samples. His version, for which the credited performer(s) are/is the VPO — the 'Virtual Philharmonic Orchestra,' places Mahler's *Feld* squarely in the uncanny valley. Behringer's version, which may be described as an example of digital outsider art, uses the sample bank Garritan Personal Orchestra 4, which does in fact permit micro-tuning; nevertheless, he left the samples in their default tuning. Reinhold Behringer and Julius Eiweck, "'Wie ein Naturlaut' and Created with a Computer" (unpublished, 2011.)

[568] Gerard Schwarz, *Dvořák 9th Symphony: Musical Analysis*, YouTube, Jun 11, 2014, accessed Sep 17, 2023, https://www.youtube.com/watch?v=olkflAslkxI, 10'08".

A: And the movement is, famously, the '*Andante* from the "New World Symphony"'… or was it the *Larghetto*…?

B: Yes, the story of how Dvořák progressively slowed the indicated tempo of what eventually became the *Largo* has been often told, but usually with reference to the famous cor anglais solo.[569] His metronome markings also slowed from ♩=60 to ♩=52, and while the solo is often played in that tempo region, the chorale is almost always taken slower. Deciding where the players breathe is inextricably linked with the choice of tempo; a downwards death spiral is possible (the slower the tempo, the more players need to breathe, so the slower the tempo…) The slowest performance I know of is Sergiu Celibidache's 1985 live recording with the Munich Philharmonic,[570] in which the brass players were obliged to breathe four times in these four bars. Five days after that concert, Celibidache gave a lecture at the University of Munich on 'Musical Phenomenology.' In an implicit defence of his tempi,[571] the conductor employed the Sanskrit term *ekāgratā* ('one-pointedness') to emphasise the value of intense concentration on a single object. It's not a coincidence that Celibidache was Rădulescu's enthusiastic referee.[572] When I try to replicate the passage at Celibidache's glacial tempo, it pushes against the limits of my **workzone** and creates a **clock→cloud transition point**. Unlike the previous examples of this I've given, which have involved information that is arriving too *fast* to process, here the information is coming in too *slowly*. It's so slow that I lose my horizontal fine pitch sensitivity; I can't **bend** and am obliged to **root**, which is exactly what Celibidache wanted (but not me.)

A: *Wider* implications, remember!

B: OK, I'll spell it out. When we work on tuning in orchestral contexts, and most new music ensemble contexts too for that matter, we are invariably encouraged to slow down. That's how wind and brass sections tune chords — they hold the thing they are tuning until it sounds acceptable. And *acceptable* almost always means reducing the perceived inner activity of a chord. There are two steps to this, although in practice they may happen at the same time. Firstly, all players who have the same written pitch (or pitch class) recognise the fact, move towards unanimity and fuse into a layer: *oh, are you on the C♯ there as well?* [swift adjustments follow, then nods of agreement.] Then the chord is built up from these layers. Although wind

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[569] Ibid.

[570] Antonín Dvořák, Symphony no. 9 in E Minor, op. 95 (B 178) 'From the New World,' Munich Philharmonic Orchestra, cond. Sergiu Celibidache, 16 June 1985, Herkulessaal der Residenz, Munich. Released as MPHIL 9305211237, 2017, CD.

[571] Defence was necessary, since at this time the 'authentic performance' movement had not yet softened into HIP, and rhetoric could be extreme: 'In matters of tempo Celibidache can be incomprehensibly arbitrary, inconsistent, and illogical … How any man of Celibidache's intelligence can indulge himself in such distortions of the composer's intent is hard to fathom. Since it cannot be ignorance of the facts, it must be ego and arrogance…' (Schuller, *The Compleat Conductor*, 242.) In his defence, Celibidache invoked Furtwängler as an authority, recalling the following exchange between his younger self and the elder conductor: "'Maestro, this transition in this Bruckner symphony - how fast is it? What do you beat there?" "What do you mean by 'how fast'? he replied. "It depends on what it sounds like! When it sounds rich and deep I get slower, when it sounds dry and brittle I have to get faster." He adjusts according to what he actually hears! According to the actual result, and not to a theory! "92 beats per minute." - What does "92" mean in the Berlin Philharmonic, and what does it mean in Munich or in Vienna? What nonsense! Each concert hall, each piece and each movement has its individual tempo which represents a unique situation.' Carlo Lionetti, *Celibidache's phenomenological view of music: A short analysis of the Romanian conductor's thought and his practice* (Vienna: AV Akademikerverlag, 2015).

[572] Bob Gilmore, 'Spectral Techniques in Horatiu Radulescu's Second Piano Sonata,' *Tempo* 62, no. 252 (2010), 71, footnote 14.

and brass sections have various methods for how they go on to build triads (some build them up in ascending pitch order, while some prefer to establish the root, then the fifth, then add the major third), and although experienced players will adapt their method to the context (coaching a youth orchestra would entail a slower process, and so on) they all share this basic heuristic. But this kind of groupthink, which is usually just called 'relying on our ears,' doesn't work in this case.

A: Because the slower you work, the more you impose the 'Celibidache effect,' and the careful work we've done to make the intonation match the other expressive parameters would be undone.

B: Exactly. It requires intense aural effort to maintain a highly active interval for a long time, and you'd need to do that to implement the tuning option I suggested, or any similar option.

A: You mean a dissonant interval.

B: There is so little agreement about the meaning of the consonance / dissonance opposition that I can't find much use for those words. A tempered major third sounds more active than a just one, so I'll use that term instead. Maintaining an active interval requires the injection of energy. Fighting against gravity is tiring. But it is a useful skill. Bending often leads to these kinds of intervals. This kind of small adjustment can be imagined as a plastic spudger — a humble-looking tool that you use to pry things open. In the case of the tempered versus the just third it is the gap between two systems of intonation. Thinking in terms of cents (a deflection of 14 cents) is of little use to us of course; we're not computers.

A: So if the normal way of working doesn't apply, what does? It was all very well for the soloist Casals to declare himself expressively liberated from the piano (because 'it is the piano that is out of tune'), but here we have fourteen musicians plus the conductor (does the conductor count as a musician?) In professional orchestral contexts — unlike in radical experimental ensembles like the Scratch Orchestra or the Portsmouth Sinfonia — they can't all be liberated from each other. Someone will need to decide the strategy, it seems — but who?

B: I'll bet good money it won't be the conductor, particularly if they've only been invited for that project. Since in orchestral contexts the binary opposition in / out of tune (= *juste*/*faux*, *rein*/*falsch* etc.) prevails, and since collegiate rehearsal methods are increasingly in favour, it's unlikely for a conductor to take the risk of being perceived as a schoolmasterish micro-manager. Grander maestros may even feel that such janitorial work is beneath them. If anyone takes the intonational lead, it's more likely to be a dominant musician from within the orchestra. The trouble is that the conductor (mostly) sets the tempo. So two musicians might potentially be pulling in different expressive-parametric directions. That is why the passage remains 'a bit of a pig.' It is an example of an **intrinsic ensemble difficulty**.

A: Remind me what you mean by that.

B: Intrinsic difficulty is shorthand for quasi-intrinsic difficulty, because it could be resolved if the circumstances were ideal. It arises where a musical situation gives rise to an ensemble conflict and no obvious voice emerges to resolve the conflict. The rhythm examples in 2.3.4.1 were of this kind. They were located at the cracks between two reference systems: in that case, between the mode of 'feeling together' in a **groove** and the leader-follower mode. I likened them to the handover of a baton between members of a relay team. And that is often fumbled, even at the Olympic level. Runners are trained to run in their lane, and musicians to stay in a consistent performing mode (remember the unhelpful rhetoric of flow that Montero criticises? (4.2)) Intrinsic difficulties aren't the same as **workflow difficulties**. Those are difficulties where the target is clear and certain, but there are obstacles in the way. Kenneth Woods was describing a workflow difficulty, although an admittedly delicate one.

A: Solutions please!

B: An intrinsic difficulty should be dealt with by a **caretaker**. A caretaker's job would be to seek out and help trainees fill gaps, and to help them deal gracefully with handovers between systems of reference. But this is not yet a well-defined professional role, even though some people with heritage job descriptions are starting to re-conceive their responsibilities in this way (3.3.)

A: So you don't have a solution?

B: Not to the Dvořák 'problem' itself, nor do I think it is a major problem in the context of how orchestras work with that symphony. It's only a few chords before the big tune, after all. It's a thought experiment, which I chose with the hope of prying open some gaps in the assumptions that underpin our musical habits. (John Cage reminded us that 'the avant-garde is flexibility of mind.')[573] Although that's a potentially uncomfortable experience, I think that NMPT musicianship should aim directly at these points. Those are the points where a caretaker needs tools. I've also tried to demonstrate that there is no meaningful separation between tools of mind ('concepts') and tools of ear, breath, hands, and instruments here — it's all cognition-in-action. We can go further in that direction next time.

A: Yes, I need a break. We still didn't talk much about new music, I notice.

B: Partly that was for practical reasons. NMP trainees in Spain, Finland, or South Korea will have quite different ideas about core new music repertoires, and I didn't want to hold up one piece of new music as a holotype. My selection might have put them off. But they'll all know the Dvořák and Mahler examples — I hope! My main reason was to try to build bridges between areas of musicianship that institutions and texts have placed in separate siloes (2.3.1.) Next time I promise you some examples of new music.

[573] John Cage, *X: Writings '79–'82* (Hanover: Wesleyan University Press, 1983), 68.

6.3 Tools of pitch

B: Let's jump straight in. Scenarios are procedures that we recognise because we've negotiated their like before. They are cases of 'here we go again.' I'll start to describe some of my scenarios, and you can tell me if they resonate with your own experience or not.

A: OK. It's not just going to be a long list, is it?

B: I'll group them. Remember that we're not principally talking about the pitches we produce and hear, but the ways we find them. These are quite different things. There's something I didn't mention from last time about that adaptive 'Just Intonation' app — you know, the one that gave me something like motion sickness? Before I tried it, I listened to the pre-recorded audio examples from the website, and I found them perfectly inoffensive. Audio examples of music being played by other people are like that. They don't evoke the immersive, atmospheric, experience of (for example) a trombonist playing the Dvořák chorale on stage, lungs and diaphragm fully engaged, enveloped in rapid fluctuations of air pressure that they can literally feel in the seat of their pants, and surrounded with sparks of the pitch cognition-in-action of their colleagues as everyone performs the remarkable feat of playing while listening. In short, audio examples don't spark memories of how the pitches were found. That's why I chose not to provide them in the discussion of the chorale, even though synthesising them would have been quite easy.[574] We would have risked confusion between pitch-as-heard and pitch-as-done.

Last time we made a lot of fine adjustments in the hope of making our work with intonation as expressive as our treatments of other musical parameters uncontroversially are. So let's start with a contrast: a simpler context where the strategy can stay consistent once it's been chosen.

6.3.1 Using anything other than pitches to find pitches: dosing dirt, braindead, wobble-dosing, tartining

B: (*continuing*) In 4.1 I offered the idea of a watermelon tourmaline crystal which transitioned from green (harmonic, functional) to red (timbral). The first group of scenarios are those where individuals play clear pitches (green), but with a goal of them turning into timbre (red) as they combine with others. We shouldn't confuse that with another very common scenario in new music — when a single player **transitions** between clear pitch and a timbral effect like a diffuse, airy sound, or a scrunchy, noisy sound (as in 3.2.) A composer focusing on the sound alone may view these as equivalent, because the sonic results may be similar, but to a performer they are obviously distinct experiences. The **transitions** scenario does not require pitch-finding, so we can leave it aside.

I call the first scenario **dosing dirt**. Here's an example from *Gib mir Dein* (2018), a short opera by Birke Bertelsmeier:

[574] Newly easy, thanks to the scorewriter software Dorico's native support for microtonal tunings. In fact, I did produce some mockups of the Dvořák chorale in different tunings, and concluded that hearing them would be actively misleading in the context of the discussion in 6.2.

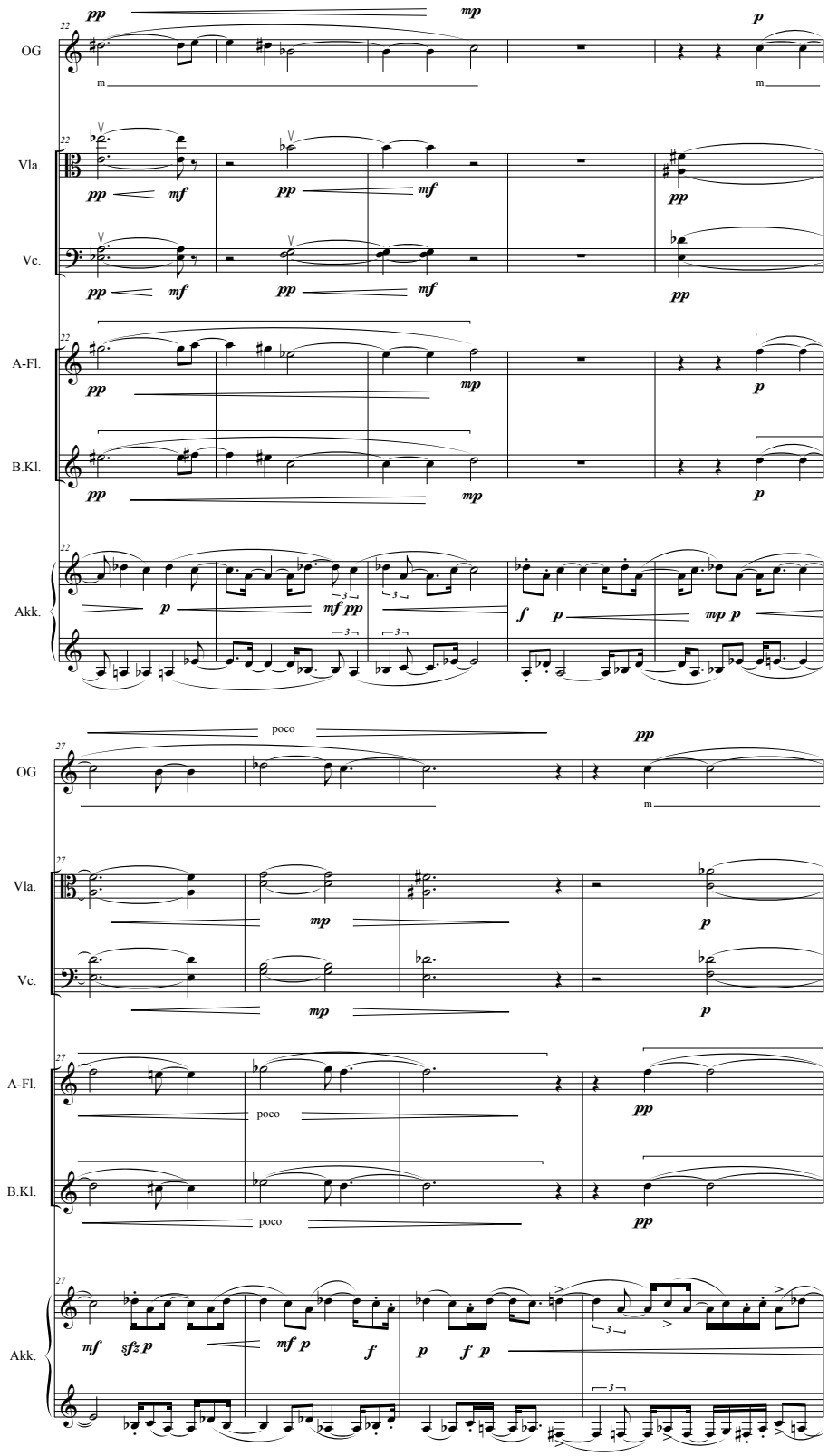

Figure 28: Birke Bertelsmeier, *Gib mir dein* (2018), scene 6 ('Tod-zählen'), bars 22-30. Transposing score. ♩=c.160. Reproduced with kind permission of the composer.

The score is transposed, so the alto flute, clarinet in B♭, and overtone singer ('OG' — but here singing conventionally) are always in near-unison. The brackets have previously been explained as simply 'verstimmt' ('detuned'): the alto flute has 'verstimmt zur Klarinette,' and the clarinet 'verstimmt zur Flöte.'

The trio continue in this way for the entire scene; later, the overtone singer adds partials and the accompaniment thickens into rich inharmonicity. By describing the pitch targets in words rather than with potentially misleading microtonal accidentals, this practical composer has done some triage for us. The desired sounding result is very clear — it's a creepy horror movie effect that might, more boringly, have been achieved via the use of a harmoniser pedal. By the way, the subject matter of the opera is a person undergoing a head transplant — or a body transplant, depending on your viewpoint.

A: That vague word 'detuned' makes me think that the pitch-finding will be easy. No cent deflections or exotic ratios to think about, so…

B: I think the performers' pitch-finding strategy is indeed quite easy to describe. But its execution isn't easy at all. The singer should remain relentlessly in 12-EDO, using as references a combination of the accordion, the strings, the memory of her coaching (on a tempered piano), and her existing frets (noting that for an overtone singer, these will probably be significantly less tempered than the frets of a conventional singer.) She should try not to listen to the clarinet and alto flute at all. The clarinet and the alto flute need to pick a role each: as Player 1 or 2.[575] Player 1 listens to the singer and plays a **bend** lower. The degree of this bend depends on the timbre of the singer: if the voice sounds tightly focused then a small bend will be most effective, and if it sounds less focused (i.e. if it has more vibrato, or a timbre richer in partials) then a larger one will be necessary. Player 1 does not think in terms of categorical pitch; they let their **frets** (their educated hands and embouchures) do the elementary blunt pitch-finding work behind the scenes. Rather, they establish the appropriate dose of dirt with reference to a few pitches, and then — this is the hard bit! — try to stick to that throughout (although they can relax their intensity of concentration as the texture thickens later on — that's triage.) It is the exact dose of dirt that is the reference rather than any particular pitch. Player 2 then undergoes the same process with reference to Player 1, and *not* to the singer! Player 1 ignores Player 2 entirely.

A: Sounds like there are head transplants going on in the orchestra pit as well as on stage. Another **intrinsic difficulty**, I suppose.

B: It's true that it's not comfortable, but who wants to be comfortable all the time? In the Dvořák example I tried to show how the comfortable intonational default strategies of orchestral and chamber music practice (*Let's just use our ears! Let's play together!*) can lead to poor results. In this case it would be catastrophic. Although I talked of a trio, there is no room for 'chamber music thinking' as it's usually conceived here. If the members of the trio allowed themselves to yield to musical gravity, they would either collapse into a unison (the likely outcome, which did indeed happen in the first rehearsal of this passage) or become subject to something like the three-body problem in gravitational physics, which is famously chaotic. This is also an extreme example of the difference between pitch-as-heard and pitch-as-done. In this case, in fact, none of the members of the trio actually ends up hearing the total result.

[575] In rehearsals, it seemed easier for the clarinet to take the Player 1 role.

A: It's certainly an extreme example. I mean, detuning as an effect is at least a century old — there's the upright piano in *Wozzeck*.[576] Or we could even think of performance traditions where singers oh-so-hilariously sing intentionally out of tune, as in the various 'cat duets.'[577] But usually such divergences seem to be taken care of by re-tuning whole instruments.

B: Yes. That approach attempts to move the whole fret structure and thus reduce a performer's cognitive load, and sometimes it succeeds. For Ligeti back in 1968, writing *Ramifications* for strings, it seemed that the only practical way to achieve a doubling of the resolution of the pitch-grid was to divide the players into two groups tuned roughly a quarter-tone apart. In fact he asked for one group to be tuned *higher* than their standard tuning, which would generally be avoided these days, and also suggests in his Introductory Remarks that 'equalisation of the intonation' may be avoided by selecting a difference of a little more than a quarter-tone — which, given the very chromatic nature of each group's material, might seem at first glance to be an incoherent request, since the more an A♯ pulls away from A♮, the more it approaches B♭. It may be that Ligeti's keen and unsystematic ear was really rejecting the greyness of 'fifty-fifty' 24-EDO in favour of the more varied glinting that results from successions of unpredictable offsets of (approximately) 60 and 40 cents:

[576] Alban Berg, *Wozzeck*, Act III, scene 3.

[577] There are at least three well-known 'cat duets': 'Nun, liebes Weibchen … Miau! Miau!,' attributed to Mozart, in the collaborative work *Der Stein der Weisen* (1790); the *Duo miaulé* from Ravel, *L'enfant et les sortilèges* (1925); and the *Duetto buffo di due gatti* (1825) of uncertain authorship, based on material by Rossini and C.E.F. Weyse. Classically-trained musicians, when signalling that they are intentionally playing or singing 'out of tune' tend to skew flat against their colleagues' reference frame. The word *de*-tuned, with its association of downwards movement, bears witness to this; among classical musicians, our default sober selves are highly-strung, while the depiction of drunkenness, loutishness, or animality tends to loosen the (vocal) cords that bind. (Real experiences of drunkenness may differ.) The ostentatious out-of-tuneness performers conventionally display in these contexts may be considered as parametrically analogous to the 'out-of-time' pianist-animals in Saint-Saëns, *Le Carnaval des animaux*, movt. 11; incompetence, here, being usually signalled by dragging rather than rushing.

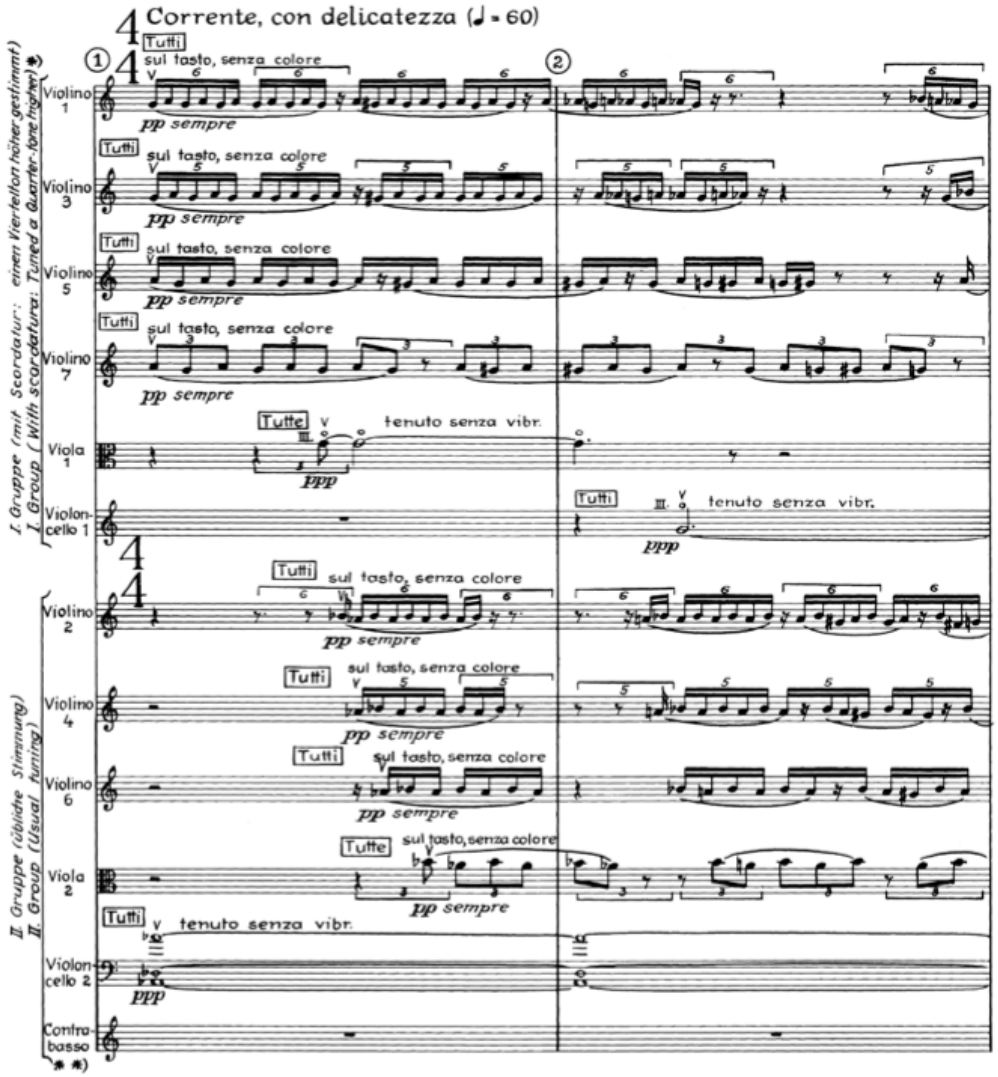

Figure 29: György Ligeti, *Ramifications* for string orchestra or 12 solo strings (1968), bars 1-2. Reproduced by kind permission of Schott Music, Mainz. All rights reserved.

But thinking in terms of pitch is a low priority in *Ramifications*. Indeed, the wholesale re-tuning approach was a gesture away from 'pitchy' thinking, since it was becoming clear that even the twelve-tone chromatic clusters Ligeti favoured around that time often risked sounding unintentionally tonal. To my ear, and presumably to Ligeti's at that time, many of the clusters in *Lux Aeterna* for sixteen-part mixed choir (1966) sound thoroughly manageable and clock-like — I could take dictation from a decent performance — and do not resemble the perception-baffling clouds that the composer was hoping to evoke. In *Ramifications* the players can give their pitch faculties a rest and concentrate on other matters. So it's no longer **dosing dirt**, because there's no need to dose anything. We could even call the scenario where the players can rest entirely on the pitches their instruments most readily generate **braindead**. Ligeti explicitly encourages that disconnection of fingers and ears, since he writes that the two groups should first be rehearsed separately, then gradually moved spatially closer as the performance approaches. In this process, the players learn not to listen to each other — or rather, to listen selectively, as in the Bertelsmeier example.

A: First lesson on pitch: don't listen. Noted.

B: Hang on — this doesn't even apply in every situation where instruments are re-tuned. In some passages of his *Book of Hours* for ensemble and live electronics (2002-04), Julian Anderson asks for a small number of players (a flute doubling piccolo, a B♭ clarinet, and the synthesiser) to be tuned a quarter-tone lower than the rest of the ensemble. Pitch matters, intensely, across the whole work. The composer's efficient solution enables some fast flourishes to be played that would certainly be impossible to achieve with microtonal fingerings and/or embouchure adjustments. Here the pitch-finding scenario is **braindead** for the duration of these flourishes (braindead in pitch-finding terms only — other parts of the brain and body are very much alive!):

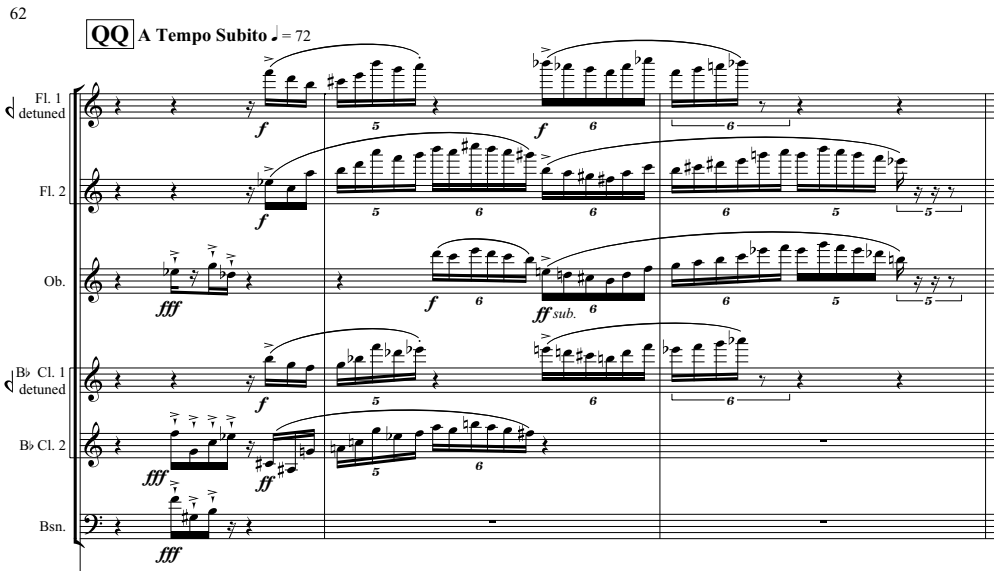

Figure 30: Julian Anderson, *Book of Hours* for ensemble and live electronics (2002-2004), Part II, no bar numbers (**QQ** to 3 bars after **QQ**). Transposed score. Woodwind parts only; Pno, Hp, Perc 1/2, Synth, Strings, Samples omitted. Copyright © 2009 by Faber Music Ltd. Reproduced with kind permission.

The first flute and first clarinet players blow and wiggle their fingers in familiar patterns, and the composer's desired pitches come out automatically; the effect is of a heterophonic disturbance. A few seconds earlier, however, the same musicians had found their pitches in a quite different, more cognitively-intensive way:

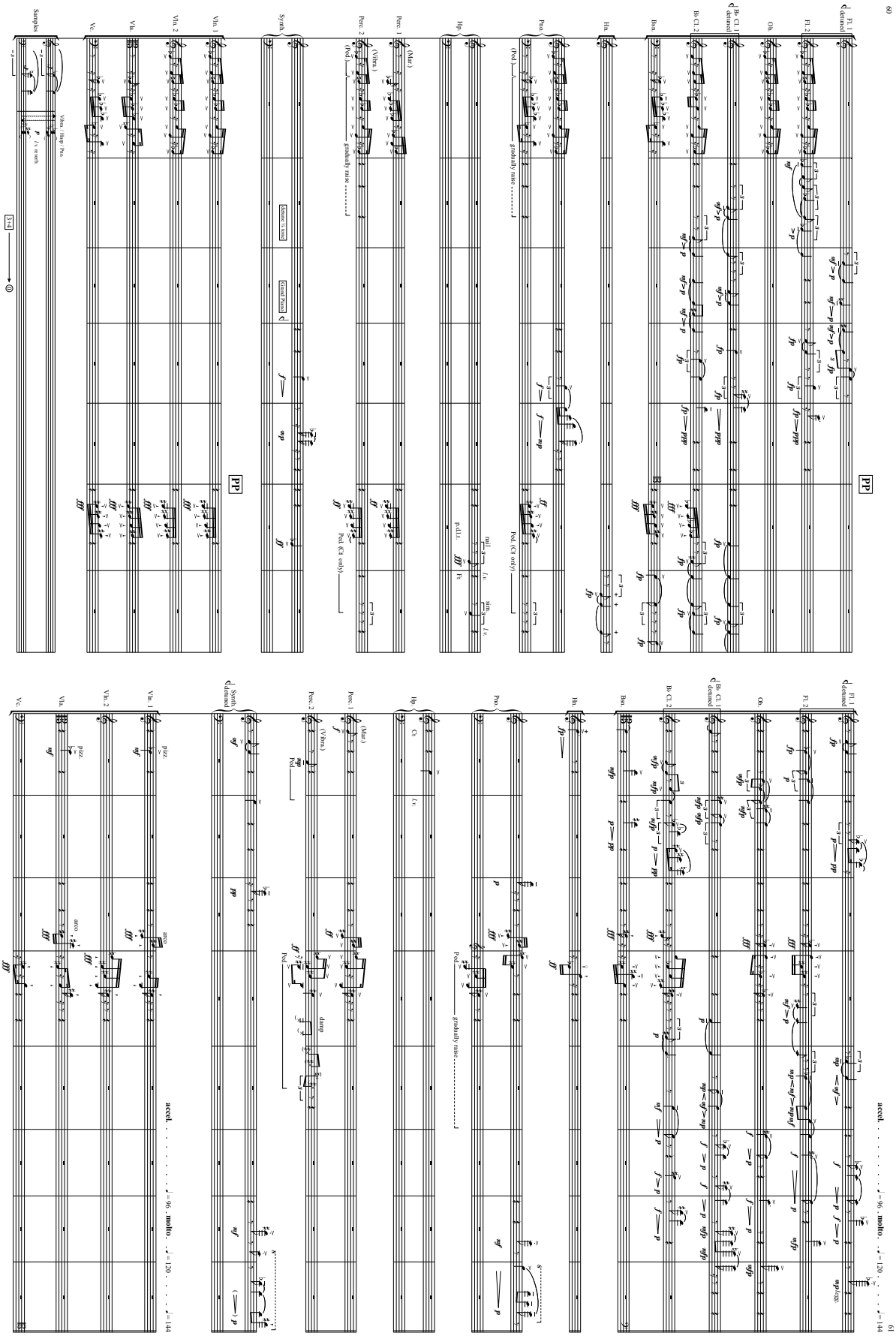

Figure 31: The same piece, a moment earlier: 1 bar after **OO** to directly before **QQ**. Transposing score (Horn in F). Copyright © 2009 by Faber Music Ltd. Reproduced with kind permission.

The detuned players need to think here in terms of categorical pitch, in real quarter-tones — not **braindead**, and not **dosing dirt** either (We'll talk about how that might be done later.) They can no more rely on the instrument solely to 'do the thinking for them' than their conventionally-tuned colleagues can. (And they can't tune to the detuned synthesiser, because that enters *after* them.) The resulting effect in the accelerando is of a Doppler shift, as if the whole ensemble were being whisked away at speed. As in the Kranebitter examples in 5.1, the key musicianship lesson here is that scenarios can change rapidly, and that these changes can happen quite independently of the pace of change of the resulting sounds or even the composer's line of thought.

'Dirt' is my umbrella term for a host of inner timbral experiences, ranging from sparkles to swirls. But sometimes dirt really is dirty. In Olga Neuwirth's *Quasare / Pulsare II* for trio (2016), which I mentioned above (**Figure 15**), the composer clearly intends to 'detune for noise': the requested violin scordatura is -60c, a figure chosen for its avoidance of existing tonal reference frames (whether 12- or 24-EDO, or JI), and for its maximum grunginess and sense of strain. When coaching this piece, I noticed that the relatively inexperienced violinist was falling into the 'equalisation' trap Ligeti had warned against, for while the player had obligingly de-tuned their strings with reference to an electronic tuner, their fingers kept creeping upwards in an unconscious attempt to 'correct' the intonation and re-join their colleagues. (I find that a polite way of pointing such tendencies out is to say *you're being too musical!*) In this case **braindead** did not straightforwardly apply, since it took self-intervention on the violinist's part, after a reminder from me, to pull the plug on their own intonational oxygen supply.

A: Poor thing!

B: While they told me that they enjoyed the experience in the end, it's true that it's usually a relief to exit a scordatura situation, realign the player's and the instrument's normal frets (5.8), and return to the status of an 'incorpsed and demi-natured' actant (2.2.3) — or a normal violinist, if you prefer. In the Bertelsmeier example what's unusual in that the **dosing dirt** scenario is sustained for so long and so consistently, without recourse to **braindead**. The scenario itself is very common. You can find plenty of further examples in the scores of painterly composers like Rebecca Saunders. Saunders' output provides many opportunities for performers to enjoy the experience of precise colour-mixing through the careful control of pitch. These cases are usually more local and subject to rapid change than the Bertelsmeier example. In this passage from *Scar* for 15 soloists and conductor (2018-19), the glissandos in the brass and strings are conceived less as gradual changes of pitch in the conventional sense, and more as gradual shadings into and then out of a desired patch of colour:

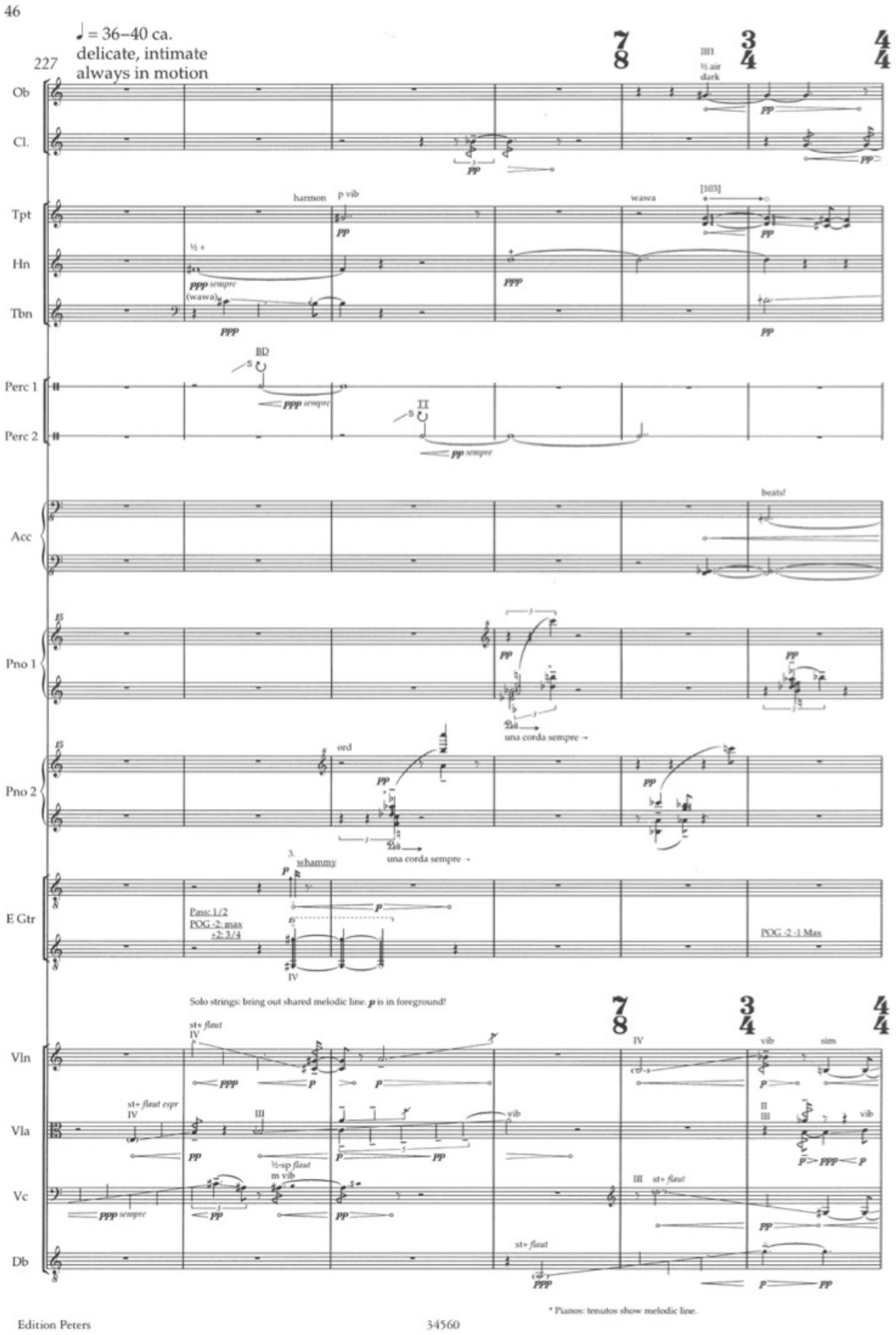

Figure 32: Rebecca Saunders, *Scar* for 15 soloists and conductor (2018-2019), bars 227-232. Transposing score: Clarinet in B♭, Trumpet in C, Horn in F.

In all these situations it's necessary for the pitch-finder to have a single point of reference: the trombone slips beneath the horn in bars 228-9, the oboe leans against the horn in bar 231, the trumpet smears past the oboe in bar 232, and so on. Despite the swirly and plasmic nature of the overall compositional thinking, the performers' pitch-finding thinking is pairwise and oppositional. Groupthink — shambling towards consensus — won't work.

A: It's always visual metaphors when we talk about timbre, isn't it? Mixing paints, pure or dirty colours…

B: Metaphors are hard to avoid here, but they needn't all be visual. Annesley Black, in *tolerance stacks II* for ensemble and a host of electronic instruments[578] (2015/2021), derived some of the pitches she wrote from the difference between two historically-competing standards of voltage. Of course, the players don't need to concern themselves with the actual frequency numbers that this arcane process yielded. What's helpful is the metaphor: we want to evoke a frisson of friction and the sense of sparking across gaps. Even though the composer wrote very detailed instructions to help realise this, including microtonal accidentals, valve positions for the brass players, and string-specific natural harmonics and harmonic-pressure glissandos, knowing that we are trying to maximise an electric effect really helps us place these pitches with assurance. That is a metaphor of touch not sight.

[578] Soprano with effect pedal, drumset with effect pedals and cracklebox, no-input-mixer, ring-modulated Moog synthesiser, turntables, and fixed media (historical recordings and field recordings).

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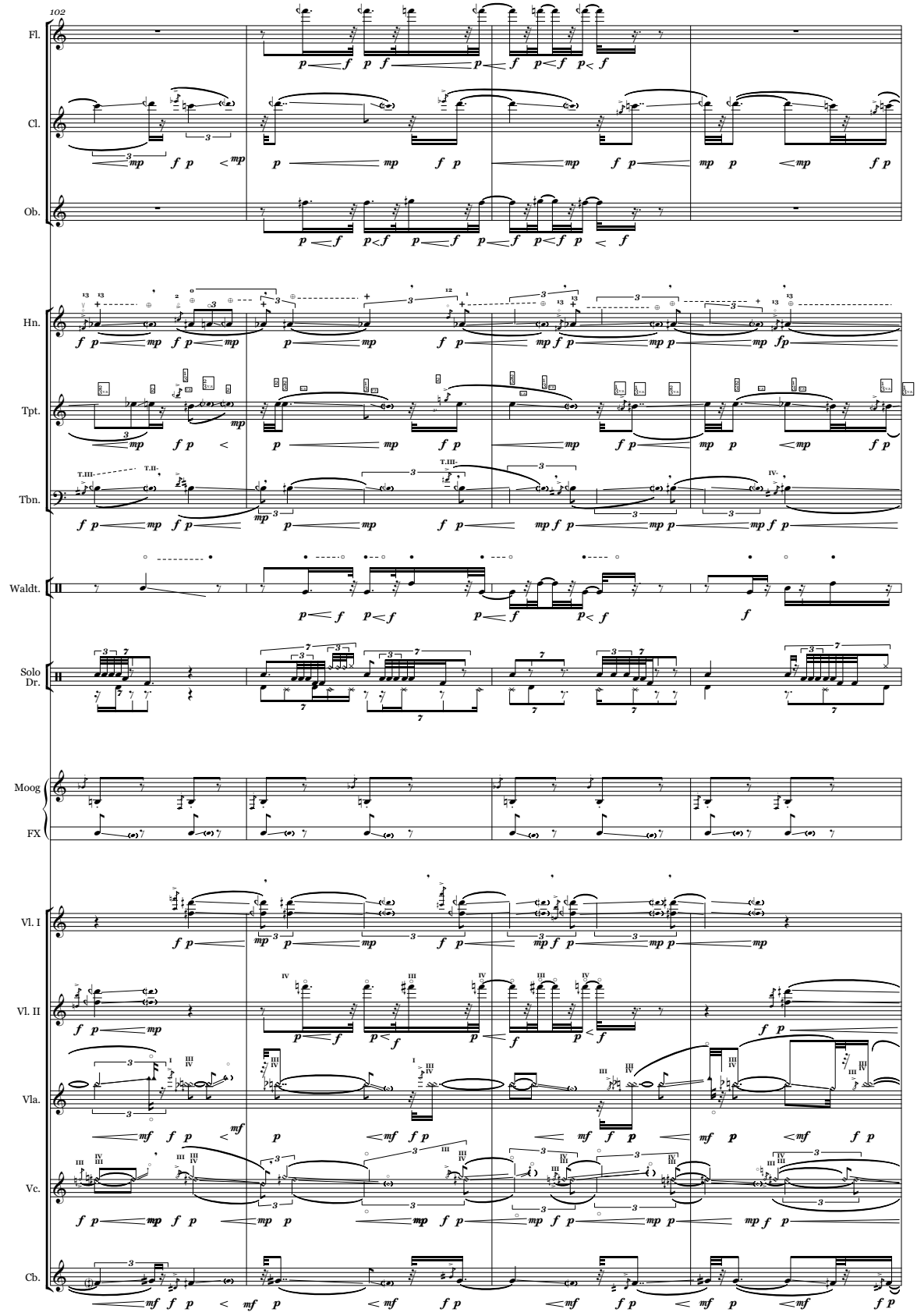

Figure 33: Annesley Black, *tolerance stacks II* for large ensemble and five soloists (2015-2021), movt. 1 ('Beginnings: Scott/Cros'), bars 102-105.

Speaking of the sense of touch, I'd put another scenario into this broad category of using timbre references to find pitches — **wobble-dosing**. This describes the experience of pitch-finding using beatings (interference / *Schwebungen*) as the reference.

A: Hang on, that's a *rhythm*-pitch intersection (4.1.2.1) rather than a visual or tactile thing. You can hear, count, and time beatings.

B: Well, it's true that the formula for calculating the frequency of beatings couldn't be simpler:

$f_{beat} = f_1 - f_2$

A German and an English oboist ought to disagree precisely three times per second when tuning their orchestras, because 443-440=3. But that is to think in terms of frequency rather than categorical pitch, and (as I'll argue below) this is usually unappealing to musicians. Curiously, such counting and timing of beatings is mostly a feature of the kind of tuning activity that takes place *outside* time — in situations where we are free to take all the time we need, such as when tuning a piano or a lute — rather than the live, time-critical contexts we're discussing here.

A: I bet there are exceptions…

B: As ever! There are zero-triage examples, like many works by Alvin Lucier and Phill Niblock, where precisely judged beatings between interfering pitches forms the main material of the music (hit them and you succeed, miss them and you fail.) However, there's little to say from a musicianship point of view about music that comes with its own assembly instructions, so to speak. And often electronics will do much of the work in these cases. There's a piece by Hans Thomalla, *Wonderblock* for ensemble (2012-2013) during which the vibraphone player is asked to adjust their motors to create precisely timed beating-like effects, which are picked up by the rest of the ensemble. That really is a rhythm-timbre-pitch intersection, although in practice the adjustments of the motors are made first, and the other players adapt mimetically, so it's not so interesting from a musicianship point of view. In Manfred Stahnke, *Beating* for three trombones (1999-2013), though, the players are asked to do it all live. The composer provides the hoped-for sonic results on a separate stave:

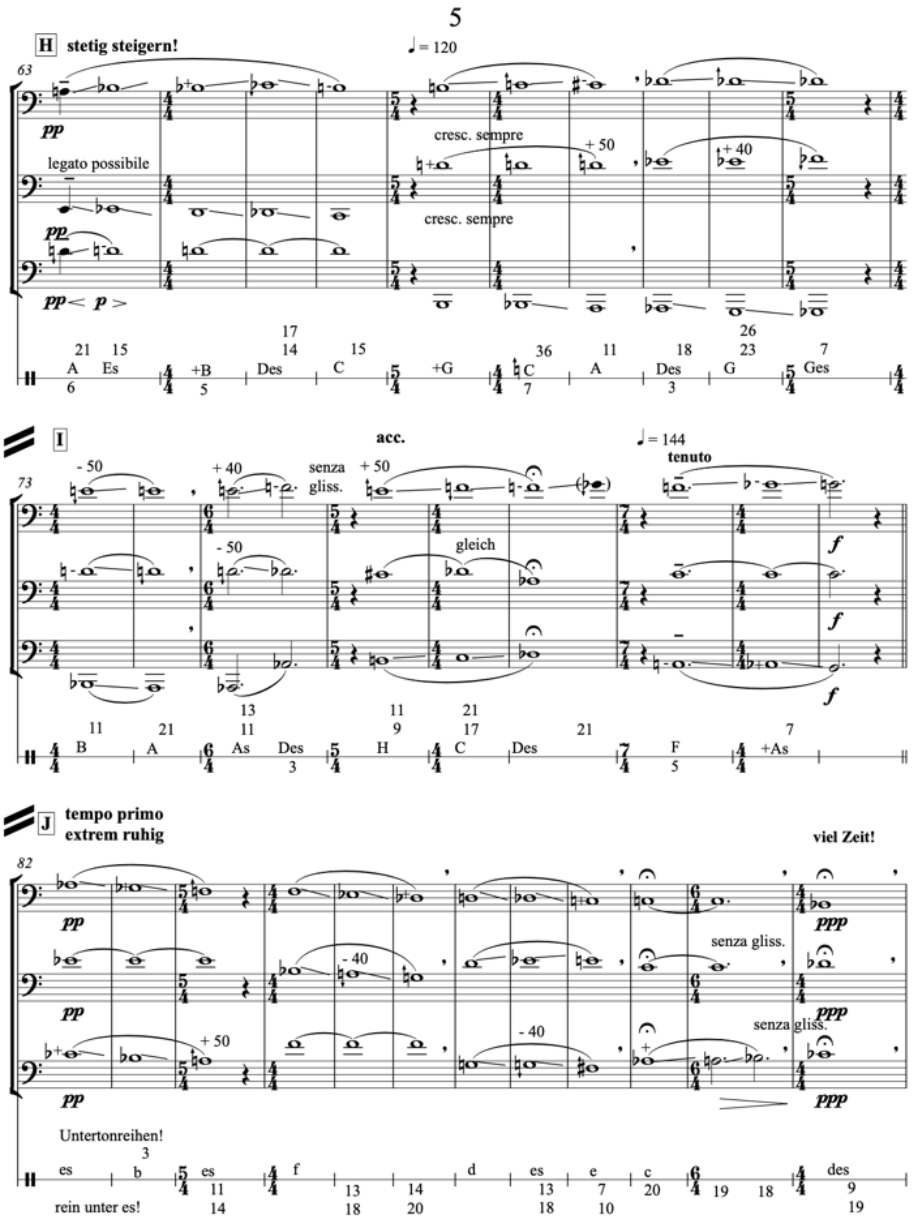

Figure 34: Manfred Stahnke, *Beating* for three trombones (1999-2013), bars 63-93. Copyright © 2013 by BabelScores®. Reproduced with kind permission.

A: Another extreme example, I see.

B: Yes. I think it's good to gain a sense of where these current limits seem to be for specialised musicians. The realisation of passages of this piece seems to push against or exceed most players' clock→cloud transition point,[579] because — as in the Bertelsmeier example, but in a far more challenging way — three extremely adjustable lines are in play, and in these contexts 3 definitely > (2+1). Pascale Criton, in *Alter* for soprano and orchestra (2022), provides more user-friendly opportunities for wobble-dosing: the singer gauges her relationship to held pitches in the orchestra in that way.

[579] For a discussion of a performer's approach to this piece, see Antonio Jiménez-Marín, 'Just Intonation applied in a practical musical context,' (master's thesis, Hochschule für Musik Basel, 2017): 11-30.

Outside examples where the tolerances are very narrow, such as the Stahnke example, beatings for a performer can more usually be conceived of as moiré-like effects (**clouds**) rather than countable events (**clocks**). As a default stance, I'd suggest approaching them in a similar way to how a string player conceives the speed of a vibrato (not its breadth of pitch.) The speed can be infinitely varied according to the expressive context. The difference is, of course, that here the 'vibrato' usually happens between two performers. So, unless you live and breathe your colleague's musicianship to the extent that you can predict exactly what they are going to do, one performer had better take the static role and the other the active, pitch-shifting, one.[580] That's **wobble-dosing**. As in **dosing dirt**, when we play out this scenario, we take a break from categorical pitch cognition ('that's some kind of A') and instead use the memory of the desired dose of wobble as our reference.

A: There's a limit to thinking in terms of wobble, isn't there? Acoustics tells us that as beating pairs of pitches move apart, the beat frequency moves into the human hearing range and we start to hear a combination tone — as so optimistically notated by Stahnke.

B: Yes. The pursuit of combination tones has proved fruitful for musicians investigating intonation on single instruments (such as violin double stops, as in the Tartini-based tuning tradition described by Christine Heman), or on timbrally-matched pairs (the flute exercises of Helen Bledsoe), and, very commonly, when playing long pitches against drones (as in a vast number of improvisations I've heard, in particular — it seems — almost anything that involves analogue synthesisers and no-input mixers.) But I doubt whether the phenomenon has much relevance for pitch-finding in mixed-instrument ensemble contexts.

A: But it does happen in those contexts, doesn't it?

B: Oh yes. If you can bear to be close to the players in this passage from Ligeti's *Ten Pieces for Wind Quintet* (1968), as the piccolo, oboe, and clarinet play sustained high pitches in ***ff*** ('*tenuto, sempre con tutta la forza*') you will experience a menagerie of weird acoustic phenomena including combination tones, in a mere 17 bars. The effect is at its strongest towards the end:

[580] An obvious objection arises: isn't it usually the composer who dictates the length and duration of a pitch-shift of this kind? An answer is that even in cases where the notation appears highly prescriptive, it is almost always the case that the performers have a high degree of control over this phenomenon. Minutely changing the speed of a portamento or the length of a held pitch, for example, can yield oversize effects. Composers conscious of the degree to which the phenomenon is in the hands of the performers often simply write performance directions such as *produce beatings!* / *Schwebungen!* / *battements!* in place of, or in addition to, microtonal accidentals.

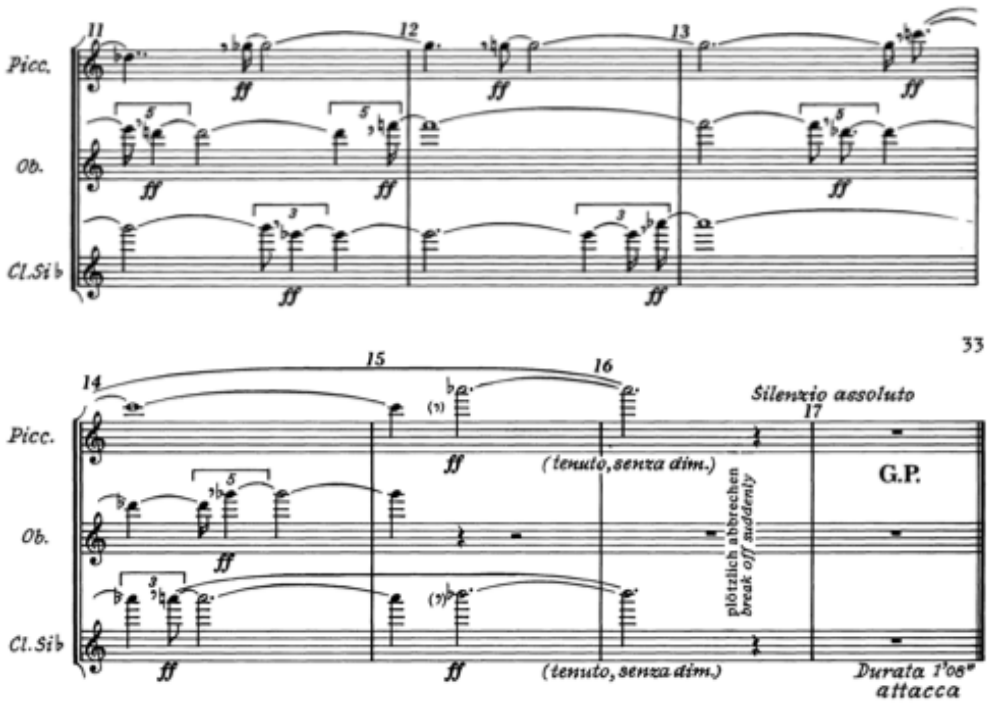

Figure 35: György Ligeti, *Ten Pieces for Wind Quintet* (1968), movt. 9 ('Sostenuto, stridente'), bars 11-17. Transposed score. ♩=60. Reproduced by kind permission of Schott Music, Mainz. All rights reserved.

Although they may create pitch-like effects — and the listener can hear them as they please, of course — from the performer's point of view these are experienced timbrally, since there is no pitch-*work* to be done with them. The extent to which the production of these can be finely controlled is doubtful, because so many physical factors are in play. We could still give the scenario a name — how about **tartining**? — and a very simple accompanying strategy: if your ensemble happens to produce one that sounds sufficiently prominent, and if you want to hear it, just stay there as long as is practical! Because it probably won't happen again, or not exactly in the same place or way.

A: So not really a portable, cross-instrumental musicianship tool then.

B: I don't think so. We've talked about using timbre to find pitches. Let's take a break and then discuss other strategies.

6.3.2 Using pitches to find pitches

A: Using pitches to find pitches? I mean… obviously! There's no such thing as a pitch on its own, after all.

B: Nevertheless, this is where we come to some thorny territory. It's clear that blunt pitch-finding, as in the example I gave of coaching a singer in leapy chromatic music with the use of 'fake' tonal chords, is a case of using pitches to find pitches. The various pitch-training procedures found in the studies of Ilomäki and Andrianopoulou (2.3.1) — call them solfeges for short — are also structures founded on this familiar approach: play me an A, I'll sing you an E. But fine pitch-finding is different. When we read self-descriptions of practice authored by practical musicians who have devoted their careers to this area, we encounter terms

that may strike the uninitiated as notably cautious. We hear about the characteristic *sonority*, *quality*, or *signature* of an interval. These words seem closer to the 'cognitive linguistics of timbre' (2.3.3.) The attitude to pitch they encode is very distant from the timbre-absent way I remember intervals being taught in aural training as an undergraduate — the instructor would stride to the piano and play (amid a ripple of disbelieving laughter) a jangling five- or six-note chromatic chord, which we students were expected to write down. That exercise was a very extended version of the 'texture' question in the early-years Music Aptitude ('Bentley') Test (4.1) and came with the same problems: the effects of spectral fusion were not considered.

The composer and organist Klaus Lang has talked about 'eine Haltung der Achtung und Vorsicht den Tönen gegenüber,'[581] which might be translated — with due caution — as 'an attitude/posture/stance of respect/carefulness/attentiveness/caution towards tones/sounds,' Lang sees this as a desirable basic position, and it certainly characterises his own practice and its rich outputs, and those of a significant number of other people working in new music. We might apply triage here and say that it is desirable in some contexts but risks paralysis in others — unless 'Achtung und Vorsicht' are conceived so widely that the stance embraces wild and extroverted performing modes, at which point the proposition would become meaningless. It raises a wider question about the level of cross-project adaptability a NMPT programme is training towards — just *how* cautious should we be as a starting point?

A: Well, it depends on the piece I suppose…

B: Only partially! I've argued throughout that that old get-out clause isn't enough. We do adapt from project to project, but we also carry a set of skills with us. Now, we could wait for a long series of encounters with the demands of composers to define those skills. We might call that the battle-scarred approach to gaining expertise. Alternatively, we can take pre-emptive action and save ourselves some trouble.

A: And you're going to say that the best way, as ever, is combining both approaches…

B: No, I'm tired of havering. I'd rather take pre-emptive action. But, as Lang says, we also need to proceed with a degree of circumspection, because this is an area in which some musicians have chosen to become exceptionally specialised.

A: Shall I try to summarise the problem, then? Solfeges aren't helpful for a lot of new music, because microtones are everywhere…

B: …and the reason they're not helpful is not because they presuppose or impose 12-EDO explicitly, but rather because their implied tolerances are so wide. Traditional solfeges help us work with pitch in broad categories — their point of intervention is prior to questions like 'to which temperament shall we tune the

[581] Quoted in materials accompanying a performance of Manfred Stahnke, *Beating* (see **Figure 34**), *Soundcloud*, accessed Sep 2, 2023, https://soundcloud.com/anto-ito-j-mar-n/manfred-stahnke-beating-19992003-fur-drei-posaunen.

harpsichord.' That is one of their strengths, in fact. They wouldn't have helped us in the Dvořák or Mahler examples either, or any context where pitch-finding is fine rather than blunt.

A: Stop interrupting! As I was saying: solfeges won't help. Microtones are everywhere. And yet we want to find tools that work across projects. We can't be the first people to have encountered that problem.

B: Of course not. For our purposes the most relevant — and certainly the best-documented — general approach to the task of finding a microtonal pitch with reference to another pitch is the notion of 'intervals tuneable by ear' — *tuneable intervals* for short — as developed by the composer Marc Sabat and collaborating performers including the tubist Robin Hayward.[582] This approach was a refreshing contrast to much of the literature on tuning written in the twentieth century. (I mean, of course, the literature that was festooned with academically acceptable tables of numbers and diagrams, and not interviews with performers such as Casals, who, despite his public adulation, was not taken seriously by theorists as an authority on the subject.) Previous writers had dreamed up attractive visual metaphors to help divide and organise pitch-'space' — lattices, diamonds, spirals, and so on. These constructions were usually sound on their own terms — and if they weren't, others would swiftly correct them in the spirit of scientific rigour. But it was less clear if the assumption on which they rested was robust: whether it was meaningful to draw analogies between static visual representations of the relations of pitch and the way music unfolds in time. James Tenney attempted to anchor these castles in the air to ground truth by applying insights from the burgeoning fields of psychoacoustics and more general studies of perception; he introduced musicians to notions including tolerances and the auditory critical band. In doing so he pointed the way for Sabat and Hayward's approach.

A: Which was…?

B: Sabat and his collaborators wanted to know which intervals were actually practical to discern and find on real instruments, so they played a succession of pitches above drones. These collaborations have yielded lists of such intervals, which are described as ratios and also notated in conventional staff notation with their HEJI accidentals.

A: (*leafing through the lists*) There seems to be an intimidatingly vast number of intervals that count as tuneable.

B: We need to appreciate the working conditions that yielded these hefty lists. The authors describe their approach as empirical, which is quite correct. However, we should be careful not to make that word carry associations that they didn't intend. *Empirical* might make us think of large trials yielding statistically interrogated datasets. But really, this was two or three fine (and already highly specialised) musicians in a sound-proofed room, with their ears on stalks. So we mustn't equate an empirical approach with the discovery of widespread 'ground truth.' The authors don't make those claims either. They say that '[t]uneability is not proposed as an absolute property. It varies depending on the register, relative volume

[582] Marc Sabat and Robin Hayward, 'Towards an Expanded Definition of Consonance: Tuneable Intervals on Horn, Tuba and Trombone' (Online: Plainsound Music, 2006). In addition to Hayward, the collaborating players were Wolfgang von Schweinitz (cello), Beltane Ruiz (contrabass), and Anaïs Chen (violin).

and timbre of the sounds, *as well as on the experience of the listener*' (emphasis added.)[583] That last caveat is really important to appreciate — it's not just cautious boilerplate. For example, we can't even assume that the granddaddy of all 'tuneable intervals' — the octave — will be perceived as such everywhere. One recent study reported that some groups of people living in relative isolation in the Bolivian Amazon do not recognise octave equivalence.[584] Since all this material is highly culturally contingent, using terms like 'conclusions' feels a stretch here. Additionally, there is a wide gap between the methodology of these studies and most real-world performing/rehearsing practice. The biggest difference is that in the studies the researchers' reference pitches could be relied on to be stable, since they were generated synthetically. In performances that's the exception rather than the rule.[585]

A: And the authors don't claim that all these intervals are easy to find in practice, do they? In fact, they put them in classes of relative obscurity, using different noteheads.

B: That relates to triage, doesn't it? It reminds us that triage doesn't just apply to the realisation of whole scores, but is relevant in musicianship contexts too. Although you'd think that we should allot relatively little effort to learning the 'easy' intervals and more to the 'harder' ones, since our childhood teachers always told us to practice the hard bits first, in musicianship situations the reverse is the case, since the 'harder' ones are likely to occur relatively infrequently and in the knottiest musical contexts, while the 'easier' ones are likely to play more stable, long-lasting, even structural roles. So a performer with limited time and resources — i.e. every performer — might profitably concentrate on the 'easier' ones first, since they will be asked to find them more often.

A: But still, there are *so many* intervals here! Even the 'easy' ones.

B: Let's step back and remember that when it comes to musicianship, pitch wears the parametric laurels (2.3.1.) Other parameters, notably rhythm, are subaltern (see Hartenberger in 2.3.4.) Accordingly, people with an intense interest in pitch have historically had their interest given greater academic legitimacy.[586] If

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583 Ibid., 3. The title of this paper refers to consonance. According to the authors, 'a consonant interval is one which may be precisely tuned by ear. Relative consonance may be described as the degree of difficulty in achieving a precise intonation.' (Ibid.) Although this may indeed be a 'precise perceptual definition,' (and one that owes much to James Tenney) it diverges so markedly from the various uses of the term in other musical practices that it is unusable in NMPT contexts that embrace multiple repertoires. The terms consonance and dissonance are avoided as far as possible in this text.

584 'US and native Amazonian [Tsimane'] listeners exhibit deterioration of pitch at high frequencies and logarithmic mental scaling of pitch. However, sung correlates of octave equivalence are undetectable in Amazonians.' Nori Jacoby, Eduardo A. Undurraga, Malinda J. McPherson, Joaquín Valdés, Tomás Ossandón, and Josh H. McDermott, 'Universal and Non-universal Features of Musical Pitch Perception Revealed by Singing,' *Cell: Current Biology* 29, no. 19 (2019), 3229.

585 In addition, instrument-specific (acoustic) objections to the approach have been raised: '[T]his paper [Sabat and Hayward] did not consider the inherent "inharmonicity" of labrosones, owing to the curvature and varying bore of the tubing, and the nature of tube resonances such that they occur over bands of frequencies rather than at individual modal points, meaning that pitches can deviate significantly from any specific theoretical locations.' Jack Adler-McKean, 'The history and future of the tuba family: Material-, resonance-, and performance-based perspectives,' *Timbre and Orchestration Resource* (2024), 33, accessed Jul 18, 2024, https://timbreandorchestration.org/writings/articles/the-history-and-future-of-the-tuba-family.

586 In the view of some musicians, you have to pick a parametric team: pitch or rhythm. Here is a revealingly dismissive recent quote about rhythm from the pitch-specialist Marc Sabat: 'When working the tuning phenomena, it seems that the phrasing, the flow of time, becomes more important than precise hierarchies of rhythm: the phrasing which emerges from calibrating and coordinating dynamics, timbre, and pacing allows the sonority of the tuning, its most unique quality, to emerge and color the music, and becomes the most exciting thing about working with harmony.' In Taylor Brook,

you have been given the license to think like a researcher, naturally you will want to map your area of interest as closely as possible. Also, if you're thinking in conventional compositional terms, you'll want to amass as many expressive resources as possible. So of course you'll write down even the intervals that are at the very limits of what anyone would consider tuneable. I don't doubt that, during the focused intensity of the work, all the listed intervals did seem tuneable. But I think they're better regarded as a utopian palette of future compositional materials (and therefore subject to a performer's triage later down the line) or perhaps as the raw elements of an improvising practice for an individual or a very small, highly specialised, group, rather than empirical findings that might underpin a model of musicianship. And indeed this is how they have mostly been used so far.

A: Anyway, aren't these lists specific to the sounds of the instrument that was being investigated? We're looking for cross-instrument musicianship.

B: Sort of. They come with a health warning — that the perception of the given interval may be affected by changes of timbre. But there's a strong implication that the JI intervals that are considered the easiest to find (and maybe many others) will likely count as tuneable on almost all instruments, and perhaps even between pairs of instruments with different timbres, even though most of these combinations haven't been specifically tested (and for good reason — think of how many permutations you'd have to test to make really robust conclusions). I don't think this is necessarily a weakness, by the way. In fact this approach is refreshingly LEGO-like (4.2) in that it doesn't feel overly constrained by the plasmic or gestural consensuses. Although the researchers did their work instrument by instrument, there's also a robust sense of pitch as something that is exchangeable and instrument-independent here: 'the intervals empirically determined by earlier testing on string instruments are similarly tuneable on brass instruments.'[587]

A: Obviously, the intervals of 12-EDO (apart from the octave) aren't considered to be tuneable.

B: Right. *Tuneable* isn't quite the same as *recognisable* or *reproducible*. Rather as an aside, Sabat allows that 'many instrumentalists can learn to reproduce the pitches of Equal Temperament, for example when playing with a piano.'[588] There's a familiar axiological subtext detectable here: the rational (*a priori*, natural, organic, wholegrain) intervals of JI exist prior to the irrational (*a posteriori*, artificial, genetically-modified, processed) 'learnt' ones of ET. Of course Sabat and his colleagues are aware that this is not the route that most musicians' aural journeys actually take. Nor is it even the route that all intonation specialists recommend…

A: Yes, I was waiting for you to mention other approaches. How about something that mentions ear-training specifically?

'Orchestration and Pitch Precision in the Orchestral Music of Marc Sabat,' *Tempo* 75, no. 295 (2021), 30. All similar propositions in composers' narratives should be read as being peppered with caveats — for every passive *it seems* and *x becomes important*, insert 'for me and possibly a small group of collaborators.'

[587] Sabat and Hayward, 'Towards an Expanded Definition,' 47. The horn-tuba pair was directly investigated, but more timbrally-distant pairs (e.g. between brass and strings) were not.

[588] Ibid., 3.

B: There are various other JI resources which aim to teach a more limited palette of these intervals, including Doty, *The Just Intonation Primer*, and a short text by Mark Johnson which I'll come back to. All of these take a **rooting** approach. They focus on the tuning of dyads. In most cases the lower pitch is provided stably, and our task is to locate the upper one. Of course, that doesn't always reflect real-world tuning practice. And even where it's possible, that doesn't mean it's the best way of working. In the Dvořák example I tried to show how this approach — focusing on building up minimally-beating chords in slow or suspended time — can limit our ability to take expressive control of a phrase.

A: Other approaches, then…?

B: Julia Werntz offers a method that is influenced by the practice of Joe Maneri and the Boston Microtonal Society (1988-2018). She describes her approach with appealing simplicity:

> My method was just to seize the 'new' pitches from in-between the 'old' pitches of 12-note equal-temperament—60 new pitches in total—and to sing the intervals again and again until I had internalized a new microtonal, equal-tempered chromatic scale consisting of 72 pitches.[589]

A: That's what you call **bending**, I suppose. It sounds like Werntz is quite happy to treat the 'old' tempered pitches as firm references. The supposedly-untuneable ones, I mean. We might even propose that she thinks of them as part of her armature — and also, presumably, that of others, since she finds the process worth teaching.

B: And here is the dilemma. If it is to be useful in the real world, any method we might come up with needs to be built on some conception of a shared pitch armature. And if even people who teach courses on practical microtonality can't agree on what this might be, what hope do we have? On the one hand, JI approaches seem to conceive the musician as an aural *tabula rasa*, building up aural awareness from 1:1 onwards. (Alternatively, as in the case of Duffin, they acknowledge the trainee's existing pitch-structures, but tell them that everything they've learnt is wrong. We won't be doing that.) On the other hand, 'Boston'-type approaches assume a strong pre-familiarity with 12-EDO — strong enough to allow us to hang successions of **bends** as tiny as twelfth-tones! That's considered a faux pas by 'pure' JI advocates, who can't conceive of such an artificial construction being truly naturalizable.

A: But they're right about that, aren't they?

B: Well. Although all writings on the subject since Vincenzo Galileo and Marin Mersenne have acknowledged the fact that 12-EDO is indeed 'out of tune' — if you favour rational definitions — most summaries of, and introductions to, fine-tuning and microtonality nevertheless come from a Boston-like starting-point. For example, a microtone is often explained to complete beginners as something lurking

[589] Quoted in Nicholas Smolenski, 'Picture of the Day,' *Women Composers Festival Hartford*, Jul 18, 2012, accessed Aug 3, 2023, https://www.womencomposersfestivalhartford.com/tag/2011-festival/page/3/. The developed approach is documented in detail in Werntz, *Steps to the Sea*.

between the keys of a piano. Remember Jeffrey Gavett's comment about 12-EDO being the 'default background radiation of classical music' — and my qualifier that even if that's not quite true, it is the default of commercial music, which is inescapable if you watch movies, TV, or ever go into shops or restaurants. That must tell us something about reality and the shared experience that a method might aim to build on. And there's another elephant in the room, and it's a big one…

A: Absolute pitch.

B: Absolutely. Can I have some extra-large scare quotes for that term, please? It seems that researchers in cognitive psychology have only quite recently caught up to something that attentive musicians have always known — that there's nothing absolute or 'perfect' about anyone's long-term pitch memory.[590] We also know that this is a thorny and very personal subject.

A: It's surrounded with taboos and mystique. Every musician knows someone with 'amazing pitch' — or at least someone who seems to have more reliable pitch memory than their own.

B: And even if you are one of those people, it may not feel so straightforward from the inside. Like Q (4.2), I'm a string player, and I'm also a (non-virtuoso) pianist. I'm confident placing certain 'anchor pitches' including A♮s, D♮s, and G♮s within fairly tight tolerances (within my registral workzone, that is), but need more focusing time to locate B♭s and C♯s, and seem to have a blind spot about D♯s, which I can only approach stepwise. As a British musician who often works in continental Europe, I'm very attuned to the difference between the A♮s of 440 and 443 Hz when heard in isolation, but I doubt that I'd notice the difference between the two tuning standards if given a different pitch class as a reference. So I can't even say much in general about my tolerances, since they differ between pitch classes as well as between registers. I'm liable to be fooled by tricks of progressive detuning[591] although the structure is sufficiently robust to cause me problems when listening to music in 'Baroque pitch' — Bach's Prelude and Fugue in C major, BWV 846, unfortunately remains for me in a painful B major throughout in such performances. I had some long-term pitch memory as a child, but I think my current structures were built quite late on — mostly during intensive periods of work in my mid-twenties. (I promise I wasn't doping with valproate to 're-open [my] critical-period learning of absolute pitch,' as one study found!)[592] The whole apparatus seems to run on coffee and sleep. It fades away alarmingly when I've been on holiday, but (so far) seems to return when I'm in a rehearsal phase. It is, in short, like a lot of other certainties I *sort-of* have:[593] my grasp of foreign

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[590] Stephen C. Hedger, Shannon L. M. Heald, and Howard C. Nusbaum, 'Absolute Pitch May Not Be So Absolute,' *Psychological Science* 24, no. 8 (2013): 1496–1502; Daniel J. Levitin and Susan E. Rogers, 'Absolute pitch: perception, coding, and controversies,' *Trends in Cognitive Sciences* 9, no. 1 (2005), 26–33.

[591] As in Hedger et al., 'Not So Absolute.'

[592] Judit Gervain, Bradley W. Vines, Lawrence M. Chen, Rubo J. Seo, Takao K. Hensch, Janet F. Werker, and Allan H. Young, 'Valproate reopens critical-period learning of absolute pitch,' *Frontiers in Systems Neuroscience* 7, no. 102 (2013), n.p.

[593] 'Sort-of': my British English translation of the philosopher of mind Daniel Dennett's 'sorta.' The 'sorta' operator is one of Dennett's thinking tools, or 'intuition pumps': 'A young child is asked what her father does, and she answers, "Daddy is a doctor." Does she believe what she says? […] Clearly her understanding of what it is to be a doctor, as well as what it is to be a father, will grow over the years, and hence her understanding of her own sentence, "Daddy is a doctor," will grow. Can we specify—in any nonarbitrary way—how much she must know in order to understand this proposition "completely"? If understanding comes in degrees, as this example shows, then belief, which depends on understanding, must come in degrees as well, even for such mundane propositions as this. She "sorta" believes her father is a doctor—which is not to say she has

languages, almost-memorised poems, the streets of my home city of London in which I still often get lost… I don't experience it as a superpower, nor like the cheat codes to a computer game. I don't have the measure of it — it surprises me at times by being far more reliable than I could have hoped, and at other times by collapsing without warning. It's certainly never simply 'on' or 'off,' and I think that anyone who does talk in that way is either trying to bamboozle you or hasn't been paying attention. The most convincing accounts of pitch memory are given by those musicians who know that their memory structures for pitch are complex and dynamic. During a long Covid-19 lockdown, the soprano Juliet Fraser described how she felt her pitch memory was being affected by isolation:

I don't believe I have perfect pitch. Or, at least, I don't have the sort that seems immutable. I definitely didn't have perfect pitch as a child, but I seem to have memorised an A, and then a D, from my years as an oboist; beyond that, it's a combination of relative pitch and muscle memory. I depend on my pitch for the sort of music-making that I do. However, at the moment it's pretty wobbly. As a result, I have come to appreciate how much my inner ear — the muscle memory of the imagination, perhaps — is oiled by all the musicians with whom I usually work. Each one of them contributes to the ongoing maintenance of my sense of pitch. Without them, I am drifting; I am untethered. I've decided not to worry about it, because there are many, many years of memory in here, but it does frustrate me when I am practising and I do wonder how long it will take to get 'pitch fit' again.[594]

We should also note that Fraser is happy in other contexts to declare 'I have more-or-less perfect pitch,'[595] and that this is not self-contradictory at all: the first quote is part of an intimate self-reflective video essay, and the second is taken from her general advice to composers writing for her voice — specifically, to composers who are relative strangers to her, and so need bluntly-phrased advice. Different tolerances and modes of communication apply. I suggested above (5.2) that in pedagogical contexts even statements that a reflective practitioner can only truly say 'under erasure' should not be made with a hesitant tone. In many situations I too confidently reply, when asked, 'yes, ~~I have perfect pitch~~.'

A: We can see why JI texts don't talk much about long-term pitch memory, since it's so messy and poorly understood. But we must admit that this is a striking omission from any discussion of tuning as a perceptual practice! Everything in classical JI texts holds true if the whole system is raised or lowered by any interval (changing the Hz values accordingly), and naturally they apply to any historical standard of A4.

B: The sets of tuneable intervals aren't so easy to move in large increments, because they involve a notion of a perceptual workzone with registral limits,[596] but you could certainly move the whole structures around

reservations or doubts, but that she falls short of the understanding that is an important precondition for any useful concept of belief.' Daniel Dennett, *Intuition Pumps and Other Tools for Thinking* (London: Penguin, 2014), 68. As Dennett points out, this condition of partial understanding applies to adults as well as children.

[594] *Inside Out:* a video essay by Juliet Fraser with filmmaker Jessie Rodger, for MaerzMusik festival (Berlin, Mar 3, 2021). Documented in Juliet Fraser, 'Inside Out,' *Tempo* 76, no. 300 (2022): 74-82.

[595] Juliet Fraser, 'About my voice,' *Juliet Fraser*, 2023, accessed Feb 10, 2024, https://www.julietfraser.co.uk/app/download/10551980/About+my+voice+2023.pdf.

[596] '[I]ntervals with melodic distance less than 1200c. are not tuneable in the very lowest register [of the tuba-horn pair]. In the bass register … these intervals begin to demonstrate an audible periodic rumbling pattern which may be described as a *tuneable noise*.' Sabat and Hayward, 'Towards an Expanded Definition,' 47. For a study of the registral limits of AP see Andrzej Rakowski and Piotr Rogowski, 'Absolute Pitch and Its Frequency Range,' *Archives of Acoustics* 36, no. 2 (2011): 251-266. It is a measure of the gulf in understanding between researchers of this subject and performing musicians that these authors were

by a tone or so either way (in principle, I mean — if the instrument(s) under investigation had been zapped with an incredible shrinking or expanding ray.) And that would take me far outside the tolerances of my pitch memory structure. I'd be **lost**. Worse still, I'd be attempting to do very fine pitch work from a position of lostness — what a curious paradox! Now, I know that everyone will experience this differently. However, I've never met a musician with no long-term pitch memory, even if the habit of sorting musicians into ones 'with' and 'without' pitch has encouraged us to think of others, and even ourselves, in that binary way. And we should certainly junk the persistent term 'relative pitch' — find me a musician who doesn't 'have' that!

One of the rare printed references to this elephant-sized problem is found in a short 2010 text by Mark Johnson, a 'Guide to Singing in Extended Just Intonation Beyond the 5-Limit.'[597] This contains useful advice well beyond its modest declared aim ('Written to aid performance of music by Toby Twining.') The author offers descriptions of JI intervals that help us find niches for these objects in our memory palaces: '9:7 … sounds like a major third stretched so wide it's almost a fourth. It reminds me of some American car horns' — a helpful description that, in its combination of vividness and concrete precision, recalls Roche's 'distressed goose' multiphonics in 2.1 above. Johnson also independently confirms, through his practical experience, a rule of thumb I ascribed in 5.6 above to Busoni and Wolfgang von Steinitz:

> 49:48 … is the result of taking a septimal minor third 7:6 and subtracting a large whole step 8:7. A little more than a third of a semitone, it seems to be about the smallest melodic step singers can hear.[598] [my emphasis]

Note the musicianly words 'melodic' and 'hear,' which do not refer to perceptual JNDs (these are much smaller than a sixth-tone for musicians and non-musicians alike) but rather to pitch-as-done, as in the sense of this text. Johnson is helping his singers negotiate a non-modulating work (i.e. one where every given ratio yields the same frequency throughout) and one for which synthesised guide tracks exist. These factors should be borne in mind when we read the following advice, in the 'Special note for singers with absolute pitch':

> As you become familiar with a piece, you may find you are able to remember the starting pitches of a section, without necessarily being able to name those notes [Johnson has previously supplied a table of cent deviations from 12-EDO]. This is an advantage, since the less time we spend naming these pitches, the more time we have to learn what they sound like.[599]

An *advantage*? There speaks the pure spirit of the JI advocate. It also reveals a rather passive and Parnassian view of the role of the performer — it's best to turn your categorisation off and just sing! We'll have to agree to disagree here.

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astonished to encounter a 'strange' subject ('Subject X9') who was more able to recognise pitches associated with the 'white keys' than 'black keys'; musicians might be more likely to call this subject 'normal.'

[597] Mark Johnson, 'Guide to Singing in Extended Just Intonation Beyond the 5-Limit.' (unpublished, 1999/2000). I am grateful to Prof William Brooks for drawing my attention to this text.

[598] Ibid., 9.

[599] Ibid., 10.

A: You already said that you couldn't help hearing Partch's ratios as deviations from chromatic reference points in your own (im)perfect pitch.

B: In the spirit of adventure (not *Werktreue*) I really tried to, but I failed. Then I realised it was counterproductive, so I stopped trying. I feel that I am a better musician as a hybrid. My appetite for naming and categorisation remains strong. It is how I make sense of the world around me. These days the term 'extended JI' is being retired in favour of the language of 'relational intonation' and 'frequential listening.'[600] It seems to me that a truly relational intonational practice would take account of musicians' relationships with their existing pitch vocabularies and memory structures rather than seeing them as clutter to be cleared out. Even if these relationships are couched in blunter terms and have much wider tolerances.

A: Meanwhile, research endeavours on AP continue to grind on with minimal acknowledgement of tuning practices outside 12-EDO.[601]

B: Yes. I wouldn't even talk about 'outside 12-EDO.' In most cases it's outside some very broad conception of chromatic pitches. Those researchers seem to be working with very wide tolerances — so much wider, in fact, than those in any of the microtonalists' procedures, that while both camps aim to understand pitch as a perceptual phenomenon, their points of departure are separated by an unbridgeable gulf.

A: Can you do better, then?

B: Maybe not. But I can do simpler.

6.3.3 A Swiss Army knife for pitch

I have a reasonable good ear in music. Let's have the tongs and the bones.

Bottom, in *A Midsummer Night's Dream*[602]

B: (*continuing*) We've given some of our scenarios vivid names in the hope of making them distinct in our memory. Let's now do the same with some intervals.

A: (*with growing dread*) How many intervals?

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600 C.f. Catherine Lamb's self-description of her teaching practice in the module 'Spiral Sessions': 'We will attempt to leave Western Music Theoretical language aside (as in intervallic descriptions, "A" or "C♯", or chord names), but rather attempt to describe partial theory through the use of elemental numerical relationships and frequencies.' 'Spiral Sessions,' *Sacred Realism: Catherine Lamb*, accessed Feb 2, 2024, https://www.sacredrealism.org/artists/catherine-lamb/the-interaction-of-tone/?content=spiral-sessions. See also Rebecca Lane, 'Commentary on Catherine Lamb - *Muto Infinitas*', *Another Timbre*, accessed Jun 5, 2023, http://www.anothertimbre.com/catlambmuto.html. Lane writes, 'I like to think of myself as a frequency producer rather than a flute player.'

601 E.g. Ken'ichi Miyazaki, Andrzej Rakowski, Sylwia Makomaska, Cong Jiang, Minoru Tsuzaki, Andrew J. Oxenham, Gregory Ellis, and Scott D. Lipscomb, 'Absolute Pitch and Relative Pitch in Music Students in the East and the West: Implications for Aural-Skills Education,' *Music Perception* 36, no. 2 (2018): 135-55.

602 William Shakespeare, *A Midsummer Night's Dream – The Arden Shakespeare*, ed. Sukanta Chaudhuri (London and New York: Bloomsbury, 2017), 4.1.28-29. Reference is to act, scene, and lines.

B: Only three. Or rather, three rational intervals, plus a sense of their differences from their nearest equivalents in the tempered chromatic.

A: A bold claim!

B: Remember what a Swiss Army knife is. It has to be mobile, so it shouldn't have too many functions. And it's not claiming to be the best tool for all purposes. It's worth carrying around, though.

A: You can fold up a Swiss Army knife, too. Try doing that. Tell me what you mean in as few words as possible.

B: Learn the tempered chromatic, and the 5th, 7th, and 11th natural harmonics.

A: Twelve words! Not bad, for you. But I bet you won't leave it there…

B: I think it needs a little unpacking. We already talked about learning chromatic pitches in a blunt way. Now I want to narrow the tolerances and bring them into sharper focus.

A: Hang on — learning *pitches*? You mean learning the sounds of intervals, or certain common combinations, or melodic contours…? Or do you actually mean nailing them to a frequential background and trying to be as 'absolute' as possible?

B: I can't deny that I've fudged those distinctions — although perhaps no more so than many other authors of solfege-like resources (2.3.2.) I've done so deliberately to reflect musicians' practice as I see it (remembering that, since I'm a conductor, my principal instrument is other people's ears.) As I see it, musicians work with a real sense of *pitch*, which always means 'pitch-as-done'; a sort of hydraulic fluid that flows between and supports structures that outside observers see as distinct (so-called AP, the intervals of JI, chromatic pitch-work, and so on.) In my case, pitch-as-done, or pitch-work, even when it's silent, is always accompanied by tiny muscular movements (my glottis, tongue, the muscles around my eyes…) so I might speculate that it's deeply connected to singing. But I'm not a scientist, and so the term might strike you as insufficiently well-defined. The trouble is that — as we've seen again and again (2.3.4.3, 4.1.1) — almost every attempt to tell musicians what their terms *really* mean or replace them (always with reference to the special interests of the researcher) has failed to find much resonance among performers. Let's try to retain and enrich the sense of terms as they are used in the hurly-burly of practice, and only reject or attempt to re-define them when we really need to.

A: Or leave the job to better-qualified authors, perhaps. Anyway, on with the unpacking…

B: There's a very distinct feel about working with the tempered chromatic in narrow tolerances. I call that scenario **gridding**. We should save discussing it for later, because its distinctness is sharpened by an awareness of the non-tempered pitches I recommend learning.

A: Remind me which they are.

B: The 5th, 7th, and 11th natural harmonics. Let's look at each one in isolation, because they are quite different animals.

6.3.3.1 Working with the fifth natural harmonic

B: (*continuing*) The sound of the 5th natural harmonic — i.e. the C♯ to a fundamental A♮, or the just major third 5:4 — is probably the first inkling many musicians get that there's a wide intonational world to discover, because it leads to so many disputes in string quartets, choirs, wind sections, etc. This massed and inchoate conflict of views about the placement of the major third in a triad is Exhibit A in our conception of expressive intonation.

A: It's so well-known that it causes its own problems, as in the 'Celibidache effect' we noticed in the Dvořák chorale. You don't need to teach people to hear the just major third — it's the first thing that everyone who talks about tuning mentions.[603]

B: Not in itself, no. What I think is useful is to recommend an attentiveness to and familiarity with the difference between the just major third and the tempered one. This might start in the JI-approved way, focusing on the sonority of the vertical intervals: play a reliable reference tone, then sing two flavours of major third above it — a tempered major third (you can use a keyboard as a reference), then a just one (adjusting downwards for maximal beatlessness.) It's immediately obvious that — to use terms as neutral as I can find — the just third sounds static while the tempered third sounds active. Find your own metaphorical adjectives for the somewhat less-familiar just third, noticing that the existing terms are all slippery: *pure* (for me) sits somewhere between advertising for organic food and eugenics,[604] *sweet* (as in Huygens' account above) feels overly synaesthetic, which is a notoriously personal phenomenon; and please let's reject the most value-laden terms that JI advocates have favoured like *beautiful* or *satisfying* — not because they are unrespectably subjective, but because they are insufficiently descriptive. Perhaps you might call it *hollow* or *fused*.[605] After that, move on to alternating the intervals, because we're going to need both. Gradually eliminate the lower line, until you are singing or feeling the flux between the two C♯s alone. Both

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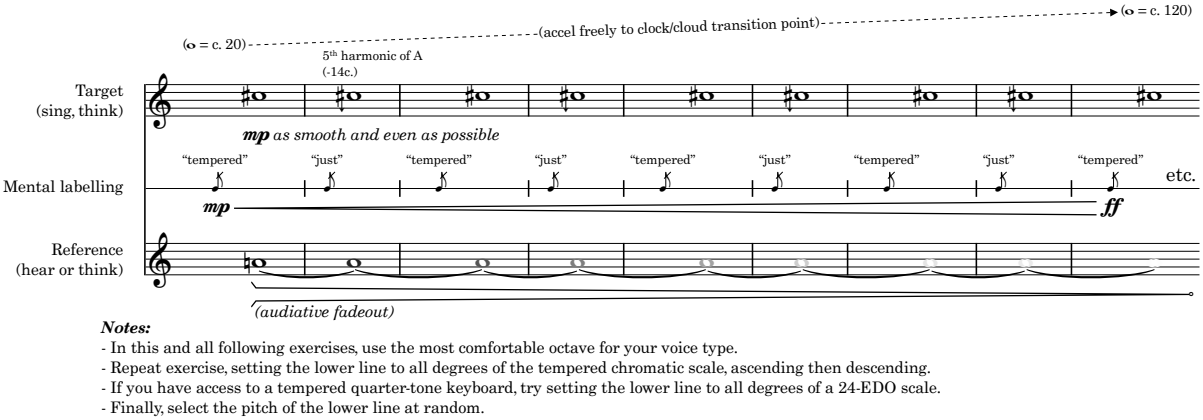
[603] For example, in the following clear and entertaining introduction to intonation: Robert Hollingworth, 'Tuning – Robert Hollingworth's guide for choral singers,' *I Fagiolini*, n.d., accessed Dec 10, 2023, https://www.ifagiolini.com/tuning/. Hollingworth starts by voicing a sentiment that we have encountered many times in this text: 'I thought I knew *how* to tune.'

[604] Readers unfamiliar with the writings of JI advocates may feel that I am overstating my point here. In his handy online resource 'Just Intonation Explained,' Kyle Gann — no extremist himself — nevertheless explicitly equates just intonation with purity. He notes that 'My teacher, Ben Johnston, was convinced that our tuning is responsible for much of our cultural psychology, the fact that we are so geared toward progress and action and violence and so little attuned to introspection, contentment, and acquiesence. Equal temperament could be described as the musical equivalent to eating a lot of red meat and processed sugars and watching violent action films.' For the association of *pure* with eugenics, note Partch's term *xenogamy* (discussed elsewhere in this text.) More generally, anyone who in their aesthetic judgments automatically associates *pure* with *good* may be said to have a poor awareness of twentieth century history. Kyle Gann, 'Just Intonation Explained,' *Kyle Gann*, accessed Sep 3, 2023, https://www.kylegann.com/tuning.html.

[605] As might be clear by now, I strongly oppose the lowly status accorded to the adjective by Raymond Barthes in *The Grain of the Voice*. Despite the slipperiness of individual adjectives, the *act* of adjective-placing is one of the ways that musicians categorise and bring sense to our world. It is always possible, and perhaps inevitable, to notice the onset of the ineffable and unsayable (as in the discussion-closing reference to Martha Argerich's 'sheer musicianship' in the Preface) but this should be a personal choice. I do not think we should impose this ban on other people, and certainly not on NMP trainees.

C♯s should be considered as being of equal importance; this is not an exercise about deviation from a norm, nor are we trying to work out which one we prefer. In practical terms this means that you should try to avoid singing and/or feeling one louder than the other. As you increase the pace of alternation, place mental signposts ever more actively (up to a quasi-***ff***) to remind you which one you're pitching: *just!* / *tempered!* / *just!!* / *tempered!!* / *just!!!* / *tempered!!!* Stop when you feel your **clock→cloud** transition coming on: don't press on further, or you will feel **lost** and discouraged. Here's a summary:



Notes:
- In this and all following exercises, use the most comfortable octave for your voice type.
- Repeat exercise, setting the lower line to all degrees of the tempered chromatic scale, ascending then descending.
- If you have access to a tempered quarter-tone keyboard, try setting the lower line to all degrees of a 24-EDO scale.
- Finally, select the pitch of the lower line at random.

Figure 36: Exercise: tempered and just major thirds.

A: But since you already hinted that many musicians already have a fairly robust sense of both the tempered and the just major thirds, what's the point of this?

B: Partly in order to help the performer make informed expressive choices: *I <u>want</u> this chord to sound static* (or *dynamic*) and so avoid the inevitable yoking-together of time and tuning that we've called the 'Celibidache effect' — an effect that he found intrinsically desirable but I'd call lazy, or at least expressively undirected. Another reason is to derive a known degree of **bend** from a **rooting** procedure. The thirds themselves are good to learn in themselves (*learn* meaning becoming increasingly aware of their distinctness as verticalities.) More useful still is having a general sense of control when working with small inflections. Like the caterpillar on a branch, we want to have an internal sense-reference of what counts as one 'ooch.'

A: Why?

B: Because the difference between a just third and a tempered one can serve as a proxy for a whole host of other small inflections in our pitch-work. In fact, let's call this little bend an **ooch** in bold type, and note that, like some of the terms in our 'caretaker's glossary,' it can serve as a verb or a noun. We can ooch up or down, and we should practice both.

A: Well, it's 14 cents…

B: No it isn't! I mean, yes it is,[606] but that's not the point. I can think of two uses for thinking in cents. One is to help with our workflow — since we have in our memory that the 3rd harmonic is +2c, the 5th harmonic is -14c, the 7th harmonic is -31c, and so on, we can swiftly categorise a pitch in a score that has such a cent deflection in those terms (i.e. 'OK, the composer is asking for a just major third' — and now we can throw away the number -14, or just use it as a shorthand or signpost.) The other use is like that card game 'higher or lower': we might want to know if an oncoming bend Y is greater or smaller than the bend X we've just negotiated. But cent values in themselves aren't helpful for finding pitches. What helps is having a known caterpillar-stretch as a word-like element of our pitch cognition-in-action: *this much I (my body, my ears, my vocal folds) know!*

A: I'm losing you again…

B: I'll give an example. I've noticed that when someone who's relatively inexperienced with microtonality makes their first **bend**-type moves, they tend to overshoot their targets quite dramatically. Hans Zender's scores often ask players to make very small alterations, such a shift of an sixth- or a twelfth-tone from a previous sounding pitch, or the same deflection from a fret:

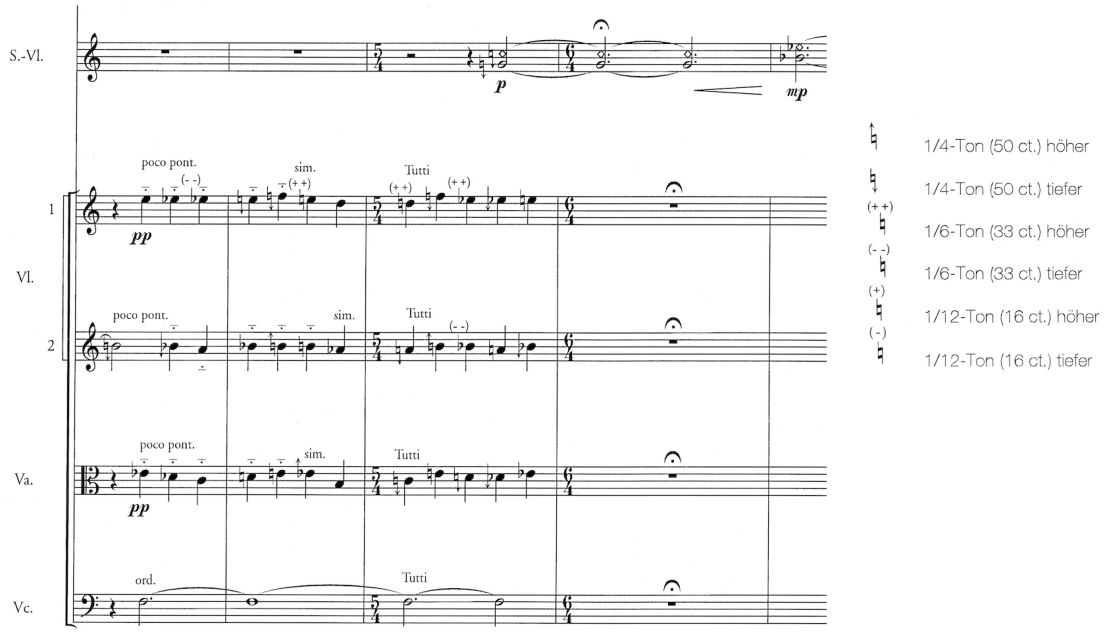


Figure 37: Hans Zender, *Adónde / Wohin?* for solo violin, soprano, and large ensemble (2008/2010). Bars 22-24, string parts only, and extract from performing instructions. ♩=70.

Zender was a practical performing musician, and no bedroom microtonal tinkerer. It would be wrong to say he worked with anything so abstract as an octave divided into 72 pitches, just as it is misleading to talk of a 'Partch 43-tone scale.' The overall effect Zender wanted to hear was one of conflict between systems,[607] like a much-more-developed version of the rubbing or friction for which I advocated in the Mahler example.

[606] 13.686 cents, to be even more precise and less helpful.
[607] Robert Hasegawa, '*Gegenstrebige Harmonik* in the Music of Hans Zender,' *Perspectives of New Music* 49, no. 1 (2011): 207-234.

A: But he doesn't ask for 14 cent adjustments at all.

B: Cents again! If it pleases you, you can remind yourself that a tempered twelfth-tone is 16.666… cents, so you can keep the change from 14 cents. My point is that inexperienced players and singers will almost invariably make these gaps much larger than an **ooch**. That's wrong from the composer's point of view, and also is unnerving for the performer, because after a succession of such oversize bends we find ourselves adrift from our frets and **lost**. Triage tells us that using an ooch to guide us when performing a deflection of a twelfth-tone, and a slightly weightier ooch for an eighth-tone, is more than sufficient to meet the composer's compositional demands appropriately here. For what it's worth, it also seemed to resemble Zender's own approach to practical audiation when I discussed the matter with him in 2016.

A: What if you want or need an even smaller adjustment than an 'ooch'?

B: As a rule of thumb we can suggest that an ooch is the smallest useful working unit when using pitches to find pitches. So if we want to work at an increased level of fineness I'd suggest using a purely timbral reference. Think of a chart of paint samples, and 'darken' or 'brighten' your sound by one — only one! — shade. In his performance notes to his *Stimmungsbarometer* for large ensemble (2011-12), Robin Hoffmann gives some advice that has wide relevance:

> Timbral inhomogeneity is not only expected, but is expressly desired in order to make the smallest pitch variances perceptible. For example, a variance of -5c. may be felt as a darkening of the timbre, etc.[608]

In such cases the player would do well to avoid the temptation of performing *any* conscious pitch alteration, because by doing so they would most likely overshoot their target.

The deeper purpose of my little exercise is to highlight the distinctness of the activities of **bending** and **rooting**, and in doing so enable the performer to do both with confidence, and not to confuse them. From the rooting point of view, the difference between the two flavours of major third is stark. No-one would mix them up — you don't have to have a particularly 'refined ear'! But from the bending point of view, an **ooch** is very small indeed. We can apply our 'Busoni-von Steinitz-Johnson' rule of thumb and say that, since the sixth-tone is the categorical limit for hearing a 'new pitch,' a move of a twelfth-tone — and an eighth-tone too for that matter — will be heard as an enharmonic adjustment and not categorically. The exercise is designed to allow a trainee to focus on the experience of refashioning a difference that is usually conceived in learnable vertical terms in learnable horizontal ones. It isn't about perception, but pitch-*work*. When considered in purely vertical terms, much smaller variances are not only noticeable but are in everyday use in contexts that wouldn't usually be described as microtonal: when violin players make tiny turns of their E string adjuster when tuning to the A string, for example, they often alter the pitch by only one or

[608] Original: 'Klangfarbliche Inhomogenität wird nicht nur erwartet, sondern ist ausdrücklich erwünscht, um kleinste Tonhöhenabweichungen sinnfällig zu machen. So kann sich eine Abweichung von -5 Cent beispielweise lediglich als eine Abdunklung der Klangfarbe bemerkbar machen, etc.'

two cents. Once the exercise feels comfortable, try the following extension task. This places the pitch to be found lower than the reference pitch:

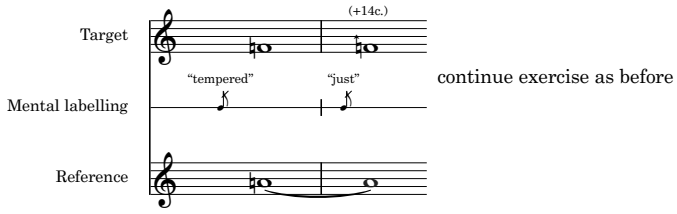


Figure 38: Exercise: tempered and just major thirds, flipped.

Then, as a final challenge, try stacking the different flavours of thirds. I wouldn't recommend ascending or descending more than one or two steps, because the aim here is to stop just before the clock→cloud transition in order to avoid lostness. (If you want to experience the ear-bamboozling effects of large stacks of these intervals, search online for comma pumps and try to sing along!) Before attempting the exercise, play back and/or audiate the following tempered reference in the interests of blunt pitch-finding:

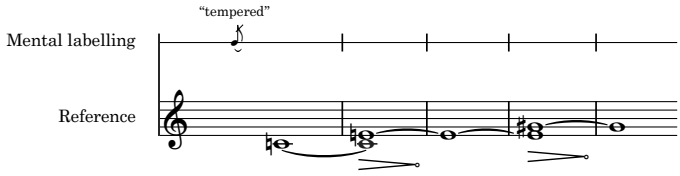
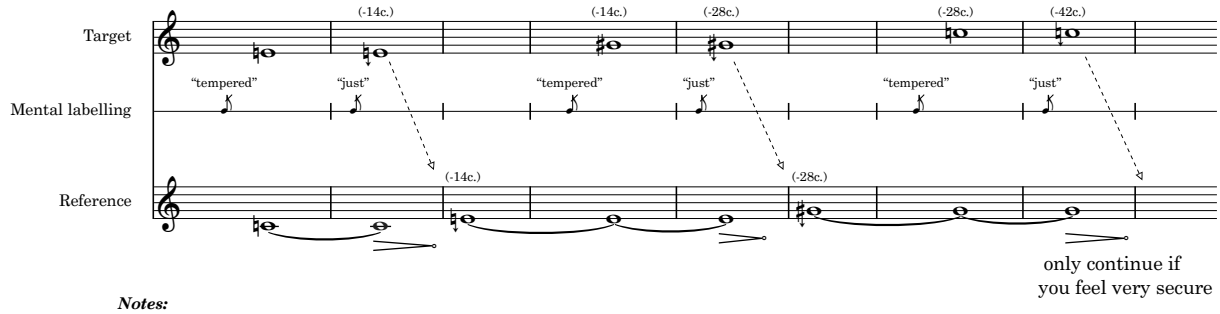


Figure 39: Tempered reference.

Then, immediately (with no accelerando):



Notes:
- All cent deflections refer to the original reference pitch. Accidentals, by contrast, refer to an action on the preceding pitch: an arrow is one "ooch".
- To play the non-tempered "reference" pitches without a synthesiser, a "melody instrument" (e.g. a violin) can be used: after locating the target pitch aurally, match the pitch on the violin and place a finger firmly on the fingerboard, then continue as before.

Figure 40: Exercise: stacked thirds, re-spelling the reference.

The goal here isn't to learn the contour of the exercise itself — patterns like these aren't rudiments of many compositional practices, and so we aren't often asked to play or sing them. What's useful is the discipline of representing the target to ourselves as the new reference. We'll revisit that in the next section. The original exercise aimed to build sensitivity, and this extension builds flexibility. Together, these are the aims of musicianship that I outlined in the Preface.

A: So that's the 5th harmonic. Moving on to the 7th…

B: Would it be OK to talk about the 11th harmonic first?

A: I suspect that you will anyway.

6.3.3.2 Working with the eleventh natural harmonic, working with quarter-tones

B: People who have constructed extended JI systems have often stated or implied that every step up into a higher prime limit (5, 7, 11, 13…) is a move towards a more utopian conception of pitch, and away from hard reality.[609] That follows from swallowing whole the doctrine that lower ratios are 'naturally' easier to find. But I think that the 11th harmonic itself is eminently learnable — much more so, in fact, than some lower-limit intervals including 16:9.

A: How so?

B: Here is Mark Johnson's entry for 11:8:

> 11:8 … the 11th harmonic, is a real quarter-tone… The easiest way to get familiar with 11-limit intervals is to practice singing the harmonics 8-9-10-11-12 … a 5-note major scale with a half-sharp 4th. The 11 goes right in the middle between 10 & 12. After enough practice, it feels like it drops into a 'slot'…[610]

It drops into a slot for me too. Now, it may be that I can find this reliably *because* it's extremely close to a tempered quarter-tone,[611] which I've heard quite a lot, or the reverse. It doesn't really matter which comes first, because I want to be able to access and move between both structures. I've practised it in a similar way to Johnson's method, but with an added earworm (with apologies to Bach and Berg):

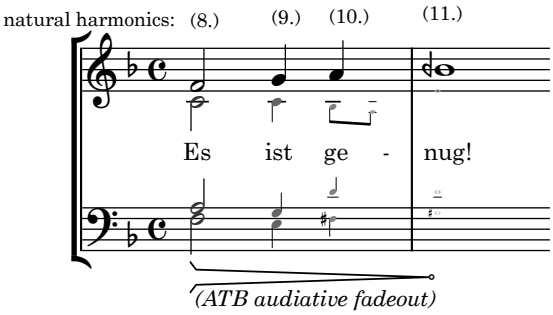


Figure 41: Eleventh harmonic earworm 1: 'Es ist genug.'

I want something memorable to avoid lostness, and for me the silly wordplay ('it's enough!') helps drive the point home and give the pitch a distinct niche in my memory palace. (I've labelled the harmonics 8–11, but I'm only interested here in the 11th harmonic, so although I've written the G and A as harmonics 9 and 10

[609] E.g. 'The intervals based on primes beyond 5 require much more specialized experience to recognize and tune properly,' Johnson, 'Guide,' 6 (in bold in original); and 'Primes beyond 13 (17, 19, 23, etc.) are probably too obscure to tune by ear in just intonation.' Ibid., 9.
[610] Ibid.
[611] The difference is 1.32c.

they actually have broader tolerances — they might be tempered pitches or natural harmonics.) After a while I start to skip over the intervening pitches and deprioritise the initial F major chord:

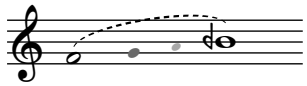


Figure 42: 'Es ist genug,' top line only.

A: But what if you have to approach the pitch in a different way, such as from above?

B: Then I'd use a different earworm — another *Naturlaut*, but from Brahms this time:

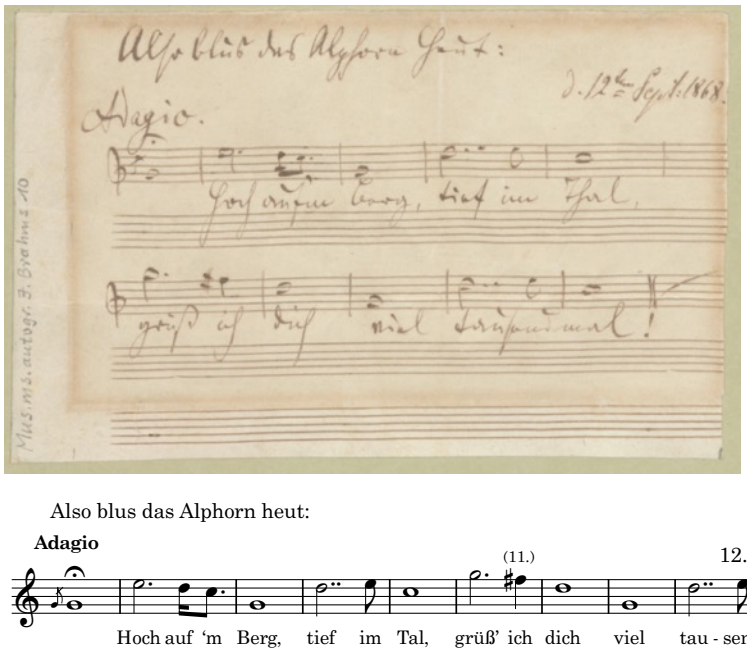


Figure 43: Eleventh harmonic earworm 2: Brahms' alphorn. Postcard from Johannes Brahms to Clara Schumann, Sep 12, 1868: original image and transcription, with implied 11th harmonic labelled.[612]

This later became the sweeping horn solo in the Symphony no. 1 in C minor, op. 68, movt. 4, but I've given it here in its original (1868) form, as an early birthday postcard from the composer to Clara Schumann.[613]

[612] Image source: 'Albumblatt für Clara Schumann 12.09.1868,' Staatsbibliothek zu Berlin, PPN 664755542, signed 'Mus.ms.autogr. Brahms, J. 10'.

[613] 'Thus the alphorn blew today: High on the mountain, deep in the valley, I greet you many thousand times!' Brahms' text recalls Eichendorff's poem of courtly love *Gruß* (1844): 'Wohin ich geh' und schaue, / In Feld und Wald und Tal, / Vom Hügel hin auf die Aue, / Vom Berg aufwärts weit in's Blaue: / Grüss' ich dich tausend mal.' ('Grüß' ich dich' is very close to 'Küss' ich dich' ('I would kiss you.') Since no transposition is given but a horn is mentioned, we can presume that this 'sounds' according to convention one octave lower, even though its 1868 'performance' was strictly limited to Brahms' and Clara Schumann's audiative faculties. (Several performances on the alphorn may be heard on YouTube.) Whether Brahms actually heard this theme or something similar on an alphorn is not especially relevant to this discussion; the alphorn *fa* is a feature of most alphorn performances. Brahms' preference for the natural horn (later influencing the Ligeti of the *Horn Trio* and *Hamburg Concerto*) has been much reported. However, the interplay between expectation and reality in this area is exceptionally complex, some players describing Brahms' horn writing as composed for an imaginary hybrid instrument, existing in the tension field between nostalgia and a desire for efficient execution of chromatic passages and rapid (hypothetical) crook changes. See John Ericson, 'Brahms and the Orchestral Horn,' *Horn Articles Online*, n.d., accessed Jun 2, 2023, https://www.public.asu.edu/~jqerics/brahms-natural-horn.html.

Brahms writes his imaginary alphorn's 11th harmonic as an F♯, but it is, of course, the plangent 'alphorn-*fa*.' This is the untameable pitch that lies furthest from the bars of the tempered chromatic grid. To ears with familiarity with microtonal music it is heard in such contexts (that is, not necessarily when actually hearing a solo alphorn) as a secure F♯ — not as a wavering shade of grey between black and white piano keys but as the chequered flag of final categorical recognition. We can extract, repeat, and remember this part only:

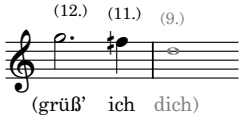


Figure 44: Brahms' alphorn, reduced.

Here's an even more explicit example from Leopold Mozart's *Sinfonia Pastorella* for corno pastoricio in G and strings (c. 1755). No-one seems quite sure what a 'corno pastoricio' (shepherd's horn) is,[614] but it's certainly some kind of simple horn that plays on the natural harmonics:

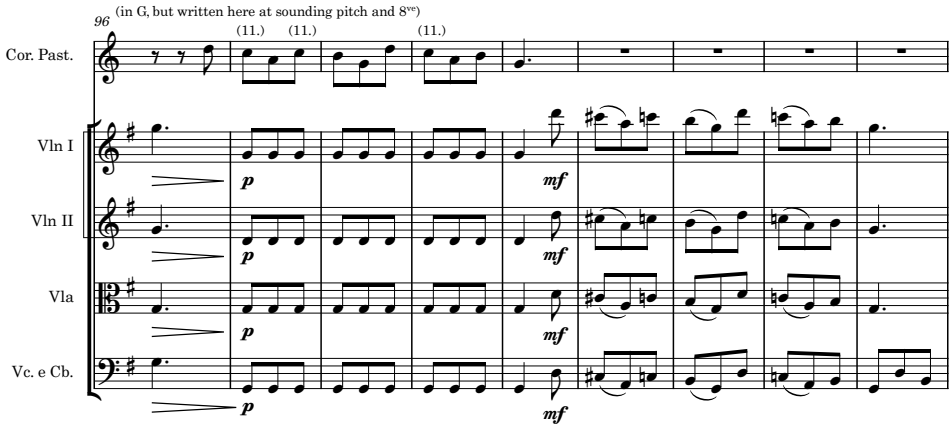


Figure 45: Eleventh harmonic earworm 3: Leopold Mozart, *Sinfonia Pastorella* (or *Pastorale*) for corno pastoricio in G and strings (c. 1755), movt.3 ('Presto'), bars 96-104.

In the Brahms example, we heard the pitch in the context of a falling three-quarter tone, which is a much more memorable interval than the quarter-tone. Leopold Mozart, on the other hand, has made hay with the incorrigibly non-binary status of the 11th harmonic, and without recourse to the microtonal notational innovations of his senior contemporary Tartini.[615] We hear the horn's C♯. The strings find themselves on the (pardon me) horns of a dilemma. They ask: sorry, did you say C𝄪? (no, not that!), or was it C♮? (no, not that either!). Let's imagine a version where the strings play a true C♯ in bar 103, resolving the conflict and welcoming the non-binary 11th harmonic into the strings' family. This example contains the full framework of the surrounding fifth G♮-D♮, which allows us to 'slot in' the C♯ so securely. But because it goes by in a flash, it's perhaps less memorable than the Brahms example.

[614] Kurt Janetzky's edition proposes 'Alp- oder Hirtenhorn, Jagdhorn, Wald- oder Ventilhorn'; in the view of Frances Jones, Leopold envisaged a relatively small, clarino-like alphorn. As in the Brahms example, **B**'s observations are agnostic about which labrosone might be used as long as the phrase is played, as it is obviously intended to be, on the natural harmonics. The piece has been performed on the wooden lur and a Kudu antelope horn.

[615] Nevertheless, Leopold Mozart was highly aware of tuning theory and practice, and had strong views on the subject. See John Hind Chesnut, 'Mozart's Teaching of Intonation,' *Journal of the American Musicological Society* 30, no. 2 (1977): 254-71.

A: From what you said earlier on, I thought you'd pick Grisey's *Quatre Chants* as a route to this pitch. I'll give an example for once:

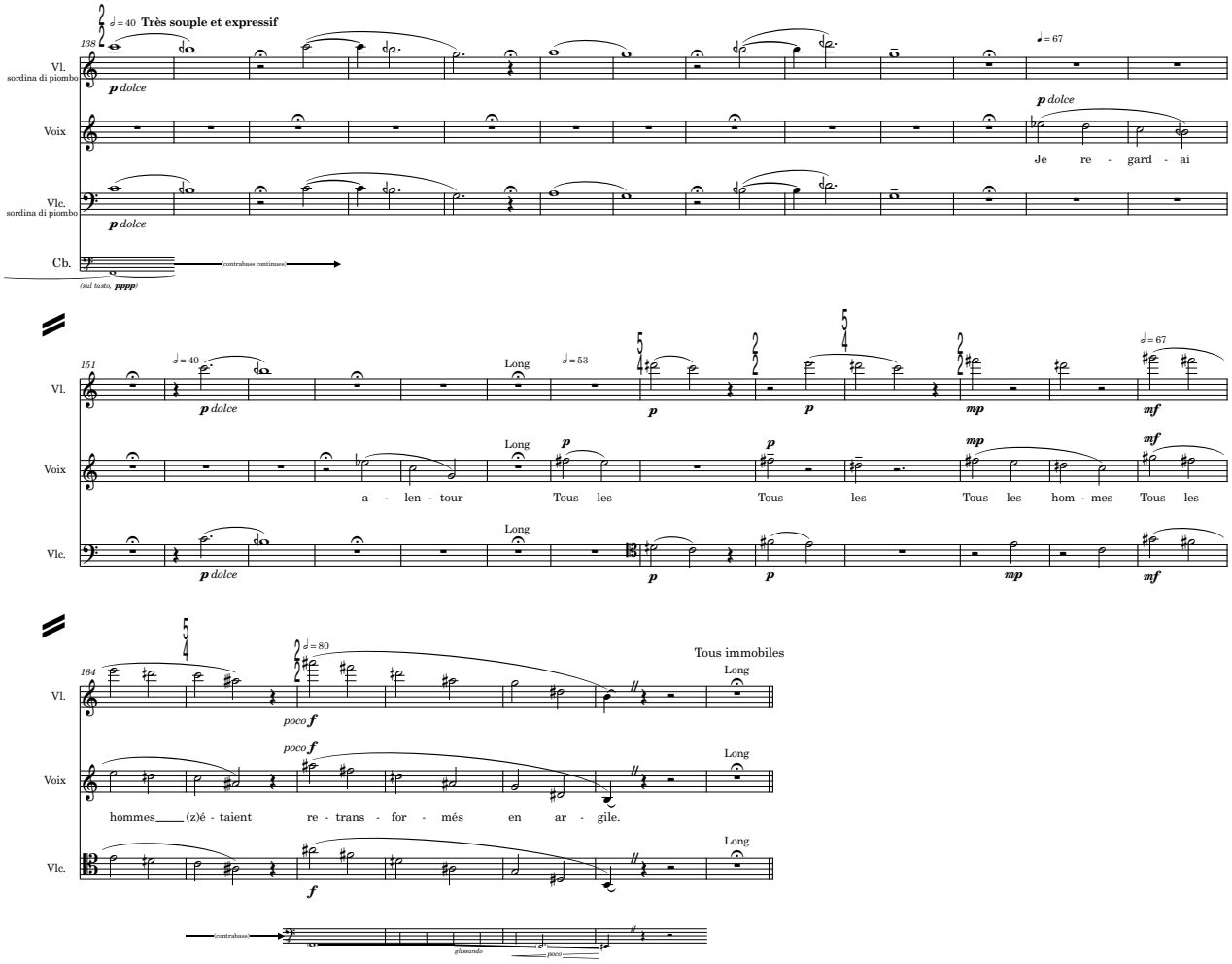


Figure 46: Gérard Grisey, *Quatre chants pour franchir le seuil* for soprano voice and 15 musicians (1997-1998), 'IV – D'après l'Epopée de Gilgamesh,' bars 138-170. Lossless condensed version of pages 117-123 of the published score. Tacent: Fl, Tpt, Sax 1/2, Perc 1/2/3, Cl 1/2, Tba 1/2, Hp. Tentative corrections: Vlc, bar 146, beat 2, orig. C♮; Vl, bar 161, beat 1, orig. F♯; rationale: to reflect majority performance practice and lack of revised edition due to the composer's death. Translation of text: 'I looked about me / All men had been / Turned back into clay.'

B: I love that bit too, and it's certainly singable and memorable. But the reason I didn't give it is that this still counts as a very delicate intonational moment for most performers. The examples from Brahms and Leopold Mozart rested on the frets of the horns and the strings and are easy(ish) to play. For most musicians, the Grisey example is the kind of challenge we are trying to help with. It isn't (yet) a secure earworm that might be used as a reference. But thanks for presenting the passage in a graspable way, on a single page instead of the seven landscape-format pages of the full score, because we can return to it at the end of this section and see if we find it more manageable.

A: Look, I don't want to sound stupid, but are all these elaborate approaches really necessary? If we want to find a quarter-tone, can't we just slice a semitone in half and sing or think something like: C♮, C♯, C♯? That would 'zero in' on the pitch from its boundaries, with the aim of minimising the risk of overshoot you warned of in the Zender example.

B: We can, and in some contexts that may be enough, particularly when we're playing or singing on our own. It's certainly appropriate for the soloist in Bartók's Violin Concerto no. 2 to conceive the indicated ¼-*hangnyi emelés/mélyítés* (meaning 'quarter-tones' — but in the loosest possible sense) in that way:

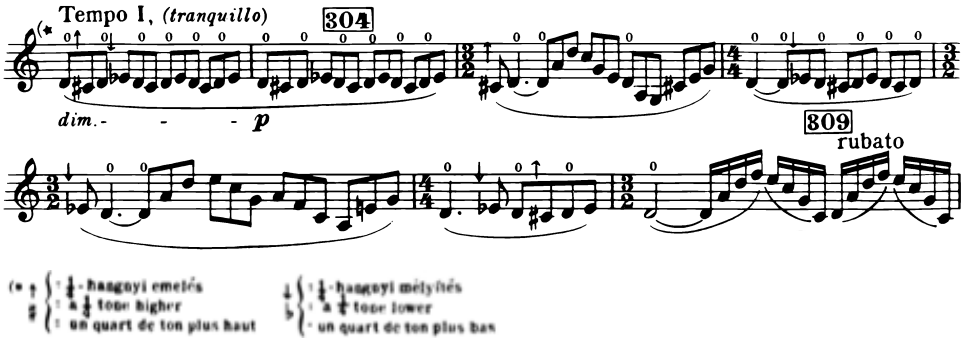


Figure 47: Béla Bartók, Violin Concerto no. 2, Sz. 112, BB 117, movt. 1, bars 303-309.

It would obviously be unhelpful to think about imaginary 11th harmonics in this situation — the soloist should apply triage and just wiggle, making sure they stay noticeably above C♯ for the second note, and below E♭ for the fourth.

Giacinto Scelsi's scores have narrower microtonal tolerances and would fall more clearly into the category of 'new music' than Bartók's. Nevertheless, the pitch-finding scenarios are often very similar: a stable reference pitch is heard, which to the performer resembles a strong magnet. The deflections are felt as effortful pulls away from this pitch; in Scelsi's music they are usually pulled back into the centre and rarely achieve escape velocity. We might call this scenario **magnetism**. It's a kind of bending, but not one that uses a known 'ooch' as a unit. The deflections are instead expressive and malleable, and we might make them greater or lesser alongside the dynamics. Such changes do not really need planning — they really are dynamic. Although it's particularly associated with older scores, **magnetism** is still quite often a useful approach to more recent compositional demands. This example, from Hilda Paredes' *Abolorios* for large ensemble, dates from 2023:

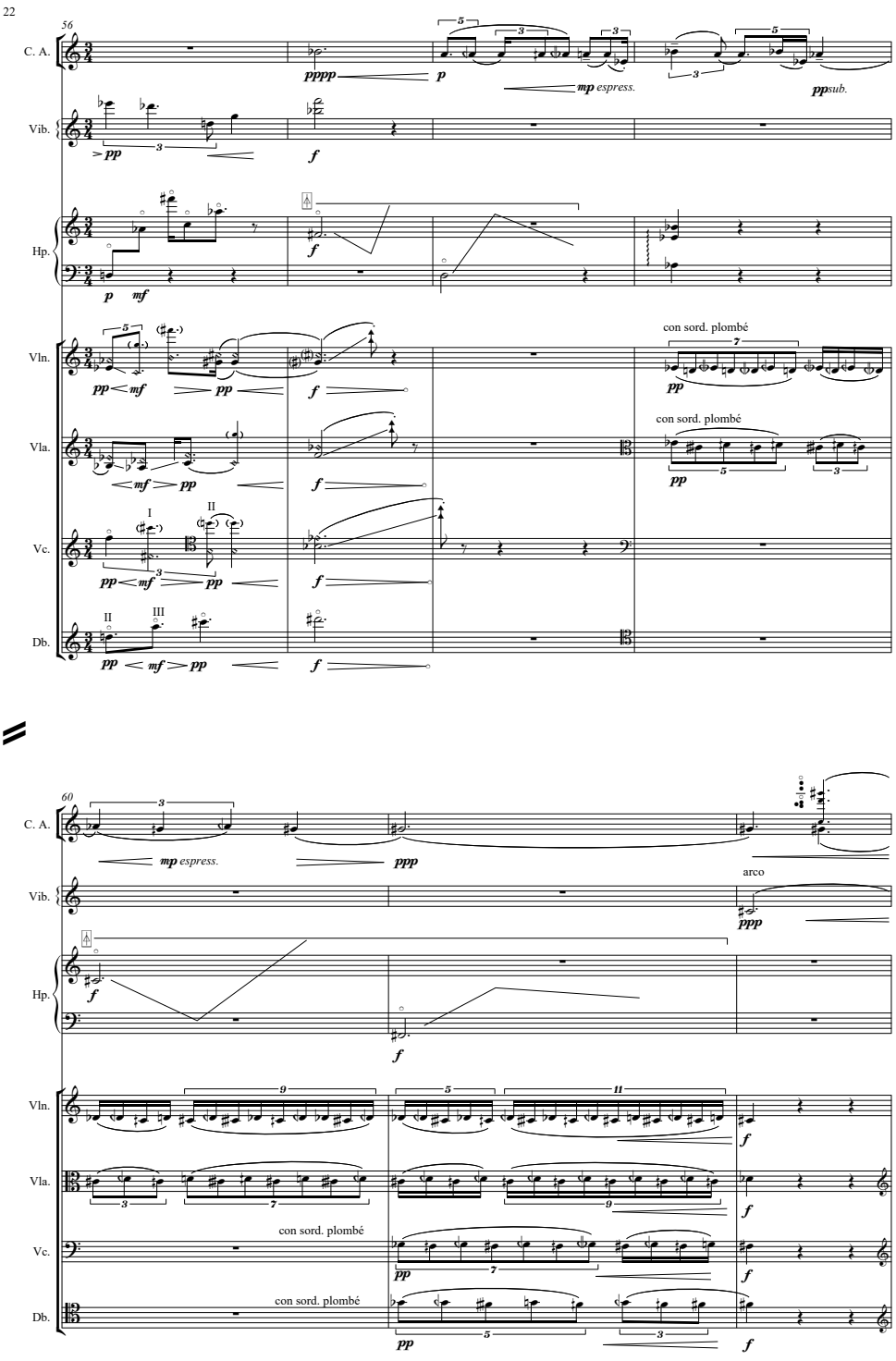


Figure 48: Hilda Paredes, *Abolorios* for large ensemble (2023), bars 56-62.

Here, the cor anglais player and the strings find their pitches by pulling against their preceding ones and those of their colleagues. You can also find situations that call for magnetism in innumerable epigonic works — think of the hundreds of student compositions that start with a single held pitch and fan microtonally outwards. To help you take control over such situations you could devise your own simple exercises:

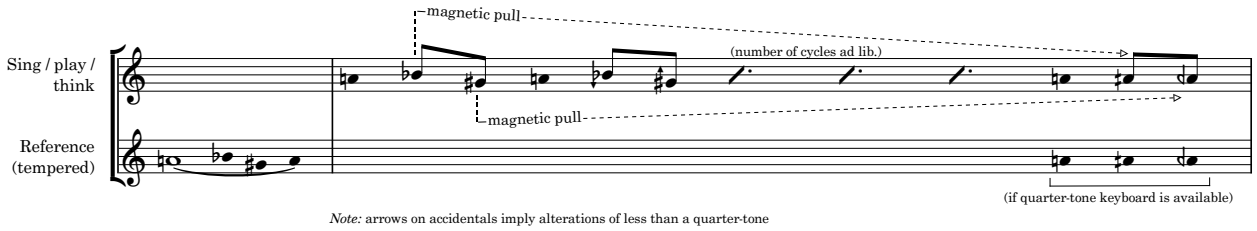


Figure 49: Exercise: using magnetism to find quarter-tones.

Then, as an extension, go all the way to unison. Mark the quarter-tone as a waypoint if you have access to a quarter-tone keyboard:

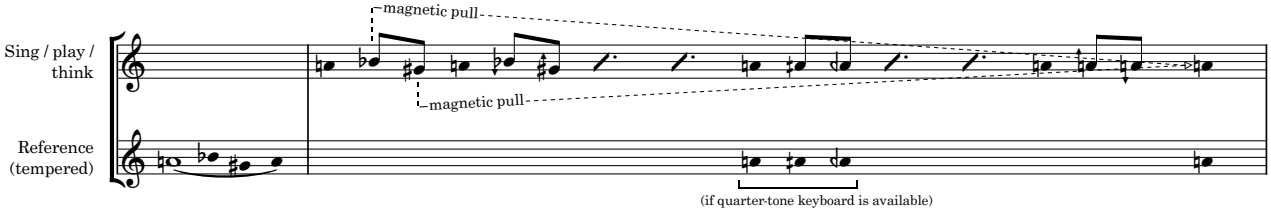


Figure 50: Exercise: magnetism, extension.

Then try both exercises in reverse, pulling against magnetism, and ending on the tempered semitones.

A: You're implying that wherever a composer uses quarter-tones as sliced-up semitones, we shouldn't worry unduly about their intonation.

B: No. The trouble is that there may be a big difference between how a composer finds pitches and how performers should. A composer may determine, in slow time, that they want to hear a C𝄲; they might (sitting at a desk, a piano, or a synthesiser) play a C𝄳, followed a couple of seconds later by a C♯, and split the difference carefully. We don't usually have time to do that in real-time musical contexts. In Toshio Hosokawa's *Ferne Landschaft II* for large orchestra (1996), which I can't include here for reasons of space, the composer writes long arcing overlapping solo lines for woodwind. Those players have some 'microtonal' adjustments that are derived from the breath-pressure-based ornamentation of shakuhachi techniques; they obviously do not have to concern themselves with categorical microtonality, but rather to bend and wave like the strokes of a shodō (calligraphy) brush — an agreeable and problem-free task. But underneath, there are chords for the strings, which also include microtonal accidentals. Although these look simpler than the woodwind lines, their execution is not. If the second violins (in unison) are faced with an A𝄲, what should they do? The pitch-finding strategy of splitting the semitone is going to yield a range of responses that is unacceptably wide in this context — across any string section, including in orchestras that play a lot of new music. They have a choice: either to agree on a different strategy, or to apply triage and write off the clarity of this pitch. And while that may be no tragedy in this moment, it is hardly ideal across large passages of similar material.

This situation is found in a great range of contexts where a composer has written a unison microtone with some kind of vague detuning effect in mind, but where the players who play that unison need to adopt a different and more focused pitch-finding strategy if they want to sound together. It arises frequently in orchestral and large-ensemble contexts, since many composers have judged the quarter-tone to be the finest intonational division that is appropriate to put to large groups of musicians. So — in contradiction to the proposed learning journey of JI advocates, who recommend working from small prime limits upwards — I would recommend learning this pitch as a priority. To do this, I've found it useful to take my upwards/Bach ('Es ist genug') and downwards/Brahms ('grüß' ich dich') earworms, and match them to chromatic pitches. It helps to have access to a tempered quarter-tone keyboard to support this (there are various online options and apps),[616] but it's not absolutely essential:

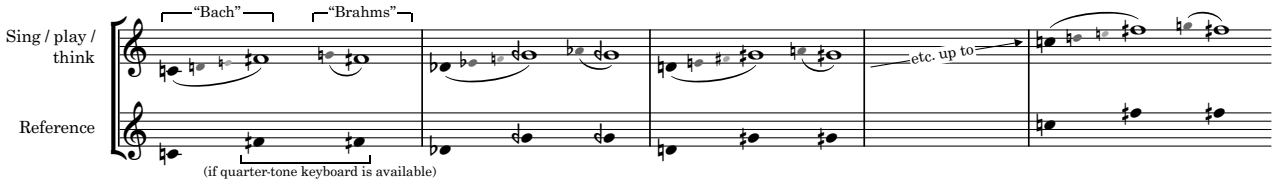


Figure 51: Exercise: Bach and Brahms, ascending.

Then try a steeper and much more challenging descent. By continually re-spelling the target as the new reference, this highlights the 'Quatre chants' quality of the descending three-quarter tone:

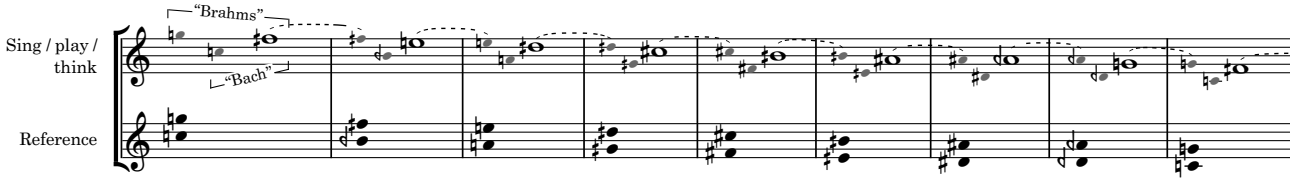


Figure 52: Exercise: Bach, Brahms (and Grisey is also there), descending.

Finally, try a mixture of both exercises, triggered by randomly-chosen (but chromatic and tempered) reference notes. Start in small steps, then introduce larger leaps in the reference pitch. Leaps of a tempered tritone seem to be the most challenging, because the pitch reached is immediately contradicted (e.g. play a reference C♮ that yields F♯, then a jump to a reference F♯.)

A: My brain hurts.

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616 E.g. Elisa Järvi (author) and Juhana Riskala (coding), 'Play Online,' *Towards the Quarter-Tone Piano*, online post-doctoral project, University of the Arts Helsinki, accessed Dec 5, 2023, https://sites.uniarts.fi/web/quartertonepiano/play-online. This is part of an ongoing project to build a viable acoustic quarter-tone piano. My home-made solution is cruder but also effective: I have a cheap electronic 'stage piano' placed on top of a Clavinova, tuned 50 cents lower and nudged leftwards by the width of half a white key. The upper keyboard may alternatively be tuned to the other pitches of the 'Swiss Army knife': -31 or -14 cents. This restricts my tuning references to contexts that include a fixed tempered chromatic; as this section argues, this restriction is a feature and not a bug. More flexible options such as Bosanquet/generalized/isomorphic keyboards (e.g. the Lumatone) have not found much use as musicianship tools in NMPT contexts. At present they are most visibly used as stage furniture, alongside other expensive toys, in the setups of pop musicians with a taste for the abstruse.

B: When I feel lostness coming on, I slow down here. Unlike in the Dvořák chorale and the 5th harmonic exercise, it's not necessary to force the pace to avoid a 'Celibidache effect.' This is because when we're asked to perform quarter- or three-quarter-tones where the 'virtual fundamental' changes with dizzying rapidity, it's almost certainly a situation that can be triaged away — as in the first Kranebitter example in 5.1. (Not all fast-looking quarter-tones fall into that category, though; it's the speed of the changing reference, not the rapidity of the notes themselves, that gives us the cue for effective triage. The rapid semiquavers for flute and clarinet in Grisey *Vortex Temporum,* I, bars 1-38, do need to be in tune — meaning, in this context, sounding like tempered quarter-tones — because they are arpeggiations of slow-moving material.) We might even propose this as a rule of thumb, or perhaps a rule of middle finger: *don't bother tuning passages in 24-EDO where the tonal centre changes rapidly*. That kind of music sounds so grey that no-one, including ourselves, will notice or care. The exercises above are only worth applying in contexts where the references change sufficiently slowly to permit us to set up a meaningful 'in tune / out of tune' opposition. And as performers, judging what is meaningful is ultimately down to us.

A: Now can we finally talk about the 7th harmonic?

6.3.3.3 Working with the seventh natural harmonic

B: A quick re-cap first. We looked at the 5th harmonic, less for its own qualities, and more for its difference from its tempered neighbour. In doing so we tried to get the feel for a very small but reliably replicable linear deflection (an **ooch**.) Then we looked at the 11th harmonic and quarter-tones. In this context it seemed that **bending** leads to relatively vague outcomes (which may be perfectly appropriate in **magnetism** contexts), and that **rooting** is more useful where the tolerances are narrow. Both the 5th and the 11th harmonics have an obvious clear relationship to the gridlines of 12-EDO: one is an ooch away, and the other is (for ear-training purposes) exactly in the midpoint between two lines. The 7th harmonic is different. It stands alone —

A: You mean because it's 31 cents flatter than its tempered neighbour? So it really isn't close to the other pitches we've seen in terms of deflection from 12-EDO.

B: Whether for that linear reason, or for its vertical sonority, this is an intensely memorable and distinct pitch. When it's associated with the seventh of a familiar scale, people have sometimes casually declared that this pitch is 'used' in blues music — although rarely with the kind of accompanying evidentiary 'ground truth' that might pass a *Temperament Police* test. In fact we hear assorted varieties of low seventh in all sorts of diatonic and modal musics. It does sometimes ring out very precisely from the close-harmony chords of barbershop singing and so has been called the 'barbershop seventh.'[617] After singing 'Happy Birthday To You' (here imagined in G major), people occasionally add this little coda:

[617] Gage Averill, 'Bell Tones and Ringing Chords: Sense and Sensation in Barbershop Harmony,' *The World of Music* 41, no. 1 (1999): 37–51.

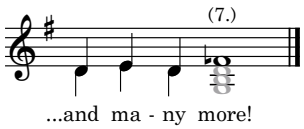


Figure 53: Seventh harmonic earworm 1: 'and many more.'

This is a harmonic seventh chord (in the language of intervals), a tonic seventh (in its functional sense), or a 'meat n'taters chord' (in barbershop language.) We could reach it upwards in that arpeggiated way,

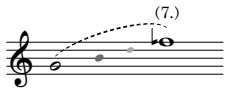


Figure 54: Seventh harmonic, from beneath.

and also downwards, even more simply:

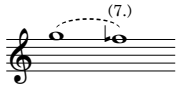


Figure 55: Seventh harmonic, from above.

I've taken the rare step of using an accidental that isn't universally recognised — Tartini's 'inverted 7' — to emphasise its difference from the other functions of our Swiss Army knife, for which I've used conventional accidentals and arrows. We could select earworms to reinforce it from a host of otherworldly moments in earlier music, such as the opening of Benjamin Britten's *Serenade* for Tenor, Horn and Strings. Britten stipulates 'The Prologue to be played on natural harmonics':

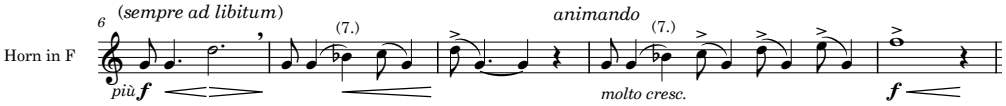
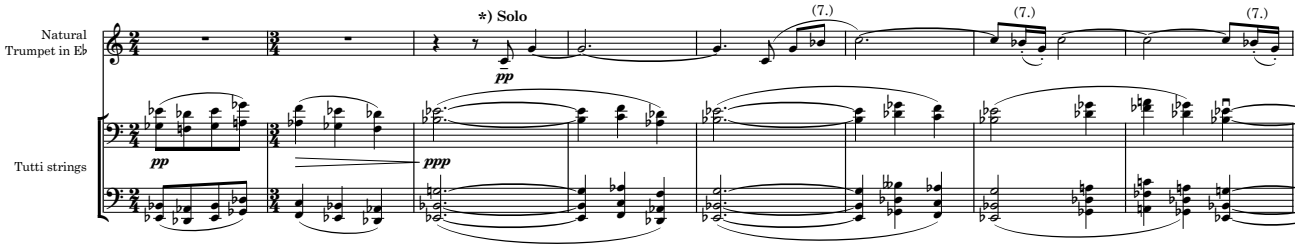


Figure 56: Seventh harmonic earworm 2: Benjamin Britten, *Serenade* for Tenor, Horn and Strings, op. 31 (1943), 'Prologue,' bars 6-10.

Or from an even earlier piece, the *Pastoral Symphony* of Ralph Vaughan Williams. The composer spells out his intonational preferences even more explicitly than Britten:



*) It is important that this passage should be played on a true E♭ Trumpet (preferably a Natural Trumpet) so that only natural notes may be played and that the B♭ (7th partial) and D (9th partial) should have their true intonation. This can, of course, be also achieved by playing the passage on an F Trumpet with the 1st piston depressed. If neither of these courses is possible the passage must of course be played on a B♭ or C Trumpet and the pistons used in the ordinary way. But this must only be done in case of necessity.

Figure 57: Seventh harmonic earworm 3: Ralph Vaughan Williams, *Pastoral Symphony* (1922), movt. 2, 6 bars before G. 'Poco tranquillo, tempo rubato.' Transposing score. String parts condensed.

It seems to be a very English pitch — or maybe one that came naturally to musicians who were all too familiar with the funereal military bugle.[618] I don't think most people will need to work hard to learn the pitch itself when its fundamental is near at hand. What needs attention is ensuring that it does not slump into a nearby arm of the armature we're trying to build here — the 11th harmonic of the fundamental a (tempered) major third higher. An awareness of this distinction is where our embrace of 'xenogamy' of systems really pays dividends. I'd recommend taking the next exercise slowly at first, to allow the difference to bed in. To emphasise the mental categorical distinctness we're trying to develop here, pitches found via the 7th harmonic are marked in green, while those from the 11th harmonic are cyan.

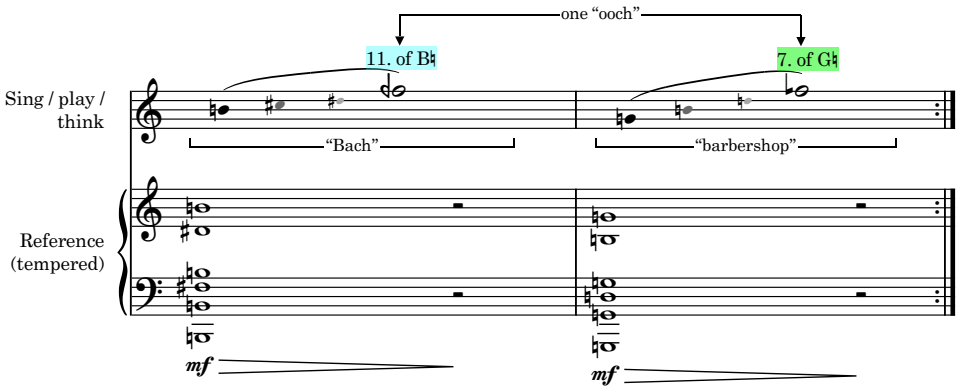


Figure 58: Exercise: Bach versus barbershop.

Once this feels comfortable, try it with less explicit preparation. (The memory-trace of the previous exercise should still be with you, though.)

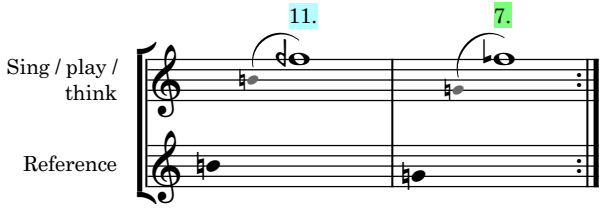


Figure 59: Exercise: 7-Eleven, convenience version.

On paper, the green and cyan pitches are separated by 19 cents. But for pitch-finding purposes the gap is an **ooch**. You can test this by linking it to the first exercise and, bringing in the major third below in its two varieties (this time, first 'tempered' then 'just.') Pitches found via the 5th harmonic are marked in magenta:

[618] For new music-focused readers who may not be familiar with the Vaughan Williams symphony — 'Pastoral' does not refer to an English country idyll. Rather, 'It's really war-time music - a great deal of it incubated when I used to go up night after night with the ambulance waggon at Ecoivres and we went up a steep hill and there was a wonderful Corot-like landscape in the sunset - it's not really lambkins frisking as most people take for granted.' Hugh Cobbe (ed.), *Letters of Ralph Vaughan Williams, 1895-1958*, (Oxford: Oxford University Press, 2008), 264-265.

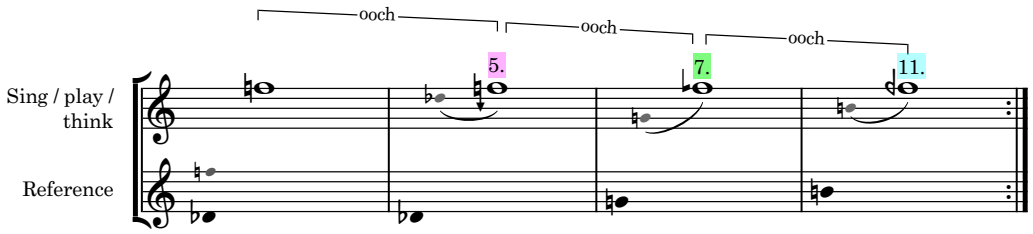


Figure 60: Exercise: multi-tool descent.

A bemused passer-by who overhears you sing the upper line in isolation (if you were using headphones to supply the references, for example) will simply hear a slithering descent, sounding very similar to the **magnetism** exercise above. But the inner pitch-finding experience is completely different: the first is a blunt instrument, while the second is a multi-tool.

6.3.3.4 Applications, exclusions, exceptions

In the interests of completeness I will give all the pitches reachable in this way marked with their 'virtual fundamentals' in an impressive-looking list:

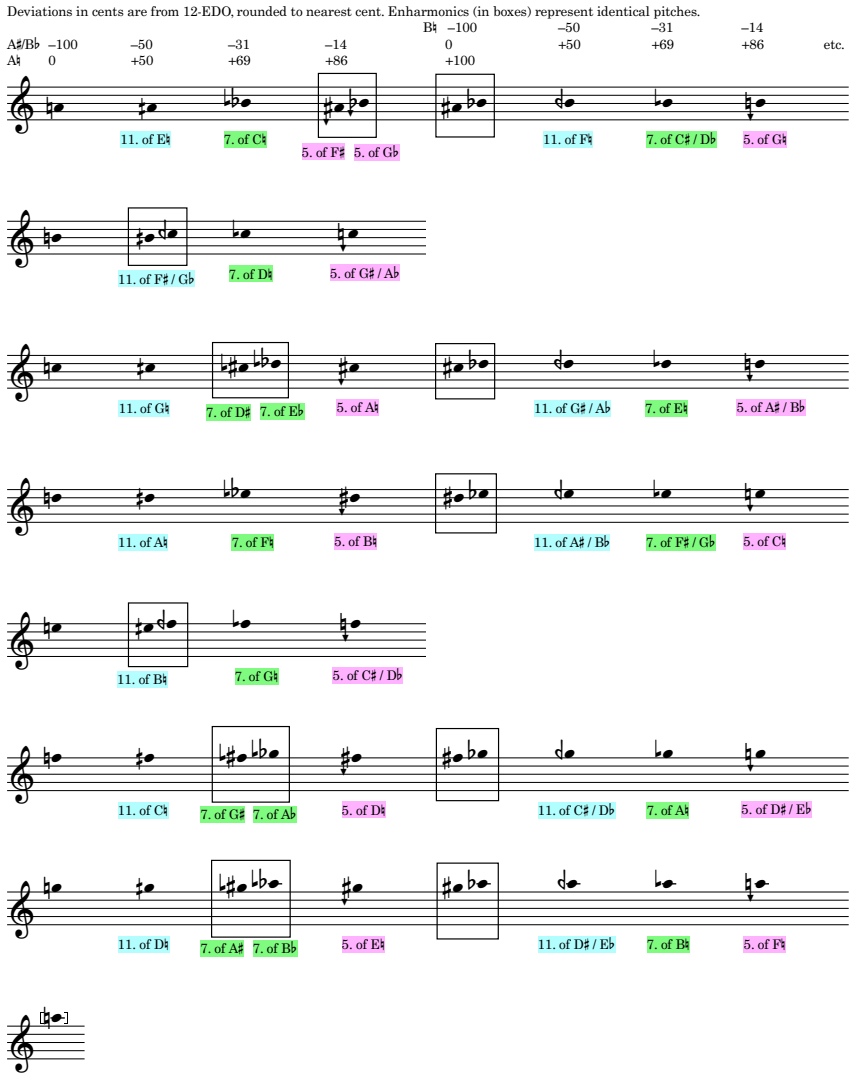


Figure 61: The Swiss Army knife opened out completely (for demonstration purposes only.)

However, unfolding the 'knife' in this way is to miss the point, because this not a scale intended for use as compositional or improvisational material. (It would be a very odd and gappy one.) In any practical orientational context only a few of the listed pitches are actually used. In a pedagogical interaction I would never show the complete list, since it is intimidating, and — what's worse — misleading. I can't race up and down all those pitches and nor can anyone I know. Rather, portions of it can be used. For example, you could use the following as an audiative warm-up exercise. It might be called 'Flavours of A.' The pitch-finding approach starts blunt and becomes finer:

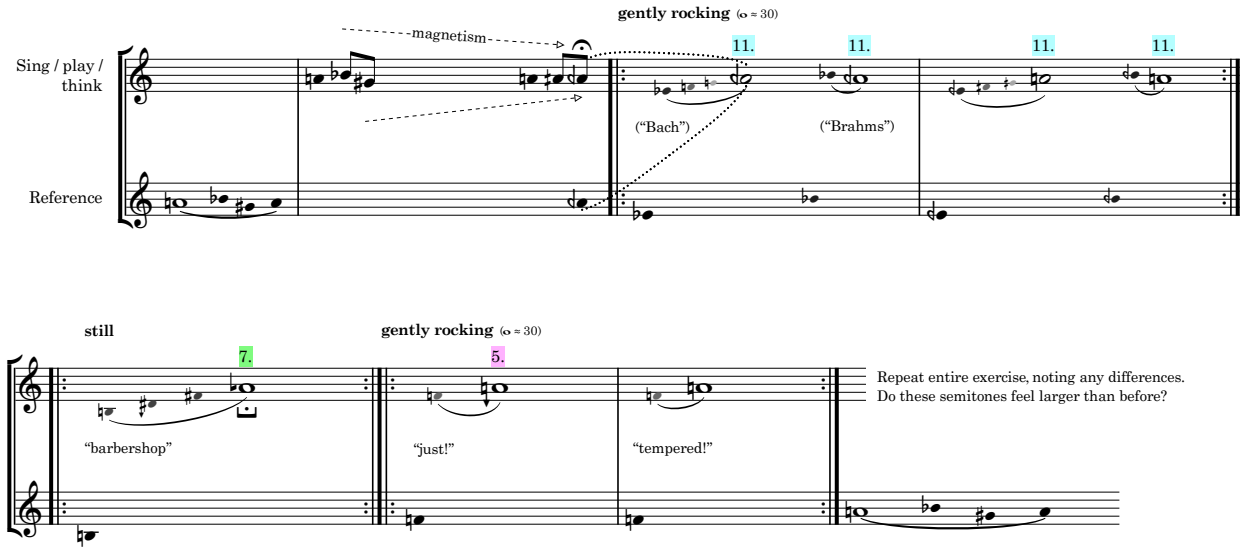


Figure 62: Exercise: Flavours of A.

The deeper skill that all of these exercises is intended to develop is not the finding of the pitches in the upper line, but rather to increase confidence and robustness when expecting and projecting ('audiating') the virtual fundamentals. As we repeat every exercise, we should try to use the sounding references less and less: meaning, playing them less frequently, at a quieter dynamic, and/or holding them for a shorter time. That's because we are trying to embody and become the reference — even though, as in the first exercise back in Chapter 3 (the steps *almost* to Parnassus), we know perfectly well that we'll never get there in reality.

A: So you've suggested learning harmonics 5, 7, and 11. Why did you miss out 3 (and 6 and 12, obviously), and 9?

B: The 3rd harmonic (or the just perfect fifth 3:2) isn't something that needs learning in itself — its ringing quality is known to all musicians, and to string players from early childhood. It either is, or it is not. If you are asked to play a sustained perfect fifth against a colleague's pitch, you have a clear choice: make it pure and ringing (this is actually the easy option, so let's not pat ourselves on the back when we do so!) or attempt to sustain the tempered difference of 2 cents and keep on **gridding** (a tough call, but sometimes the right one.) It doesn't usually provide useful opportunities for pitch-*work*: moving fundamentals around, bending, etc. Its difference from 12-EDO is either too obvious (in the case of tuning the adjacent strings of a cello)

or too small (it takes fully seven octaves — the range of a piano — stacked against twelve just perfect fifths to yield the Pythagorean comma.) That is the zone where fixed temperaments come into play, and we're not discussing those here.

A: And missing out the 9th harmonic? Even Vaughan Williams wanted to hear that one, and people wouldn't usually call him a microtonal composer.

B: That omission is less easy to justify, but I'll try. Outside specifically JI-based compositional contexts, where dyads tend to be held long enough to allow the performer to really lean into their vertical identities, I must confess that I find the difference between the large and small major seconds (9:8 and 10:9) utterly unmemorable. Perhaps because we focus so much on the just major third 5:4 (or 10:8), which outlines these pitches in the harmonic series, the intervening step seems less certain. Or perhaps it is simply because equal temperament has dulled our sensitivity to it, as JI advocates suggest. I was looking for pitches that jump out in primary colours and seem to demand distinct niches in our memory palaces, not ones that may be cherished and worked with by connoisseurs only. The 9th harmonic didn't make the cut. Nor did any higher primes — 13 is already a mystery to me in the sense of pitch-finding,[619] and I'm sceptical about claims to be able to do ensemble-relevant active pitch-work that is reasonably reliable and replicable with anything higher (but prove me wrong, please!)

A: So is that your Swiss Army knife, then?

B: It's an outline of its main functions. The functions can now be combined to make 'calisthenic' (remember Friedmann?) ear training exercises. They can be relaxing, strenuous, or exploratory, as you please. You could select a starting pitch, then (on paper) construct a long succession of leaps — always supported by tempered 'virtual fundamentals' — that eventually ought to return to that pitch. Then sing or play it and see how far you have diverged, discover which leaps caused the problem, and isolate them for practice. The closed, constrained, and fundamentally LEGO-like nature of the 'knife' enables this kind of work. The Oulipiens — a loose collective of writers who employed deliberate constraints — declared that they were 'rats who construct the labyrinth from which they plan to escape.'[620] Instructors (and brave trainees) can do likewise and build their own little labyrinths with these constrained materials; the level of complexity can be matched to the abilities and capacities of the trainee. Alternatively, you could use these materials as starting-points for 'outward-pointing' exploration. For example, you could stack seventh harmonics on seventh harmonics, continually re-spelling the found pitch as a reference and jumping down the octave as required to stay with your vocal range and workzone. (It's easiest to use a string instrument for this kind of exploratory 'open chain' play, because you can use a placed finger as your 'memory' of the previous

[619] Whereas for Harry Partch, '[T]he reason for resting at the limit of 11 is a purely personal and arbitrary one. When a hungry man has a large table of aromatic and unusual viands spread before him he is unlikely to go tramping along the seashore and in the woods for still other exotic fare. And however skeptical he is of the many warnings regarding the unwholesomeness of his fare … he has no desire to provoke further alarums.' Partch, *Genesis*, 123.

[620] 'Être oulipien, c'est être le rat qui se construit lui-même le labyrinthe dont il se propose de sortir.' Jean Lescure [?] (also attrib. Georges Perec and Raymond Queneau), in Jean Lescure, 'Petite histoire de l'Oulipo,' *OULIPO: La Littérature* Potentielle (Paris: Gallimard, 1973 / 1988), 32.

reference.) But that activity starts to resemble 'relational' or 'extended JI' practices, and moves more in the direction of live composition / improvisation than our focus here.

A: I thought the idea was to help NMP trainees play pieces with more confidence, not to build new structures.

B: Yes. The knife is principally intended to be applied to pitch-finding challenges presented in the conventional way — from a composer to a performer via a score. You could directly apply it as an aural workout or warm-up when preparing a difficult section of Georg Friedrich Haas' *Atthis* for soprano and eight instruments (2009), bars 215-270 ('nimmermehr komme ich wieder.') This passage, which is too long to quote here, contains a succession of overlapping and strongly-conflicting chords derived from the natural harmonic series, all built on tempered fundamentals: i.e. a highly-developed version of **Figure 25** (the 'xenogamy' tuning option of the Dvořák chorale) with some additional fragmentary expressive lines written in the tempered chromatic. For all performers — not just the singer — the pitch-finding in this passage requires careful attention, since the durations of the overlaps are long enough to make aural lostness a real risk if performers forget where their reference is coming from. For example, the clarinettist in bar 249 needs to think: *here I should listen to the B♭ fundamental in the bassoon, and <u>not</u> to the C♯ fundamental in the contrabass*. The composer gives some help by supplying performance directions such as 'the G4 of Vln.1 (a fifth above C) is to be played slightly higher than the G5 of Vln.2 (a third above E♭); the octave between the two instruments beats strongly.' Of course, a composer cannot provide wordy explicit instructions for every such interaction. Nor can every musician adjust 'musically' as they go to the playing of their colleagues, and nor should they, for the reasons we explored in the Dvořák discussion. It is highly advantageous here for performers to *enter* the rehearsal process with a shared and relatively stable sense of a natural seventh, a just major third, and an 'alphorn-*fa*,' as well as the ability to securely negotiate leapy and strictly tempered chromatic lines. That's what the knife is intended to help with. Then the rehearsals can be devoted to enjoyable music-making, and not only survival.

A: I'm exhausted. That's it, I hope?

B: Two final points. The first is to repeat the disclaimer at the start: this is not proposed as an alternative to, or a cheat-sheet for, a performer's approach to all microtonal contexts — although I have found that this limited palette of 'moves' has been efficacious in my own performing and pedagogic practice. It may not be the appropriate way to approach some works written with very fine tolerances, and there may be cases where its use is actively unhelpful. That last scenario has its own name: **look-it-up**. In this scenario, a performer copies an set of external pitch references that are completely fixed (not frets, which are located on the player-instrument actant.) These may be tuning forks, portable electronic tuners, bespoke project-specific tools such as a tuning CD or synthesised learning track supplied alongside a score, or more developed resources such as Robin Hayward's *Tuning Vine*, Caspar Johannes Walter's web app *Chord Player*, or Martin Suckling's *Just Tune!* iPad app. *Tuning Vine* has been used as a study tool and also a prompt for improvisation, *Chord Player* has been used by (amongst others) performers learning Stahnke's utopian *Beating*

(see above), and *Just Tune!* — well, that was built at my request,[621] because I wanted the nimblest way to learn to dance between the pitches of the harmonic series and those of 12-EDO, and I am a technological illiterate. So although in this text I have emphasised the worth of live pitch cognition and denigrated mimesis, the truth is that I do make use of these technologies in my own performing practice. However, I try to use them in the initial stages of preparation only, and let them fall away quite early; I'll always fly solo if I can.

A: You've mentioned **look-it-up** last, but I bet many people would take that approach first when they're faced with a shower of microtonal accidentals, particularly when they're short of time and need to prepare a piece quickly.

B: And rightly so, if triage demands it. I don't know whether the memories go deep, though — deep enough for them to be transferred usefully to the next project and the next, I mean.

A: You're really down on technology! Embrace your inner cyborg…

B: I value it when it offers us humans something genuinely new. Here's a case where **look-it-up** met other scenarios, with cognitively challenging and refreshing results:

[621] I requested the following features: the ability to play the first few natural harmonics above a given fundamental (the app goes to the 30th harmonic, which, while rarely necessary in itself, aids rapid playback of octave transpositions of lower-numbered harmonics: 7 / 14 / 28 or 11 / 22); rapid selection of tempered fundamentals with easy shifting up and down a quarter-tone; one-touch shifting between the reference pitches A4=440Hz and 443Hz, a small selection of pleasant-sounding waveforms (sines are generally inappropriate for live tuning since they sound flat; square and triangle waveforms are more useful), and a very simple user interface with large buttons to aid rapid reference-giving in rehearsals. Much more feature-rich apps exist; the utility of *Just Tune!* is in its simplicity. In this respect it is a technical analogue to the Swiss Army knife proposed here. See the list of thanks in the Preface.

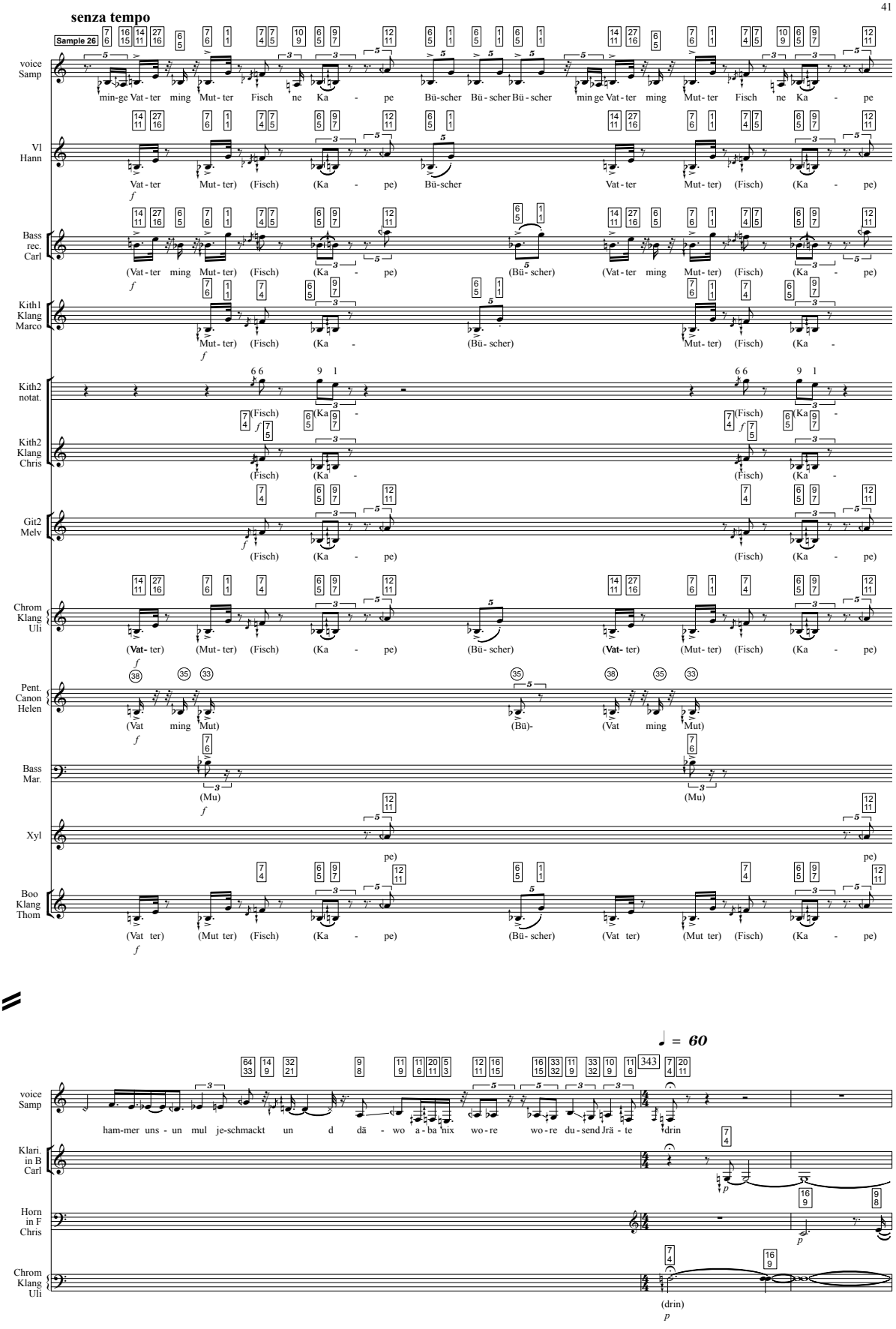


Figure 63: Carola Bauckholt, *Voices for Harry Partch* for ensemble (2014-2015), bars 342-344. Thürmchen Verlag. Reproduced with kind permission.

This is from one of the works Ensemble Musikfabrik commissioned for the Harry Partch instruments combined with conventional Western ones — I mentioned these in the Preface. The technology in question is very simple: a timbrally-unmodified, but wittily decoupaged, recording of a boy talking about a fishing trip. He has a lilting Kölsch dialect with a wide melodic range. Elsewhere in the piece we hear Partch's own speaking voice, treated in a similar manner. Bauckholt has carefully traced how she hears the pitches of the boy's voice and notated them with microtonal accidentals, and also supplied Partch's equivalent ratios above the stave. So the players have to take account of three sources of pitch information — samples, accidentals, and ratios — and also need to think about playing with each other. **Look-it-up** was the dominant coping strategy here — the players listened intently to the samples and matched the pitches they heard. But it wasn't the only strategy in play. The notation (both types) offered mnemonic benefits and also practical guidance by helping with blunt pitch-finding: getting fingers and embouchures into position in advance, and making sure the rods of the Kitharas were more-or-less in the right place. And it also played a role that we might call categorical, or even grammatical: it allowed us to understand these pitches internally by relating them to existing memory structures. Bauckholt's maximalist approach prompted an informed and rich conversation between (at least) three ways of conceiving pitch, each with different tolerances: mimesis, deflections from the chromatic, and JI ratios. You might feel that this wasn't a very efficient communicative strategy, given the different and potentially-conflicting tolerances of each line of thinking, and, if you think that a performer's job is to replicate a composer's fully-conceived sounds (the Parnassian view) you might be right. But, speaking personally, I don't think that's my role — I'll leave that job to the play button on a DAW. If I conceived a performer's role in such a drudge-like way, I wouldn't bother thinking about NMPT musicianship or even performing; there are easier ways to earn a living.

A: You said two last points…

B: The second point may be hard to accept for some. It's that **gridding** can rank among the most intensely aurally-challenging scenarios, and sometimes mandates — even for quite experienced performers — some moments when it's best to **look-it-up**. But it's also an important part of the Swiss Army knife. It's the casing, providing structural support, while the three natural harmonics are the blades, only to be folded out where necessary. So it deserves its own subsection.

6.3.3.5 Working with the tempered chromatic

A: Gridding meaning just playing in 12-EDO?

B: Gridding meaning playing and thinking *relentlessly* in 12-EDO. Musicians who have undergone the kind of aural hybridisation I talked about earlier — i.e. players who have played a lot of microtonal music — often seem to find it challenging to play in strict 12-EDO. Now, I don't know if that really is the case in terms of their sounding results (compared with colleagues with less explicitly microtonal experience), or whether it just feels that way, because their sensitivities have been sharpened and they are more aware of the possibility of systemic differences. As the German phrase goes: *wer die Wahl hat, hat die Qual* (literally: 'whoever has choice has torment' — or maybe that such a person is 'spoilt for choice'!) As far as I know, no-one has formally investigated that subject. It could be another case for the *Temperament Police*…

A: So when do you **grid**?

B: In the performance of vast swathes of twentieth-century repertoire, for a start. Anything that's serial-adjacent, for sure: late Stravinsky,[622] Webern, Elizabeth Lutyens, Josef Matthias Hauer… take your pick. When we perform Webern there's a strong temptation to make our expressive intonation match the hyper-attentiveness we bring to other musical parameters: a delicately elastic rubato, a quality of suspended breathlessness in the silences, ultra-fine dynamic control, and scrupulous balance. But I think we should resist the temptation and remain — for expressive reasons! — relentlessly in 12-EDO. Here is an entire movement at a glance:

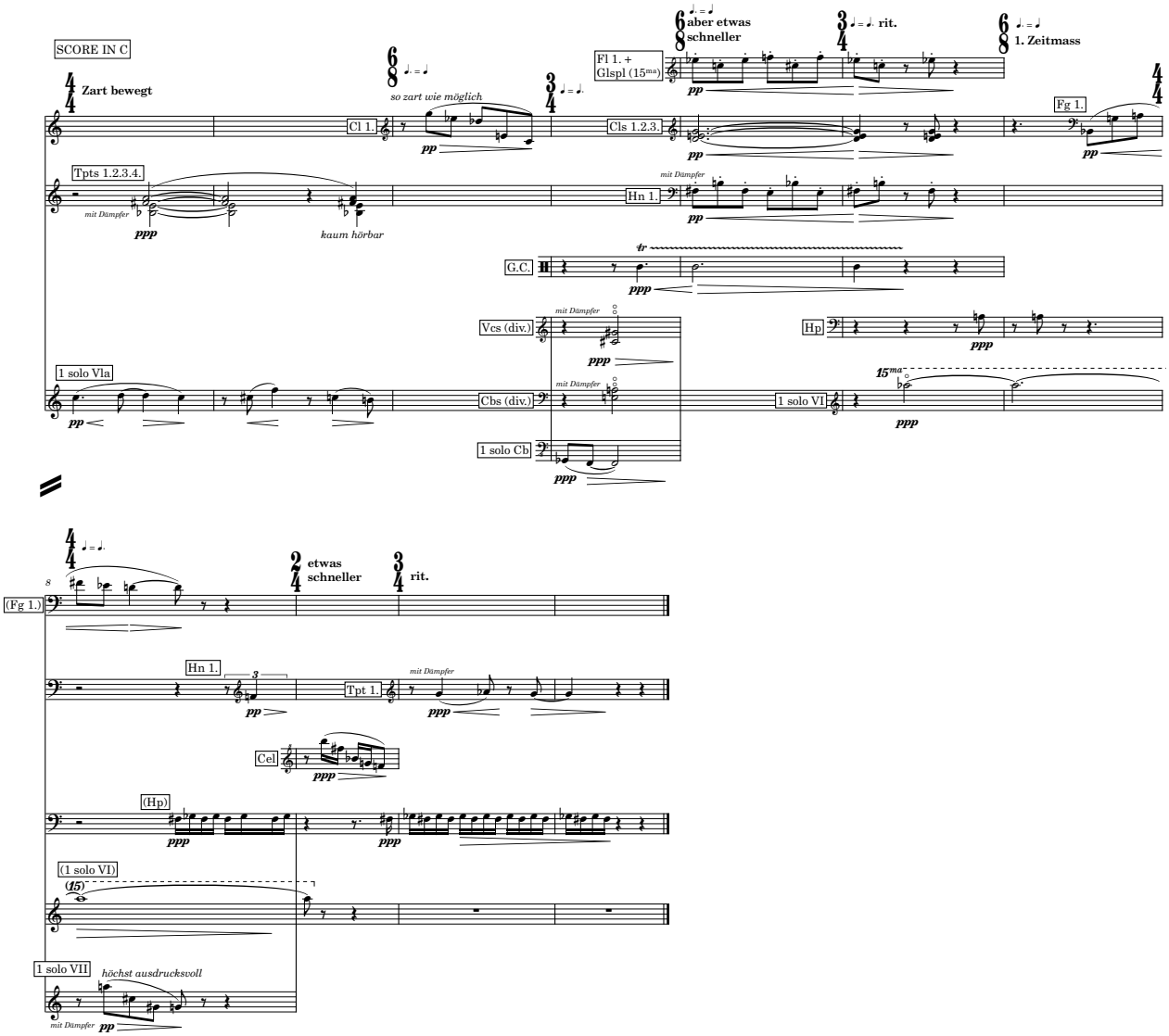


Figure 64: Anton Webern, *6 Stücke für Orchester*, op. 6, movt. 3, complete. Original version (1909). Lossless condensed presentation, based on Universal Edition no. 6646.

[622] Stravinsky, at the age of 84, made the following teasing prediction: 'And what of the future? … I know … that I will never cross the gulf from well-tempered pitches to sound effects and noise … But predictions are dangerous.' Robert Craft and Igor Stravinsky, *Memories and Commentaries* (London: Faber, 2009), 263. As in my previous quotations from Stravinsky, this self-description as a composer positioned on the 'tempered pitches' side of a stylistic 'gulf' should be taken with a pinch of salt, since that composer — notwithstanding his habitual use of the tempered piano as a compositional reference — had already made glorious use of 'sound effects and noise' in his orchestration of *Le Sacre du printemps*, and had (in an early example of de-fretting without de-tuning) drawn bell-like non-tempered pitches from the pianos in *Les noces* through the artful registral placement of conflicting major and minor thirds.

In its expressive character this is the least grid-like music that could be imagined. However, in contrast to the situation in the Dvořák chorale, I cannot think of any benefit arising from any deviation from 12-EDO here. This little flower breathes at its sweetest, and feels most cogent, when we hear — and cause to be heard — certain persistent pitches as identical, especially when they skip between octaves. For example: the initial F♯ in the second trumpet links to the G♭ in the bass solo, then to the horn entry, the peak of the bassoon solo, and finally the fading harp throbs. If it does not — if, for example, the trumpeter selects a locally-just tuning option against their colleague's A♮, if the solo bassist considers their sighing gesture in isolation and plays a dolefully 'expressive' low G♭, if the harpist has not tuned the F♯/G♭ strings in advance with sufficient care, if a high-quality celesta is unavailable, etc. — the piece fragments into a series of inconsequential gestures. The collegiate and musical-seeming strategy *I'll tune to you, you tune to me*... is here even less helpful than it was in the Dvořák discussion, since the non-negotiable pitches in the harp and celesta arrive *after* those in their more-adjustable colleagues' parts.

During a rehearsal of another twentieth-century work, Hans Werner Henze's *In memoriam: Die Weiße Rose* for twelve instruments (1965), the sensitive players found that many verticalities posed what they perceived as intonation problems. Accordingly, they tried to tune their chords in a similar way to the process I described in the Dvořák discussion: carefully but unsystematically building well-sounding fifths, fourths, and major thirds, and later adding the 'foreign' pitches (semitones, major sevenths, etc.) Due to the unremitting chromaticism of Henze's harmony in this piece, this well-intentioned and natural-feeling approach caused more problems than it solved: no sooner was a satisfying-sounding verticality established than it was contradicted. The players would have been better off **gridding** and using **look-it-up** — that is, tuning the pitches individually to the nearby piano, or using an electronic tuner. (At the time I lacked the insight to suggest this.) This uninspiring-sounding strategy can be the appropriate one more often than some sensitive players would like to admit.

All this conforms to the much-told narrative about the supremacy of equal temperament in the early-to mid-twentieth century. What's perhaps less expected is that we often need to **grid** when performing music by more recent composers who are highly aware of, and even make explicit use of, microtonal practices. An clue for the appropriateness of this scenario is a composer's use of sustaining instruments to continue attacks from the piano, marimba, or vibraphone. This orchestrational feature is not only extremely common, but in the works of composers including Michael Jarrell and Marc-André Dalbavie might even be called their default practice: we might speculate that it was influenced by the jangly instrumentation of the Ensemble Intercontemporain, which included three pianists, three percussionists, and a full-time harpist among its 31 members, and also by its pianist-founder's somewhat brisk attitude to microtones. The microtonal inflections in this passage from Jarrell's *Music for a While* for ensemble (1995), for example, only make sense when the *un*inflected pitches are scrupulously played in 12-EDO:

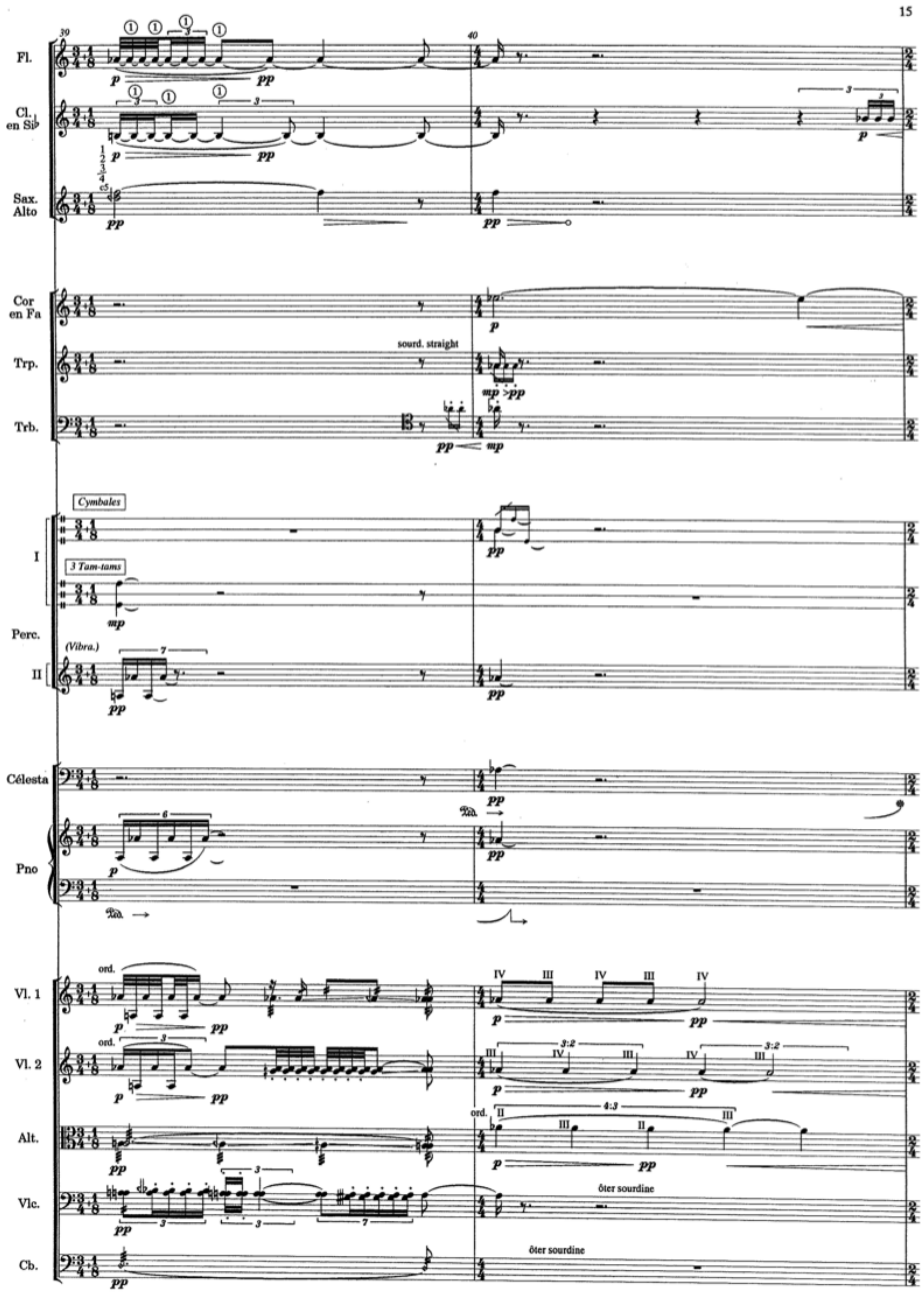


Figure 65: Michael Jarrell, *Music for a While* for ensemble (1995), bars 39-40. Transposing score.

Throughout this section, and in most of the rest of the piece, the pitch-finding strategy is **gridding** for the tempered pitches (e.g. the delicate and registrally-extreme bars 1-20), plus **magnetism** for their deviations — and, unlike in most of the examples in this dialogue, those really are deviations. The mere presence of an unaltered piano (or a vibraphone, or celesta) in an ensemble does not necessarily imply that gridding should be assumed to apply throughout, however. Indeed, other passages in the same piece (e.g. bars 21-36) demand **dosing dirt**.

Here's a recent example from a very different stylistic world: Andrew Norman's *Try* for chamber orchestra (2011). The piece contains numerous **transitions** and pitch bends and glissandi that demand **dosing dirt**. The composer's communicative strategy is non-Parnassian and dialogic: the score contains a large amount

of triage-like advice ('chaotic rewind: winds need not be accurately coordinated, so long as they finish on time' / 'horns/trumpets: if the 2 octave leaps are awkward/unstable, bring the lower note up an octave,' etc.) Nevertheless, the default pitch scenario is **gridding** throughout — one of the few pieces of advice for the performer that the composer did not think necessary to highlight, but one which demands assiduous attention:

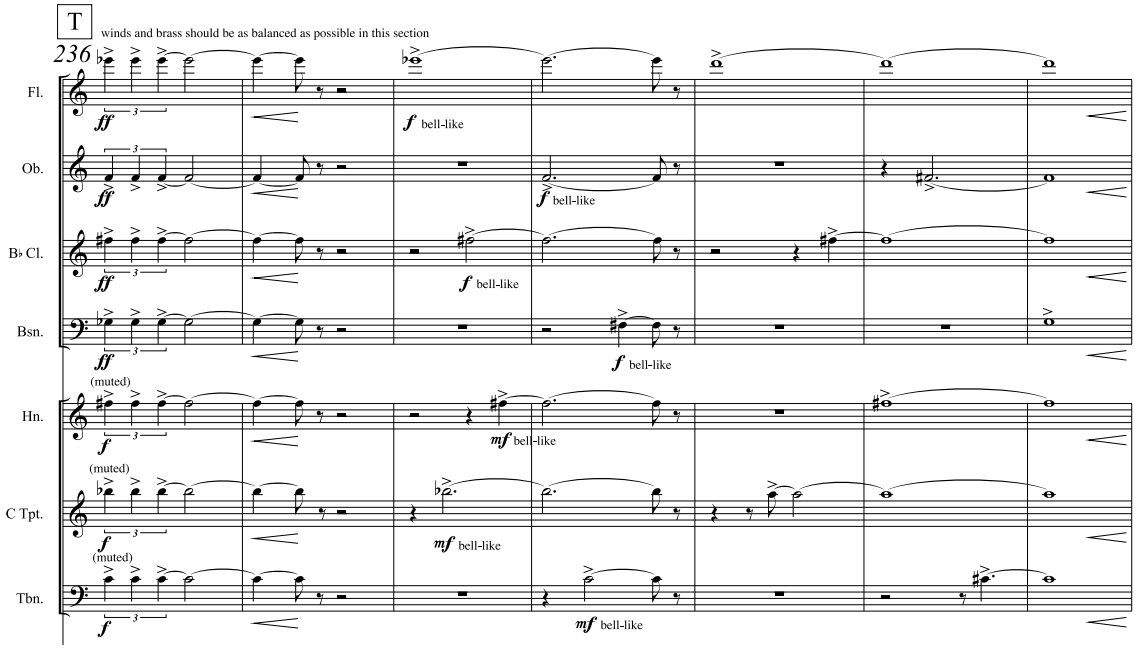


Figure 66: Andrew Norman, *Try* for chamber orchestra (2011), bars 236-242, woodwind and brass parts only. Transposing score (horn in F).

The music continues in this vein for several pages, in the course of which the brass and wind build up some exposed and tonal-looking triads: F major, D minor, B♭ major. Careful players might well decide to work on the tuning of this passage, particularly since it arrives after some stamina-draining, registrally-extreme heroics. However, if in doing so they assiduously build their chords in slow time, they risk falling prey to the 'Celibidache effect': later, when the bassoonist holds an F♮ while the chords change, the player's orchestral training would encourage them to inflect its tuning accordingly, but the context makes it clear that they should not. A similar hyper-concentration on the production of tempered pitches is the appropriate strategy in the performance of numerous works associated with so-called 'minimalism' (see 7.2.1 below.) As in the case of the Dvořák chorale, this can very rarely be assumed to be a performing default (in Europe, at least.) We might even advise today's composers who desire it to mark their scores accordingly: *to be played in (strict) equal temperament throughout* (or, *unless otherwise indicated.*)

6.4 Returning to frets

B: In the discussion of the Swiss Army knife we consciously took a break from considering our physical instruments and how we play them. Let's briefly return to them now.

A: You recommended getting to know three natural harmonics, and your earworm examples were mostly from brass music. So I'd imagine that brass players would have a significant head start if they wanted to learn this approach.

B: You mean horn, trombone, and tuba players. A trumpet player who manages to squeak out the 11th harmonic will have other things on their mind than intonation! But actually, no, because the tempered **gridding** element is equally important to the tool's construction, and that is relatively foreign to brass players' fret structure. Relative to that of pianists or harpists, for example, even though the story of the development of every orchestral brass instrument can be told as a (labyrinthine) journey towards a grudging rapprochement with equal temperament. The Swiss Army knife I've described does not fit neatly on any instrument. Or rather, on any actant's fret structure. It's too harmonic-series-y for organists, oboists, and clarinettists, and too tempered for hornists, tubists, and contrabassists…

A: Isn't that a problem?

B: No, it's the whole point. I surveyed the richness of the available instrument-specific materials in 2.2. Almost anyone who goes in search of intonation advice tailored to their instrument will find plenty. The knife is an attempt to mark out a negotiable middle-ground that is the natural province of no single instrument or instrument family. I tried to show in 3.2 that the division of performer training into the traditional siloes of instrument families has great advantages of efficiency when training orchestral musicians, but frequently fails when conveying even some of the most basic skills of new music. I've sought wherever possible to find score examples that included singers alongside instrumentalists. Singers almost always seem to get pushed away into the remotest of all training siloes — ones with particularly low expectations about their pitch skills.[623] This just makes an existing problem worse, since if you treat musicians like airheads, what do you expect?

A: But surely you'd accept that singers almost always have fewer and less secure frets than, say, oboists — so surely they do need a different training model? And what about percussionists?

B: May I tell a story before trying to answer that? In 2019 I conducted (or rather rehearsed and oversaw, since I did not physically conduct during the performances) a work by Benedict Mason, *Hotel Paradiso*. The performance was originally intended to take place on a storm-ravaged mountainside in the Dolomites, but we had to be content with a gently-sloping grazing meadow nearby, although still at high altitude and backed by a half-bowl of rocky peaks. The human ingredients of this Fitzcarraldo-like project were: two actors,

[623] Plenty of singers have rejected this designation, of course. The existence of intonationally hyper-aware singing individuals and vocal groups including Ekmeles, Exaudi, and Roomful of Teeth does not invalidate this broad observation. The only other instrumental training pathway within the broadly classical field that exhibits a comparably vast range of expected pitch sensitivities and tolerances is the training of percussionists, which in many cases omits fine pitch training entirely. Conductor training is, in most cases, even more of a black box.

two operatic singers (a super-high soprano and a rich-toned bass), several brass bands split into marching platoons, three percussionists playing at about a football field's distance from each other, a large local amateur choir, and — the *coup de théâtre* — thirty-six players of hunting horns (*Jagdhörner.*)[624] The hunting horn players first became visible in a line on the brow of a hill, and moved slowly towards, then came among, the public. Orientation was achieved by individual radio clicktracks, controlled from a large technical setup concealed in a cowshed at the bottom of the hill, since at times the groups played as one, at other times in sub-groups, and sometimes individually.

The hunting horns didn't have valves, pistons, or crooks. They were about as simple as instruments get — coiled conical tubes with mouthpieces. With that in mind, the composer had written passages intended to sound on the natural harmonics, especially the 7th. Quite understandably, the composer imagined that the players could adopt what I've called a **braindead** scenario — although he didn't quite put it in those terms. After all, the pitch was 'there' on the instruments, and all the players had to do was push air through them. The rehearsal schedule was complicated, and we had to rehearse in subgroups. My first rehearsal was with a subgroup of amateur hunting horn players who knew each other well since they played (and drank) together socially. I had anticipated that some of these players might have trouble finding and stabilising the seventh harmonic. However, what I encountered in the first rehearsal caught me completely by surprise. There was very little uncertainty or hesitation; instead, I heard a clear unison pitch — but a *tempered* one! I was so astonished that I checked my electronic tuner to see if high altitude or overwork had affected my pitch sensitivity. It transpired that these players often played with an accordionist and so had got into the habit of adjusting — somehow! — their 'natural' seventh harmonic to the tempered accordion. I then, of course, had to persuade them politely to play in the old, 'wrong,' way, which — as they patiently explained to me — they associated with beginner players. This felt distinctly awkward. With my apparatus of radio click-track sets, electronic tuners, and iPad scores, I felt rather like a photographer for the National Geographic persuading some long-suffering indigenous people to hide away their mobile phones and T-shirts and pose in their traditional clothing.

A: Did they agree to play it 'wrong,' then?

B: I'm not sure we ever came to a consensus.

A: And the moral is…?

B: Well, I learnt that frets are never completely secure, and can't be taken for granted. Players play with their ears, and not with their hands, mouths, tubes, and strings, to an even greater extent than I had imagined, even though I am a violinist and (lapsed) singer. I had already noticed that, in contexts outside new music, contrabass players frequently make use of the seventh harmonic to avoid rapid hand displacements, but tend to 'correct' (i.e. sharpen and thus temper) its intonation by pulling the string

[624] The actual number of hunting horn players varied. Some of the players worked on the land, others were doctors, lawyers, and so on, and a few were professional players. Since the project coincided with the busy harvest time, some members of the first group naturally performed their own acts of triage and absented themselves from rehearsals.

sideways to increase its tension.[625] Through practice, this tensioning becomes part of the harmonic's production and recedes into second nature. So it would not be correct to say that, for those players, the natural seventh exists as a fret, because the fret is on the actant and not the instrument. (Even though, on the dumb instrument itself, the seventh harmonic remains at the same fractional point that it has on all strings since the Sumerians invented the monochord.) The example of the hunting horn players made me realise that this isn't only the case for musicians with the kind of specialised training we are discussing here. I am constantly surprised by how intonation plays out in the real world. For example, you might imagine that when a digital instrument is involved, you can go **braindead** and concentrate on other things, because it's bound to be 'correct.' But that's not true at all. In a recent (2023) performance of Julian Anderson's *Book of Hours* (see 6.3.1) it proved remarkably awkward to detune the synthesiser by a tempered quarter-tone (the programmed settings were incorrect.) It was mission-critical to have access to inner pitch structures that were instrument-independent. Of course, you can use an electronic tuner to fix this kind of problem, but first you need to notice it!

A: And new music has sought to de-fret, and (sometimes) to re-fret, anything it can get its collective hands on. So where does this leave frets?

B: Oh, they certainly exist, or we'd all be swimming around in a soup of lostness. But maybe they're most usefully imagined in large patterns rather than individually (as in '*x* pitch is secure on *y* instrument.') And perhaps we should concentrate on the fret-structures of other actants rather than our own…

A: Meaning?

B: I think that the 'secret sauce' of successful mixed-instrument ensembles is not the individual virtuosity of their members, but their deep knowledge of their colleagues' music-making in a projective sense: predicting their next moves, and how they will (probably) react to a given situation. Achieving that quasi-telepathic connection might take years, and intonation is only a part of the picture. However, we might get a head start by thinking about the patterns of our colleagues' frets.

A: 'Thinking about' — what does that mean?

B: I've expressed scepticism about the applicability of visual metaphors to pitch, but I think it's useful in this case, because frets are located at the threshold between the abstract(ish) pitch-work of our Swiss Army knife and the real physical world of instruments, and so have a diagram-like quality. We could start by visualising generalised versions of the fret structures of instrument+player actants in rainbow colours. A violin(+violinist) could look like four vertical stacks with solidly-coloured bases (the open strings), neat and small bands for the secure natural harmonics, somewhat blurrier bands for the position of the fingers in first position, and smudges of colour up the fingerboard. An oboe(+oboist) conjures up a dense herringbone of tight, semi-regular, high-resolution stripes like one of Gerhard Richter's *Strip* paintings. A clarinet(+clarinettist)'s stack looks disturbingly chaotic. A trombone(+trombonist) is a three-dimensional

[625] As shown in Chris West, 'Where to find all the harmonics on a double bass (1/2),' YouTube, Mar 7, 2021, accessed Jan 2, 2023, https://www.youtube.com/watch?v=MXiueEuJ45I.

shape: we can imagine a neat stack of the first few natural harmonics, then the whole structure being swept to the side and upwards as the slide moves, interrupted by little plateaux to indicate the regions of the habitual slide positions. The frets of a piano(+pianist) look like a neat and even ladder from far away, but on closer investigation we notice a slight expansion of the gaps between the rungs at the bottom and top (the stretched octaves), and also that from each lower rung, perpendicular and directed away from us, stretches a much fainter uneven structure (the sounding upper partials). And so on…[626]

A: That's a *start*?

B: Then we can add our knowledge of our actual colleagues. Start by adding our awareness of any major physical adaptation of their set-up: quarter-tone keys, a singer's in-ear reference, and so on. Then emphasise the side of the fret notion that has more to do with the player than the instrument: each new fingering a player learns adds an extra line to their stack. We can reliably predict that the expert authors of the woodwind ISMs I surveyed in 2.2 will have much denser fret-structures than will less specialised players. Finally, we can try to add our knowledge of our colleagues' off-instrument pitch structures (their armatures) and their favoured 'plays.' Some performers are harmonic-spectral to the bone, others are happier bending than rooting, all have some kind of long-term pitch memory. All this should be painted into our pictures, which now start to resemble a complex — but, hopefully, not baffling — web of potential interactions. This is a partial description (partial because it only concerns pitch) of an instrument called the *ensemble*, which NMP trainees and instructors alike perhaps should call our true principal instrument. This living, breathing, instrument has a definite existence and identity prior to any new compositional pitch demand that's offered to it: it is not a blank canvas. This is what I meant in the Preface when I talked about the 'palpable form' of shared pitch-work. I don't think I'm proposing anything new here; I'm trying to describe the existing musicianship expertise of others. I don't think we celebrate it enough. And I do think it's worth trying to understand, and to teach.

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[626] 'And so on' through the Western instrumentarium. Gaining intimate knowledge and control is here viewed as a good thing. This makes most sense in contexts where the same instrument-performer actants are repeatedly encountered — as in orchestral practice, and also in mainstream new music ensemble practice. In this respect the approach outlined here aligns with the traditional pedagogic pathway that valorises control: of a physical instrument, and of our own musical faculties. Narratives that emerge from self-described experimental practices tend to deprioritise this quest in favour of embracing risk, serendipity, and interesting modes of failure. Nicolas Collins, in *Handmade Electronic Music: The Art of Hardware Hacking* (New York and Abingdon: Routledge, 2006), lays out an essentially serendipitous attitude to sound. However, as any instrument loses its novelty to the performer and becomes somewhat more reliable (be it a circuit-bent Sega controller, Gregoire Lauvin's Potato Organ, or a cracklebox) it tends to become expressively controlled and eventually classicised. Experimental practitioners, aware of what they perceive as a danger, then seek out less predictable instruments. For example, Laetitia Sonami has retired her 'Lady's Glove' in favour of deliberately inefficient instruments including the Spring Spyre and Bellowtron: 'Sonami cited her familiarity with the glove as a main reason for its retirement. "I felt like I knew it … I had mastered it, and it had been for so many years unclear how I would think of music outside of the Glove," said Sonami. "My imagination and the technology I was using were so interwoven, I was curious if I take that out, what would I imagine?"' Report of a lecture given by Sonami at Brown University, Department of Music, Mar 2014: Emily Dupuis, 'Musician explores gender in electronic genre,' *The Brown Daily Herald*, Mar 21, 2014, accessed Jan 2, 2024, https://www.browndailyherald.com/article/2014/03/musician-explores-gender-in-electronic-genre. I do not think the two working modes necessarily exclude each other (see Jennifer Torrence's description of her practice in 1.2.1 above); it is possible to play in a highly controlled way for one project and a more exploratory way for another.

Chapter 7: Conversations about rhythm

7.1 A question revisited: what is a difficult rhythm?

B: In our conversations about pitch we negotiated some tricky material, but I felt that we came to some positive conclusions. Whether it's useful or not, I managed to summarise a possible approach to quite a large set of pitch-finding contexts in twelve words (plus a lot of exegesis!) Now we've come on to rhythm in new music, I'm much less hopeful about being able to do likewise. The construction of a Swiss Army knife is beyond me.

A: Well, there's a downbeat start to our rhythm discussion.

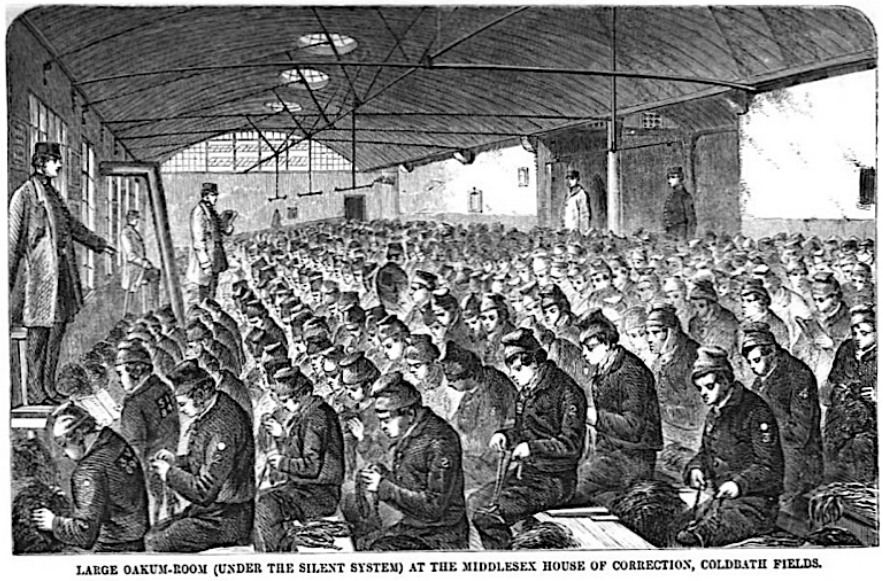
B: Ba-dum tss. As a time-beater I suppose I count as a rhythm specialist, so I ought to be in my comfort zone here. But frankly, we find ourselves in trouble from the start. Let's remind ourselves of the problems that we've already identified, so we don't have to argue the same points again:

There's a growing concern that dedicated rhythmic training has been neglected in many 'Western classical'-adjacent performer training contexts. This neglect has been ascribed to a legacy of structural racism within the parametric priorities of musicianship training (2.3.4.) To meet this need within NMPT it would seem most efficient for instructors to focus directly on the training of rhythms via generalised examples and exercises, rather than waiting for teachable situations to emerge haphazardly from the chosen repertoire, since repertoire choices are subject to multiple conflicting pressures (3.2.) Training entails improvement and overcoming challenges, and while no-one seriously doubts that new music poses rhythmic challenges to performers, they are hard to characterise. The words *difficult* and *complex* are often bandied around when discussing certain rhythmic practices in the late twentieth century, and sometimes to characterise rhythm in new music generally (2.3.4.2.) However, there is no consensus on what these words mean; some see them as equivalent, while for others they are distinct. I made a distinction between workflow difficulties and (quasi-)intrinsic difficulties (2.3.4.1), and argued that most existing resources only address the former set.

An example of a resource which offered help with workflow difficulties was Vanoeveren's text, which incorporates the insights of Edwin Harkins. These difficulties unquestionably exist, and the inclusion of strategies for their resolution is notably absent from most performer training models. Indeed, when coming from a voice as eloquent as Steven Schick's, such discussions can take on an artistic value of their own: he wistfully remarks, in discussing the 'eight or nine months' of 'glacial' preparation work that he devoted to the solo percussion piece he commissioned from Brian Ferneyhough, *Bone Alphabet* (1992), that 'the learning of a piece … is rarely savored for its own unique qualities.'[627] To excuse myself from the need to prove that I have done my own share of hard decode-and-embody rhythmic labour, I had intended to supply here a photomontage of some of the blackest and most intimidating-looking scores I have conducted, along with my beating patterns and self-corrective exhortations to myself. Unfortunately, copyright rules do not

[627] Schick, 'Developing an Interpretive Context,' 132-133.

permit the full effect to be shown, so in its place is a public-domain picture of some new music performers dutifully unpicking their nested tuplets and metric modulations:



LARGE OAKUM-ROOM (UNDER THE SILENT SYSTEM) AT THE MIDDLESEX HOUSE OF CORRECTION, COLDBATH FIELDS.

Figure 67: Prisoners doing time, unpicking strands of oakum in the Middlesex House of Correction, c.1860.[628]

We can be sure that, whatever rhythmic difficulty is, it's not a linear and gradable phenomenon like the ascending grades of difficulty in rock-climbing — even if it's tempting to rate *Bone Alphabet* as a 5.15d on the Yosemite Decimal System.[629] I proposed that any difficulty that goes beyond examples of high computational/administrative loading — real as these problems are — is an ensemble difficulty. The notion of ensemble difficulty doesn't only encompass how hard players find it to play together, but also includes the success or failure of other ensembles, including the performer(s)-composer ensemble and the ensemble of performer(s)-participatory listener. Difficulties arise where these ensembles disagree, so there are multiple moving parts to consider here: success on one metric may imply failure on another. Consequently, these difficulties do not resemble a climber pitting themself against a bouldering problem, where the problem may be hard, but the boulder does not move. That basic conception of rhythmic difficulty — each expected event in time posing its standard for success and failure, like the colourful dots that rush madly towards a player of *Guitar Hero*[630] — was what I found problematic in the training approaches I discussed that stressed the development of true-to-page rhythmic accuracy skills — as, for example, in the Boulez quote about the need for performers to 'really feel the quintuplets' that Reina found so motivational.

A: If you don't like that conception, aren't you implying that anything goes, rhythmically speaking?

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[628] Henry Mayhew and John Binny, *The criminal prisons of London, and scenes of prison life* (London: Griffin and Bohn, 1862), 300. As the authors note, 'Every man's own experience, indeed, can tell him how irksome it is to see the work he has done prove of no avail.' (Ibid., 301.)

[629] As of March 2024, 5.15d is the highest grade given to a rock climb (to the route *Silence*, completed by Adam Ondra in 2017.) The names given to extreme rock climbs could be mistaken for the titles of compositions emanating from IRCAM (*Action Directe*, *Realization / Biographie*) or the names of punk bands (*Disillusioned Screw Machine, Womb Bits, Hairless Heart.*)

[630] I have elsewhere called this conception old-fashioned. However, within the pedagogy of beginners in particular, it is thoroughly up-to-date: the app *Flowkey* (2015–), which comes bundled with new Yamaha digital pianos as of 2024, monitors the learner's output via a microphone or MIDI cable and flashes a green tick when the note is correctly placed (within the opaque tolerances of the app.)

B: No. From the other side, I found London's attempt to broadly characterise new music's rhythmic practices as arbitrary unconvincing, because I felt that by excluding consideration of aspects of the new music experience that demonstrably exist — including the visual and haptic elements of a performance, and usually the existence of a score (whether present in reality, in direct pictorial memory, or as a best guess, since when a seasoned performer attends a concert they often gain a good idea of the look of the score, even if they have never seen it) — he had wilfully placed himself in a Mrs Munt-like position for the sake of his argument. And that didn't square with a perception-led approach. I would have preferred it if he had simply said that he didn't care for new music because it often challenges his expectation of easily-entrainable pulse, which is his right of course, but would hardly qualify as a 'critique.' I've used London's (sophisticated and not dismissive) text to stand in for a crudely dismissive attitude to new music performance that I suspect almost all musicians have encountered: *no-one's seen the score, so it doesn't matter what you play*. In my experience, that attitude leads to boring performances, because what comes out when we relax the rhythmic intensity that comes from an engagement with detailed compositional demands — whether communicated via a traditional score or by other means, such as through a group's intimately-developed improvising practice[631] — is often uninteresting and nondescript. Such, at least, was the result of Laskowski's attempt at a provocation ('improvise in a … new complexity style' — see 2.3.4.3), even when it was placed in the hands of truly thrilling performers.[632] Schick once again puts his finger on the point of tension, so I'll quote him at length:

> … the act of learning a piece is primarily one of simplification, while the art of performance is one of (re)complexifying. In the learning process, rhythms must be calculated and reduced to some potable form, the turbulences of the microforces of form must be generalized, and various kinds of inane mnemonics must be employed simply to remember what to do next. […] Performance … is a real-time explosion of the rich complexity of a work: what took months to learn takes only minutes to play. Kinetic energy, embedded in a piece during an extended practice phase, burns—like a kind of musical lignite—as the heat and light of a performance. This energy poses a danger though, especially in works of substantial compositional sophistication. If the interpretive skeleton, built up painstakingly during the learning process, is not sufficiently strong to support the weight of the complexities in the score, then the entire piece threatens to collapse into a simple and singularly unappealing mass. <u>How then to retain and project complexity in performance?</u> (my emphasis)[633]

A: And all that's only in the consideration of a solo piece! I remember the discussion of the simple-looking quintuplet and septuplet examples (2.3.4.1), in which you argued that something might sound completely together, but still count as an unresolved rhythmic problem, because it violated other silent ensembles: the ensemble of composer and performers, and/or of performers and participatory listeners. You gave the example of the sixth note in a crotchet septuplet sounding like the third of a minim triplet.

---

[631] If this seems self-contradictory, the reader is reminded of this text's very broad definition of *composer* (in the Preface) as a musician who makes musical demands of a performer. The construction of a work, notated or not, is not the focus here. A person billed on a concert programme as an improviser might well count as a composer in this sense.
[632] Thrilling: both when executing scores with detailed notation, and also when improvising with minimal notation. The problem in this case was not the lack of notational specificity but rather the limiting nature of the improvising stimulus.
[633] Schick, 'Developing an Interpretive Context,' 133.

B: Yes. Our caricature of Boulez (here playing a Beckmesser-ish role as the fall guy for a great number of real pedagogues, in the twentieth century and today) would simply say that that's sloppy and wrong — *Schlamperei!* I would say that the problem is that such an outcome would only satisfy one of the ensembles that we have to consider when an intrinsic difficulty arises. But even if the breadths of view of these 'positivistic' pedagogues may be more limited that they acknowledge, that does not invalidate their local observations. For what it's worth, I agree with Boulez when he observes that '[t]his type of precision is still not really in the habits.' In fact I'd go further and note that, in my experience, the appearance of a notated rhythm as innocuous-looking as a quintuplet (and even in some cases — whisper it! — a triplet) can yield a much wider range of responses than performers might like to admit, even in contexts where everyone agrees that a mathematically-precise execution would be desirable, such as when negotiating Carter's metric modulations. Can I provide hard evidence to support this assertion? No, because, once again, we are restricted by professional taboos. To put it bluntly, no-one has had the brass neck (nor the budget) to book the Ensemble Intercontemporain or Ensemble Modern for a day and test their members' abilities to play ranges of even tuplets at different tempi. And as for testing the rhythmic abilities of conductors against a metronome…! Until such cat-belling takes place — and does it sound likely to happen? — we must be content with field reports and the hunches of experienced participants.

A: I think that a real-world example would help.

B: Here's one I prepared earlier:

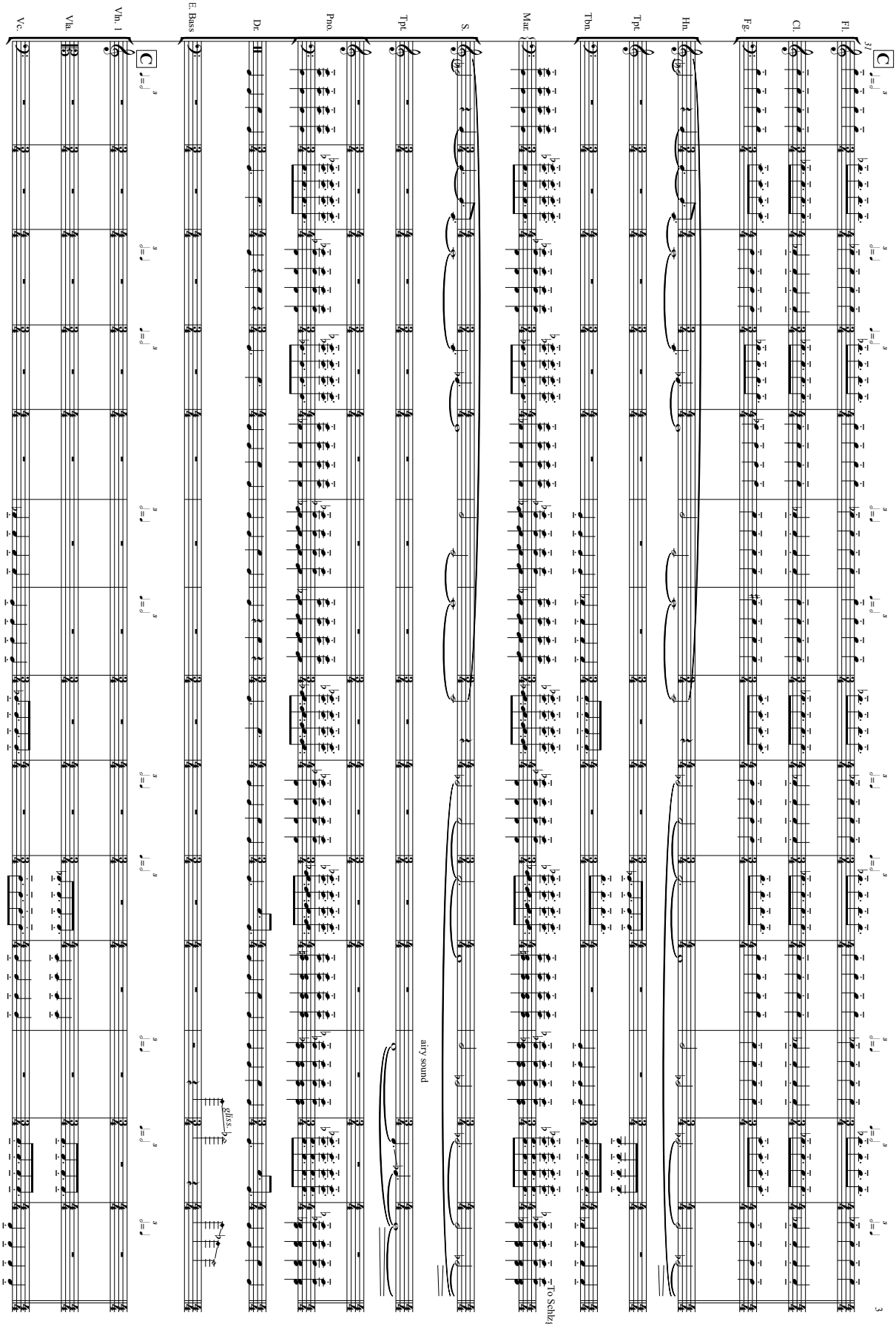


Figure 68: Manu Mayr, *disappear*, from *collisions and momentum* (2020-21), bars 31-44. Reproduced with kind permission of the composer.

This is part of the song *disappear*, composed by Manu Mayr, from *collisions and momentum* (2020-21), a 50-minute-long, multi-movement collaboration between the band 5K HD ('known for its computerless electronica') and the new music group Klangforum Wien. All players are in rhythmic unison (a few decorative exceptions aside) throughout the 101 bars of this song. Here is the passage in simplified short score, with many subtleties removed. It's provided for ease of reference only and shouldn't be taken as a stand-in for Mayr's score.

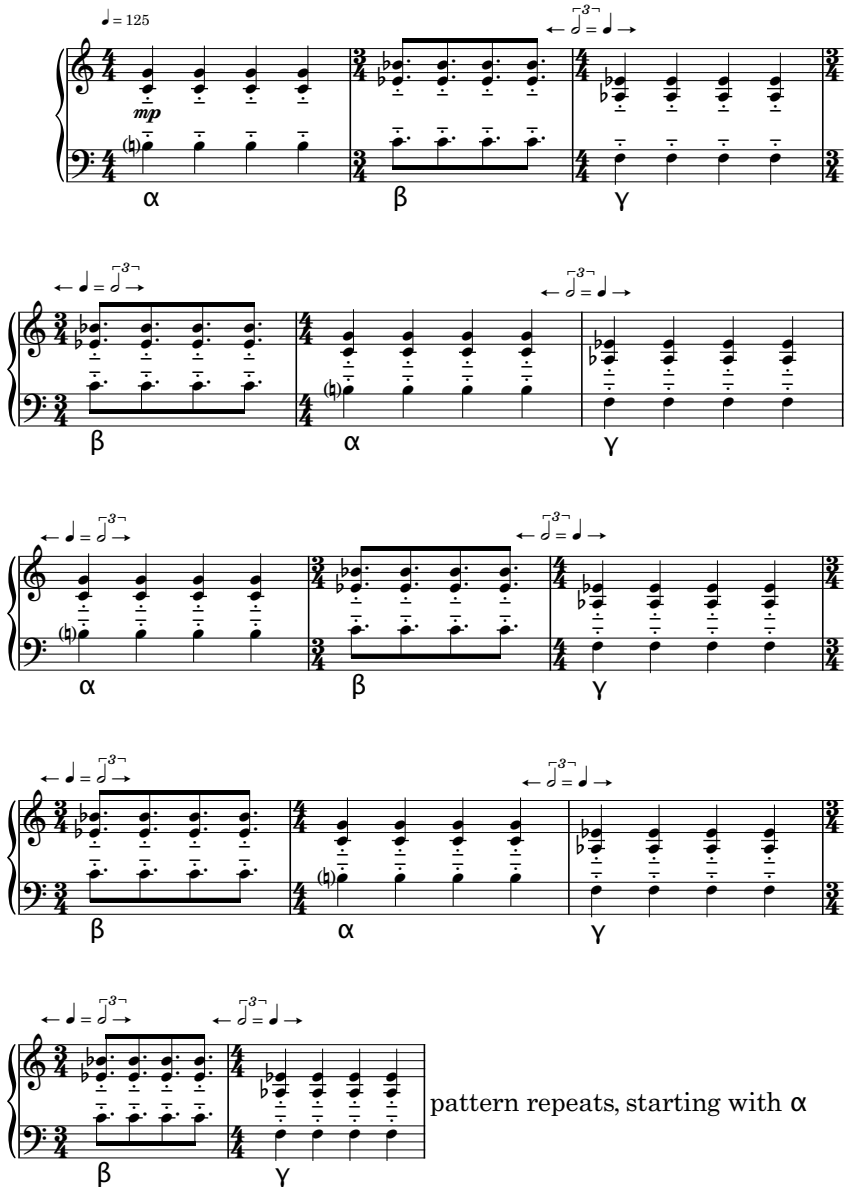


Figure 69: The same passage, condensed and labelled. Arrows (←old unit=new unit→) added for clarity.

First, let's consider rhythmic difficulty from the true-to-page perspective, and think about the challenges performers would encounter in trying to replicate the timings of a computerised version of the passage — i.e. what Boulez called 'really thinking' the rhythms. The passage looks quite white: there are only three recurring rhythmic elements, and each of these simply consists of four isorhythmic attacks. That's the case across the whole song — the whole page's rhythmic structure is repeated several times and is definitely heard and felt as some sort of groove, to the extent that later in the song (bar 89), when an element drops

out completely, it is 'heard' in quasi-***ff***. This effect will be familiar to head-banging fans of EDM; this is not a score that London would throw into the waste-(of)-paper basket marked *unentrainable* along with his Babbitt examples.

Despite — or because of — this simplicity, the difficulties for the performers are quite severe. I've labelled the three elements α, β, and γ. We can give them blunt characterisations: α is 'the reference' (because it's heard first, and because it's the median speed of the three), β is 'rushing,' and γ is 'dragging.' Each is obviously trivial to perform in isolation. The challenge is moving between the elements. And all the possible permutations are present here: α→β, α→γ, β→α, β→γ, γ →α, and γ→β. We need to be able to move between all of them. And it seems to be a situation where it's desirable that every α is distinctly felt and heard as an α, every β as a β, and so on.

A: It's challenging because of the constant metric modulations, you mean?

B: Well, we can make them go away through re-notation. Here are three alternative notational options for the first three bars — always remembering that we will also need to consider these bars in any order. The first option has the flavour of Ligeti's rhythmic notation in the *Études* and the *Piano Concerto*:

Option 1: à la mode de Ligeti

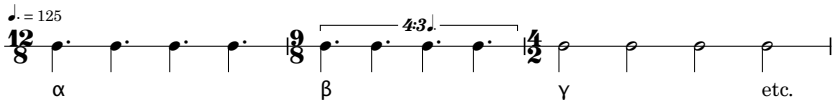


Figure 70: Re-notation, option 1.

while the second and third use so-called 'irrational' time signatures,[634] as employed by an increasing number of composers including Thomas Adès:

Option 2: with incomplete tuplet brackets

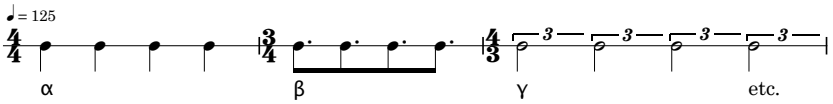


Figure 71: Re-notation, option 2.

and

Option 3: delay the problem

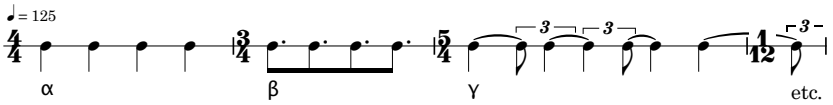


Figure 72: Re-notation, option 3.

[634] Not, of course, irrational from a mathematical point of view. A truly irrational time signature might be 3/*e* or 4/π, neither of which I have encountered just yet (although Conlon Nancarrow, in *Study for Player Piano* no. 33 (1968), writes a canon between 2 and the square root of 2.) Despite the logic and century-old history of time signature denominators such as 6, 12, 5, 10, dating back at least to Henry Cowell's *New Musical Resources* (written in 1919, but unpublished until 1930), these numbers still have the potential to sow confusion among musicians. For example, in scores by Claude Vivier (published by Boosey & Hawkes) there are numerous examples of such confusion: in *Lonely Child*, p. 17, we find a written 5/6 — in giant typeface — where 5/24 would be more usual. See Henry Cowell, *New Musical Resources* (New York and London: Alfred A. Knopf, 1930), 52-65.

A: Well done — you've made it look harder…

B: If you want, I can make the rhythmic values look much easier. Good luck performing this one, though!

Option 4: you are a computer

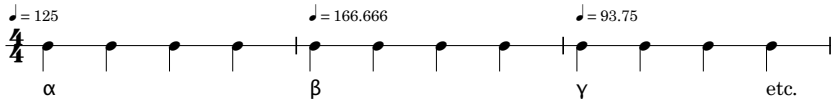


Figure 73: Re-notation, option 4.

The three tempi (125, 166⅔, 93¾) look arbitrary in this version but stand in a simple ratio, 12 : 16 : 9. Knowing that doesn't help the performer in the least, of course.

A: This reminds me of your point that low pitch ratios aren't automatically easier to negotiate than higher ones. We aren't rational beings, whatever Pythagoras is supposed to have have claimed…[635]

B: Before we pick favourites, let's step back and remind ourselves of the claims of two broad 'camps':

1) Some people state or imply that all these versions encode the same music. Reina, in his application of Karnatic approaches, implicitly does so. The notation programme Dorico 'thinks' likewise: for example, unlike its older competitors Sibelius and Finale, it treats a tied note as a single block of time, even if it spans many barlines, its visual manifestation as a split entity existing merely for orientation — thus reflecting, consciously or not, the spectralists' dream of a notational practice uninterrupted by the dreary tick-tock of a metric grid.[636] Comparably, the influential educator Edwin Gordon, to whom we owe the word *audiation*, offered strategies (aimed at early-years learners) to learn what he called 'enrhythms' — 'those patterns that sound the same but are notated differently.'[637]

2) Other people insist that these versions are necessarily different, and that the notion of enrhythms is therefore incoherent: Schick, echoing Ferneyhough, does so explicitly: 'of course, there is a big difference between changing meters and changing speeds' (emphasis added.)[638] I suspect that almost all the figures I mentioned in the 'gestural consensus' discussion would agree with this point, as would commentators such as Nicholas Cook, who sees performance as a cultural practice 'prompted by scripts' (4.2.) In the 'prompted by scripts' view, the psychological and communicative aspects of notation are foregrounded. The thousands of new music scores that exhibit what we might call 'downbeat allergy' fall into this category: that is, the

[635] Like Rasputin, this myth refuses to die. This 2024 attempt to administer the deathblow will probably not be the last: Raja Marjieh, Peter M. C. Harrison, Harin Lee, Fotini Deligiannaki, and Nori Jacoby, 'Timbral Effects on Consonance Disentangle Psychoacoustic Mechanisms and Suggest Perceptual Origins for Musical Scales,' *Nature Communications* 15, no. 1 (2024): article no. 1482. It was publicised by the University of Cambridge, rather reductively, as 'Pythagoras was wrong,' Feb 27, 2024, accessed Mar 1, 2024, https://www.cam.ac.uk/research/news/pythagoras-was-wrong-there-are-no-universal-musical-harmonies-study-finds?fbclid=IwAR3UD_LhjmvE6u7jaX-m4wbvc4-s1-zTdGiQS15d--RJe-bwaosBthSwZSY.

[636] I am simplifying, since at time of writing Dorico does not yet natively 'understand' time signatures like 2/6. Its treatment of tied rhythms as single units caused much online debate and confusion among users transitioning from Sibelius and Finale — thus testifying to the continuing unresolved status of rhythmic notation.

[637] Edwin E. Gordon, *Learning sequences in music: Skill, content and patterns* (Chicago: G.I.A. Publications, 1980), 100.

[638] Schick, 'Developing an Interpretive Context,' 139-140.

very new-musicky habit of placing an attack on (for example) the third of a quintuplet, even when it is preceded by a long unentrainable silence or held note. (Webern's scores, alongside precursors in Schumann's lieder accompaniments, are probably the source of this fastidious avoidance of beat- and barlines; extreme examples of it can be found in scores by Marc Andre, a composer fascinated by πνεῦμα (*pneuma*: breath/soul) for whom the varying preparatory inhalations that such notation provokes comprise key elements in his compositional language.) For people in this second camp, even such equivalent-seeming options as a septuplet written in the older way (seven crotchets in the time of four) versus one written in the newer way (seven crotchets in the time of eight quavers), would retain a fundamental difference. Elaine Gould, in her influential notation manual *Behind Bars*, calls these options 'contracting ratio' and 'expanding ratio,' and unhesitatingly recommends the former.[639] Her view that such matters are the province of copyist-editors rather than creatives (and being herself an impeccable example of this vanishing role) places her in the first camp. Cherishing a high sensitivity to the difference between 'equivalent' options reminds us of Feldman's provocative choice of accidentals in his *Composition* for violin (5.1); that composer is firmly in the second camp. In the discourse of new music, the second camp is viewed as sophisticated and progressive, while the first camp is LEGO-like and therefore old-fashioned (4.1.1.) Talgam, taking cues from the literature on rhythmic perception, defends a performer's right to re-notate rhythms, and understandably sweats blood justifying the process because, as a sensitive musician, he is intensely aware of the competing claims of both camps.

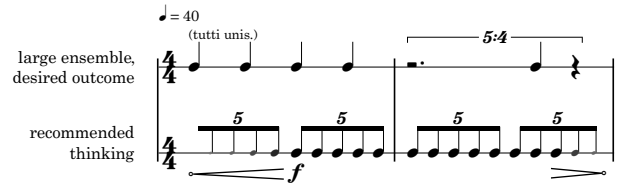
A: We are in the first camp, for the moment, right?

B: For the moment. Let's go through the pros and cons of the versions, imagining ourselves like Stravinsky at the piano composing the *Rite of Spring*, supposedly able to play his rhythms before knowing how to write them down. **Option 4**, in that it obscures information that would help a performer establish relations between the elements, seems to be a joke and can be put aside: it's a more refined version of my original blunt description of what's happening here: start steady, rush lots, drag lots… The others imply thinking in rhythmic hierarchies, or what a performer would simply call *subdividing*. Knowing when, and into which units, it is most helpful to subdivide is an urgent question for performers. The universal habit of drawing orientational lines above the stave bears witness to this. The number of such lines that a performer deems appropriate to draw (i.e. the fineness of the chosen grid) and their qualities (wavy or drawn neatly with a ruler, distant or close to the noteheads…) is a triage-type decision, and one that often has a major impact on the performance. In the dullest cases, as I pointed out in 2.3.4.3, we can end up 'hearing the lines.' Discussions of subdivision also form a major part of the literature on rhythmic perception; all considerations of what counts as a beat, as meter, or as hypermeter, can be seen as falling into this category. We won't make much use of that literature here, though, due to the limitations of its datasets that we described earlier.

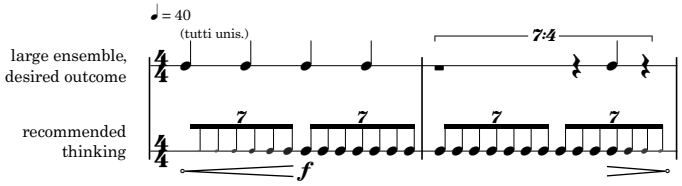
A: So how would you feel the subdivision here?

[639] Gould, *Behind Bars*, 203-204.

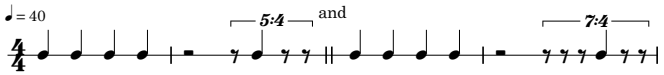
B: Well, obviously, one of the reasons I chose this as our first example is that it's not obvious. Sometimes when rehearsing, particularly in NMPT contexts, I've found it helpful to give unambiguous advice on these matters. For example, returning briefly to the examples in 2.3.4.1 (**Figures 2 – 5**), I would think-and-feel, and recommend that others think-and-feel, as follows — *if and only if*, that is, a metronomic tuplet truly is the appropriate target in the given context, and it's not a case like the Vaughan Williams or Janáček examples:



and



Note: **Figures 3** and **4**, and **Figures 2** and **5**, are of course here treated as 'enrhythmic' equivalents. A third notational option can be added, which preserves the half-bars and would be preferred by most performers:



This notation almost invariably yields more precise results on first reading, since it avoids gross placement errors: the quintuplet attack can be bluntly seen as 'a bit after beat 3' and the septuplet as 'just before beat 4.' Despite this understandable orientational preference — since performers, like navigators, tend only to zoom in on their target after gaining initial broad situational awareness — it should not be assumed that a composer being 'clear' in this sense is automatically the optimal approach, since it may re-inscribe overly blunt tolerances and general rhythmic sloppiness among performers. It also tends to produce unprompted extra accents on the 'offbeat' attacks.

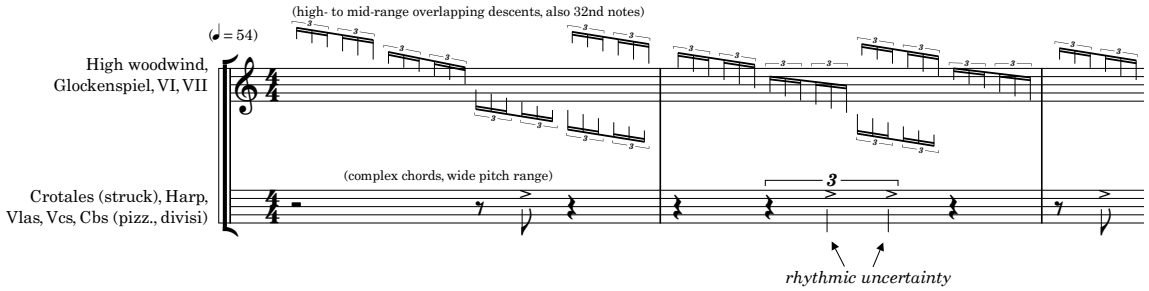
Figure 74: Elementary advice.

All this is so elementary that I blush to present it as advice worth giving, but the fact is that I find myself returning to these matters very often in my practice. This usually takes the form of a polite suggestion to perform inner preparatory subdivision earlier, and in smaller units, than is habitually done. By the way, from now on let's just say 'think' to mean 'think-and-feel.' We've allied ourselves sufficiently with the cause of cognition-in-action (4.2), and it also happens to correspond to normal rehearsal usage (*are you thinking in crotchets there?*)

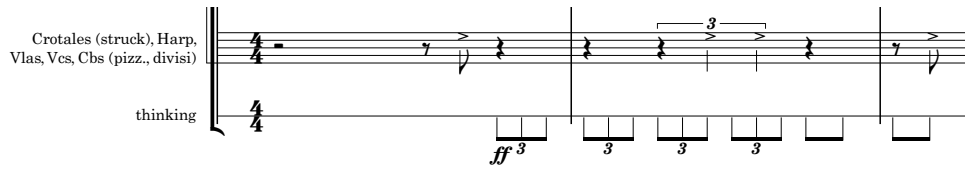
Workflow advice of this type, which Vanoeveren and Harkins attempted to systematise, may not be glamorous, but is often very welcome. Here is an example of a simple strategic reminder that I was surprised to find necessary to suggest in a recent rehearsal with a symphony orchestra; the reminder was simply that if a desired isochronous tuplet falls outside the workzone, it may be brought back into that zone via subdivision. (I didn't put it that way, of course! — I just said 'I'm thinking in triplet eighth-notes here.') As

in my artificial examples above, there was plenty of available thinking time to achieve this (for cases where there is not, see **jumpcuts** below). I have anonymised the context to avoid any implication that this otherwise excellent orchestra was incompetent:

Problem:



Solution:



Rationale: the original $\overset{3}{\frown}$ s are at 81ppm, which is located towards the lower limit of our shared high-precision rhythmic workzone. An additional hurdle is that the triplet spans the half-bar. Doubling the thinking speed to 162ppm (quaver triplets) was found effective. Although it related to a very obviously gestural effect (unison pizzicato and harp accents, hard crotale attacks), the intervention was not predominantly physical in nature, and I did not consciously change my conducting style to reflect it. Rather, it was a musicianship intervention.

Figure 75: Elementary advice in action.

As additional evidence for the desirability for the wider dissemination of such basic subdivisional 'workzone' thinking among non-performers, we might also note that it did not seem to have occurred to London that his 'unplayable' *Subtle Etude* would become easy to perform after a few such tweaks. Comparably, it appears that to some observers the venerable rhythms of Stravinsky's *Rite* still represent 'the limits of irregularity': a quite recent article breathlessly asks, 'The challenges to rhythm as measurable flow can be severe: How can we engage with continual interruption? Is there any order in the seeming chaos?'[640] To most professional performers today those rhythms feel unproblematically regular: the governing βs of the *Danse sacrale* and the βs of the *Glorification de l'élue,* for example, chug along at a countable and danger-free indicated 252 and 288ppm respectively (in performance, I would push both a little faster), while the βs of the *Jeu du rapt* run at a pacier but still manageable 396ppm. The risk in this repertoire is not that we are

[640] Gretchen Horlacher, 'Rhythm in Post-Tonal Music: A Modernist Primer,' in *The Cambridge Companion to Rhythm*, ed. Hartenberger, 125. The section is headed 'The Limits of Irregularity: *Stravinsky's Rite*.'

derailed by irregularity, but the opposite: that we sink into comfort and produce the kind of performances that Stravinsky famously railed against — results 'duller than Disney's dying dinosaurs' at a 'tempo di hoochie-coochie.'[641]

In these conceptually elementary cases, we can reliably establish a steady flow of *countable* small units. That's what makes them elementary. That doesn't necessarily make them easy to execute of course. Thinking in (grouped) flows of small isorhythmic units — that is, in smaller units than we might expect from the sounding context — is a well-known strategy to help improve one's sense of 'inner pulse.' It seems to be employed most explicitly and intensively by new music specialists who have been influenced by Karnatic and/or Hindustani (*shastriya sangeet*) approaches to rhythm: the performance practices of mridangam and tabla share a chattering, fine-grained, quality. Even if the rapid rhythms they play are countably isorhythmic,[642] no-one would suggest that playing either instrument is easy; comparably, the astonishing ability of some new music-specialised performers (pianists and percussionists in particular) to negotiate vast flows of very quick, but just-about-countable, isorhythmic units in works by Xenakis, Philippe Manoury, Beat Furrer, and others, can seem to reach the sublime — how on earth do they do it? Being a virtuoso on the tabla or mridangam, or playing the Ligeti *Études* or the *Concerto for Piano*, involves very obvious high-speed physical mastery. Seen in musicianship terms, it also involves finding ways to delay the **clock→cloud transition point** as far as possible — that is, to beat the White Queen's interrogation tactic ('What's one and one and one and one and one and one and one and one and one and one?') In the following passage the smallest units (𝅘𝅥𝅯s) flash by at a dizzying 552ppm:

[641] Quoted in Peter Hill, *Stravinsky – The Rite of Spring* (Cambridge: Cambridge University Press, 2000), 134.
[642] Fundamentally isorhythmic, in part because in these practices the tempo does not usually change during a piece: 'As the first strains of the melodic composition are delivered, the *mridangam* player must quickly identify the *tala* and the tempo, which then remain constant throughout the piece,' James Kippen, 'Rhythmic Thought and Practice in the Indian Subcontinent,' in *The Cambridge Companion to Rhythm*, ed. Hartenberger, 246.

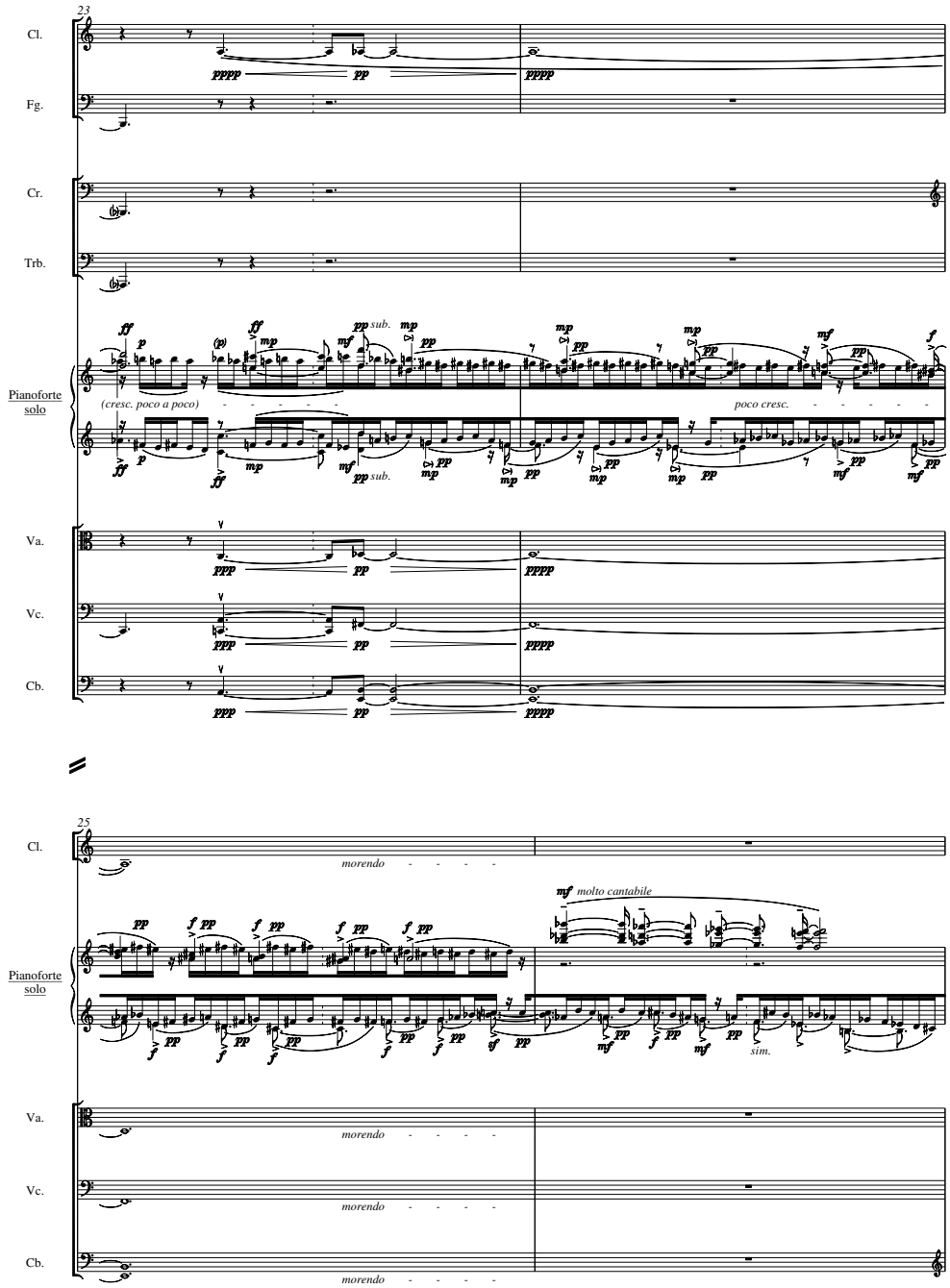


Figure 76: György Ligeti, *Concerto for Piano and Orchestra*, movt. 3 (1986), bars 23-26. Score in C, ♩=138. Reproduced by kind permission of Schott Music, Mainz. All rights reserved.

We might suggest that such passages derive much of their thrill for listeners from the gulf between what they, versus what the performers, seem to be able to keep pace with and count. When I said sublime, I meant it in the sense of Kant's 'mathematical sublime' — the human response to the condition of computational overflow, like the error message on a calculator after too many presses of the 'multiply' button.[643] But we're talking here about performer experience, not the audience's perception. For us, careful preparation has rendered these situations *not* uncountably sublime — and if it hasn't, we're in trouble!

[643] In Kantian terms, the 'Absolutely Great.' Robert Doran, 'Judging Nature as a Magnitude: The Mathematically Sublime,' in *The Theory of the Sublime from Longinus to Kant* (Cambridge: Cambridge University Press, 2015), 221–239.

A: You went on for ages, but I didn't get an answer! How would you think about the subdivision in the Mayr song?

B: The problem in our example is that there is no available isorhythmic small unit. So none of the above applies.

A: What are you talking about? Any series of numbers has a lowest common multiple. We can choose that as our unit of subdivision.

B: For the Mayr passage, that would be the 𝅘𝅥𝅯s of **Option 1**, and the triplet 𝅘𝅥𝅯s of **Option 2**, **Option 3**, and of the original notation. There would be 48 of them in α, 36 of them in β, and 64 of them in γ. They fly by at a rate of 1500 per minute, which is close to the speed of a hummingbird's wings. No human is going to be counting these. Not only do they lie far outside our rhythmic **workzone**, they are bursting out of the parametric category of rhythm itself, because this rate corresponds to 25 Hz — the area where, if they were actually sounding, we might start hearing pitch: roughly a G♮0. (This is the so-called 'Stockhausen insight' of 4.1.)

Consequently, our re-notations resemble attempts to squash a wrinkle in a carpet; it just pops up somewhere else. **Option 3** might be called the 'dumb conductor,' or 'control freak' version; it's a desperate attempt to keep counting in crotchets until the bitter end — at which point the sudden appearance of a $\frac{1}{12}$ bar sticks a spoke in the wheels. Such little extra bumps, glitches, or hiccups at the end of an established groove are notoriously destabilising and usually call for some kind of re-notation. Here are four examples of awkward moments of this type, given in no particular order. I've abstracted each repeating phrase from an assortment of compositions:

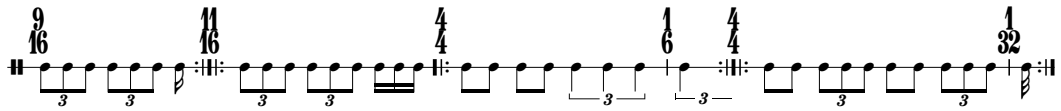


Figure 77: Assorted rhythmic glitches.

None of these is playable (for me) without some extra **Figure 74**-style 'notes to self,' whether written on paper or only in my head: 'I should think *x* values in advance at *y* point.' In the case of the $\frac{1}{12}$ glitch in **Option 3**, the resulting wobble might just be survivable — if practised repeatedly and learnt as a corporeal memory without any feeling of subdivision, perhaps — if the sequence looped 𝄆 α→β→γ 𝄇, but it doesn't; in this version the γ→β transitions are likely to be particularly uncomfortable. **Option 2** moves the problem earlier, and so avoids the final 'bump.' It shares with **Option 1** a greatly increased ease (relative to the original notation) of negotiating the transitions α→γ and γ→α, because we can feel a flow of steady units at 375 per minute, grouped into 3s and 4s. But in **Option 2** it's not clear how we might feel prepared for γ when our attention during β has been devoted to ensuring an even 4-in-the-time-of-3. The situation would be even worse if we had thought in small-unit subdivisions (the 𝅘𝅥𝅯s of the original) to stabilise β with respect to α (and if only α and β were to exist, we might well do so: to establish the groove, and also possibly to 'check in' periodically

to ensure that it wasn't loosening.) These run at a manageable 500 per minute, then collide into γ — in the context of which they are worse than useless.

A: I'll give you one last chance. *How would you think about the subdivision here?*

B: Is that the most important question? Remember the non-solution to the Dvořák chorale in Chapter 6?

A: [*rises to leave*]

B: OK, since you insist — I have a mild preference for thinking along the lines of **Option 1**, because the 'wrinkle' is pushed to the shortest element (β), and I might suggest that this would have been the best notational choice. But I wouldn't grumble if I was offered **Option 2**, and I didn't object to the original notation either, because no matter how this was presented to me, I know that I'll need a pencil and paper. That need implies, of course, that in this case we are being pushed towards an 'old-fashioned,' 'ideal kilogram' conception of rhythm and away from the 'sophisticated,' 'prompted by scripts' consensus. In practice, when I sit down alone with this rhythm I think through in a steady stream of 375 pulses per minute: i.e. in the s of the original version, letting the quadruplet of β float on top. If something has to feel 'off the beat,' I've decided that it should be β. The compound metre of **Option 1** encourages that way of thinking, hence my preference. **Option 3** is a disaster, but an instructive one, because plenty of well-intentioned composers — perhaps scarred by encounters with conductors whose training lacked a rhythmic focus — have attempted comparable metric simplifications to keep the large-unit pulse as constant as possible. The results are usually ham-fisted and musically alienating. Their ancestor is Koussevitzky's semi-mythical re-notation of the *Danse sacrale*;[644] a whole history remains to be written of this dubious notational reflex, an extreme example of which is a glorious-sounding but exasperatingly-notated work by Bernd Alois Zimmermann: *Photoptosis* for large orchestra (1968), which is written in throughout.[645]

A: So it's another Deweyan 'deliberation'? What's the wider conclusion of this thought experiment?

B: Initially, that some rhythms can look simple and be expressible in low ratios, and still pose problems that aren't obviously solvable via the kinds of workflow assistance offered by existing texts that focus on the performance of black-looking polyrhythms. And remember that this is only an intermediary stage of the process; we still have only been considering the difficulty of a single performer producing true-to-metronome attacks (or rather, true-to-clicktrack playback, since in this case there is no single reasonable metronome setting that supports α, β, and γ on equal terms.) We could call this an example of **solo intrinsic rhythmic difficulty**. I call it *solo* because these difficulties are classically encountered in solo preparation

[644] Not, it seems, in the  of the often-told story. According to Marc DeVoto, 'the fact is that Nicolas Slonimsky re-barred several pages for him in  .' Marc DeVoto, 'The Rite of Spring: Confronting the Orchestra,' *The Boston Musical Intelligencer*, Feb 6, 2021, accessed Jan 2, 2024, https://www.classical-scene.com/2021/02/06/confronting-rite/.

[645] Clearly, no conductor is going to flap up and down in one place for fourteen minutes while the orchestral musicians attempt to count dozens of empty bars. Any preparation of *Photoptosis* will entail grouping these bars and communicating the chosen groups to the players; while this does not take a very long time, it is a questionable use of rehearsal time, particularly if the musicians are using parts that still have the previous performance's chosen groupings pencilled in.

contexts. However, of course there is a relational 'duet partner' here — the imaginary clicktrack that underlies this way of conceiving rhythmic precision ('really thinking' a rhythm.) I think we can propose a **rule of thumb**:

- A solo intrinsic rhythmic difficulty arises when the smallest available isorhythmic unit that we might use for subdivision falls outside our workzone.

And, while we're at it, a second, more tentative, rule of thumb, which doesn't arise directly from this example but rather from a constellation of examples I've encountered in my practice:

- The upper limit of the workzone for thinking in such small units is approximately 600 pulses per minute.[646]

A: And your evidence is….?

B: Insufficient, hence 'tentative.' For that second rule of thumb, I thought of saying 'my workzone' instead of 'the workzone,' because the rhythmic **clock→cloud transition points** of different musicians are not the same. Maybe you know this old joke? A viola player says: 'You know *Für Elise*? It's the piece that starts with a trill…' However, it is noticeable that the smallest units in Ligeti's numerous compositional explorations of this point fall consistently in the region of 500-600 ppm, and that corresponds to many other composers' attempts to encode speed-of-thought-limits that I've encountered — i.e the moment where order dissolves into chaos. (Although these often are enacted by polydactyl piano+pianist actants, we shouldn't confuse this limit with physical speed limits on the piano, which can be much higher.)[647] Although I'll give a few more examples of this proposed musicianship speed limit in the course of this discussion, a future multi-work, multi-musician study would be needed to bolster our confidence in the figure itself. But no-one doubts that a clock→cloud transition must happen somewhere: 120ppm is definitely a clock, and 1200ppm is a cloud.

A: And a way out of the difficulty?

B: In the hope of making progress, let's revisit the subdivision-free **Option 4**. Even though it initially appeared absurd, it has one great benefit: it allows all three elements to breathe freely and co-exist on equal terms. Nothing has to be 'against' anything else. Maybe we could just internalise the three elements as three learned tempi — within reasonable tolerances. After all, performers often end up approaching rhythms that look exceptionally complicated on paper in comparable ways. In his discussion of Ferneyhough's *Bone Alphabet*, Schick leverages both strategies: when negotiating a nested tuplet, he sometimes conceives the 'master' tuplet as 'the beat' — i.e. something felt in tempo terms — and the inner one 'ornamentally' in terms of

[646] Although it can hardly be a coincidence that this figure roughly coincides with the figures given in 5.6, *Example 3* above, those are statements about a listener's perception and not about a performer's cognition-in-action.

[647] In certain contexts c.1000 piano attacks per minute are possible, as in the 'continuous music' of the pianist/composer Lubomyr Melnyk (1948-), who claims to be 'the fastest pianist in the world' at 'over 19 notes per second in each hand simultaneously' (the equivalent of 1140 per minute, while strumming simple triadic patterns), while Guinness World Records cites a teenage gamer and drummer, Keita Hattori (484 repetitions of a piano's top C in 30 seconds.) More serious investigations of the intersections between 'played' and 'thought' speed limits have been undertaken by the pianist Marc-André Hamelin: in interviews and masterclasses (including his 'Exercises for Mind & Fingers' for the website tonebase.co) and most strikingly via his compositions for player piano such as *Circus Galop* (1991-94).

'varying degrees of rhythmic dissonance' to the outer one.[648] In my conducting approach to *Inconjunctions* I did likewise: depending on the context and the level of ensemble unanimity, often I chose to beat out a tuplet, relieving the players of the need to perform one level of subdivision (in some cases, with **triage** in mind, this involved consciously sacrificing the comfort of a few individual players, whose parts actually became *more* complicated in these moments; I was also aware that this approach directly contradicted the express wish of the composer.)[649] I try not to torture myself with worry about the propriety of what Schick calls 'approximation' and 'guesswork' playing a role in the process, because I know that approximation is an inevitable feature at all hierarchical levels of intricate rhythmic work, and not only the innermost of a nested tuplet. Comparably, when conducting Pierre Boulez's *Le Marteau sans maître* for contralto and six instruments (1953-55), I make very little use of subdivision in some of the passages where the bar lengths change rapidly (although I have done so in my preparatory work), because while it is possible that live subdivision might marginally tighten my true-to-page rhythmic accuracy, triage reminds me that I should also be listening to pitch, articulation, and balance here. Being a mere mortal, and not a seven-eared beast like Schuller's Compleat Conductor (4.1.1), I can't manage all those feats at once:

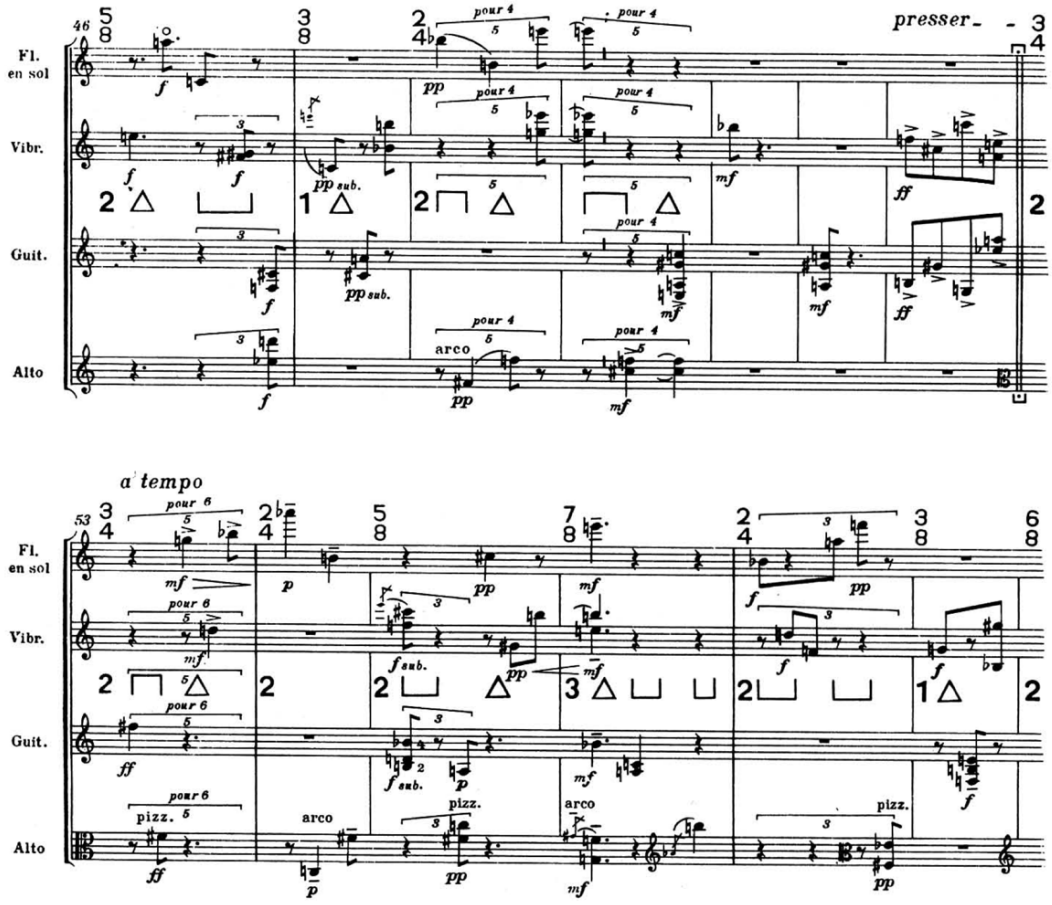


Figure 78: Pierre Boulez, *Le Marteau sans maître* for contralto and six instruments (1953-55), movt. 1 ('Avant "L'Artisanat furieux"), bars 46-58. ♩=168. Transposing score.

[648] Schick, 'Developing an Interpretive Context,' 137.

[649] 'In rehearsal Ferneyhough clearly expressed his desire that the performer not translate polyrhythmic composites into shifting tempi. He felt that polyrhythms seen as shifting tempi imply a reorientation of the overall metrical point of view.' Ibid., 138. But, as Dr. House pointed out, 'you can't always get what you want' (5.1.)

When considering the 5:6 tuplet in bar 53, I must admit that I do not undertake any preparatory subdivisional thinking at all, even though I probably would have time to do so in the tense fermata after the *presser*. Having the bar in my body is enough. Schick describes conducting a passage for percussion quartet that closely resembles the notated metric of that passage of *Le Marteau*:

> Conducting this difficult passage [Josh Levine *Four Places, Many More Times* (2011), bars 137-140] I find that subdividing is less useful than simply remembering the speed of the duple, triple, and quintuple subdivisions and accessing them through corporeal memory.[650]

The Levine and Boulez examples share a tumbling, head-first, quality, and even though they are written in short irregular bars, they invite the performer to physicalise quite large groups of these bars as single, lumpily-memorable, gestures. If desired, this process may be aided by programming chunks of a tricky passage into software such as Click-Tracker and repeating (a lot!) Once fully consumed, the metric bones of the chunk may be regurgitated on cue with little reference back to the notation. This resembles the work of an expert impressionist who can replicate the micro-timings of the speech patterns of their target with uncanny accuracy, and without needing to give much consideration to what had prompted the original act of speech or its grammar. Performers are born mimics, and so we often welcome this working method. Although it requires much repetition, it does not require intensive critical thinking — I have sometimes tapped along to a clicktrack while listening to an audiobook, for example — and can therefore even feel relaxing or hypnotic. Perhaps more surprisingly, the results can often rate highly on the true-to-page scoreboard of rhythmic accuracy. I don't think the word *difficult* is helpful in these cases, and they aren't *complex* either, because that implies managing multiple simultaneous strands or entities, and this does the opposite: it flattens rhythmic hierarchies into a single stream. Whether rightly or wrongly, the performance practice of Ronni Ancona wouldn't usually be described as complex, even though she is a virtuoso of micro-timings. As a child I was advised to 'solve' my first polyrhythm in a flattened way: *for two against three, think 'nice cup of tea'* ().[651] Even then I noticed that, in order for the two rhythmic strands to retain meaningful separation and not dissolve into a single 'nice cup of tea,' the involvement of another musical parameter was required: different pitches, articulations, dynamics, or timbres.

A: So **Option 4** wins, after all? Just do it!

B: Of course not. But to understand why not, we need to move beyond solo intrinsic difficulties and consider **ensemble difficulties**. It's not hard to imagine the chaos that would result from the hierarchically-flattened, relational-information-free **Option 4** being offered to a group that eschews the distinction between rhythmic leaders and followers (the Scratch Orchestra, for example.) Of course in reality no practical musician would allow a rehearsal to descend into guesswork and anarchy in this way. One glance at the score would suffice to make it obvious that someone would need to be appointed as a source of rhythmic initiative. But this causes its own problems. Recalling the **braindead** pitch scenario (6.3.1), we might think that the obvious answer is to follow the drummer here. Sometimes in so-called 'collaborations' between

[650] Schick, 'A Percussionist Understands Rhythm,' 72.
[651] We might propose this approach as a scenario: Poly? Put the kettle on.

classical and pop musicians — where the orchestra plays the role of a deluxe sample bank, providing backing string swoons and brass stings while the band sits up front — this is the best, and indeed the only, way to work. But not in this case. There are too many musicians playing in what is evidently intended to sound in rhythmic unison for this approach to sound sufficiently tight as each element changes. Waiting for the establishment of new entrainment with the drummer for each element will make the first couple of pulses of each group a mess — in particular the rapid ones of β. This is the case even when it is understood that such entrainment wouldn't take place via sound alone — that would be much too imprecise for the context — but via the performers' attention to the drummer's bodily gestures. In this respect the drummer would play a conductor-like role in providing some preparatory information. However, there are also too *few* musicians playing to allow us to adopt the more tolerant mode of performing and (participatory) listening — literally, one with wider tolerances — that we associate with orchestral practice.

A: Shouldn't everyone just follow the conductor, then?

B: What is true of the drummer's role is also largely true of the conductor's role here. In a naïve view of conducting, ramifying fuse-lines of rhythmic initiative run outwards from the podium towards each player, igniting attacks at the mighty conductor's will. This is hardly ever how initiative and signalling actually play out; the existence of *Éclat*, in which an arrangement of this sort really is envisaged (4.1.2.2), is the exception that proves the rule. I've already made reference to the complexity of a conducted ensemble's pulse-signalling network, and the inadequacy of the language of leading and following, in cases like *Zeitmaße* where the score explicitly directs us to manage time-giving otherwise (5.3.) However, in truth the exhortation *follow the conductor* is never a simple matter (and not only because, as the old saw goes, *if you follow, you are behind*.) Here, a player taking an **Option 4**-like subdivision-free performing approach and 'brainlessly' attempting to gather gestural information directly from the conductor for the placement of every attack comes with the same problems as 'just following the drummer,' plus the extra downside of not receiving sonic reinforcement. In reality, any musician who attempted such an improbable act of self-submission would rapidly become utterly exhausted. (Among other problems, they would need to know their entire part from memory.) We can say with confidence that some kind of active preparatory subdivisional thinking will be going on within everyone on stage here (and within any alert participatory listener too) even if they haven't attacked the problem with pencil and paper. The need for, and challenging nature of, such thinking has been red-flagged by the composer with his provocative use of constant rhythmic unison. Although the dynamic is a cool general ***mp*** and almost everything is played in a middle pitch register, this music isn't laid-back at all.

A: Challenging, I suppose, because no sooner is consensus achieved than it is snatched away. If it does end up sounding together and also close enough to the notation, it must create quite a special effect.

B: Yes. It's especially challenging because the subdivision is never explicitly spelt out to the ear in the form of sounding fast notes. The piece would largely lose its intrigue if we ever actually heard $\overset{3}{\overline{\text{♪}}}$s=375 or ♪s=500. We might propose another rule of thumb:

- When subdividing, the less the small units actually sound, the more effort it takes to maintain them internally.

Or, for short:

- Sounding ***pp*** ⟹ internal ***ff*** / sounding ***ff*** ⟹ internal ***pp***.

(The dynamics stand for degrees of rhythmic concreteness and definition rather than volume settings.) Hartenberger says that comparable challenges involve 'a different kind of virtuosity.'[652] I might even add that to negotiate them acceptably can feel like approaching a state of grace. But how to achieve that? For Schick in his Levine example (and for me conducting *Le Marteau sans maître*) non-subdivisional thinking made matters easier: he could 'simply' outsource the problem to his 'corporeal memory.' But that approach won't work for every member of the much larger ensemble here. They won't agree with each other.

A: Unless the sixteen musicians on stage are so devoted to the project that, like Zappa's Mothers or the Sun Ra Arkestra, they will live and breathe the same rhythms for years, so that they come together as a single body.

B: Even in such cases there's no guarantee that *all* the ensembles in our wider conception of ensemble practice will receive appropriate levels of care. In Anne Teresa De Keersmaeker's / Rosas' 2013 'danced counterpoint' to Grisey's *Vortex Temporum* (1996), the Belgian group Ictus played from memory.[653] As you'd expect, this required the musicians to undertake a long 'corporealizing' rehearsal process. This, combined with the experience of repeating the performance many times on tour over several years, gave the musicians an unusual level of intimate familiarity with the work. While the results were acclaimed as stupendously successful on their own terms,[654] the digestive process of embodying the music and playing with an exceptional degree of in-group unanimity entailed a noticeable sacrifice of true-to-page rhythmic accuracy (in particular, the maintenance of steady 𝅘𝅥𝅯s in the first movement and the equivalent passages in the third); we might not choose to hear that version without its choreography, nor was it intended to be heard that way.

In our example there are too many possible and plausible ways of physicalising the relations between the three elements to make corporealization alone a viable option within majority new music performance practice. Vague exhortations like *let's feel it together*, and the standard rehearsal tactic of repeating a passage until it somehow falls into place, come with problems comparable to the 'Celibidache effect' we identified in Chapter 6. Without acknowledging the fact, they structurally push us to favour one performing mode over another: in pitch, the reflex of tuning in slow time pushes us towards local JI, while in rhythm, the reflex of repetition — if done without conscious intervention — tends to prioritise the inter-performer (sounding) ensemble over the true-to-page (silent) ensemble. And that's even before considering longer-

[652] Russell Hartenberger, 'A Different Kind of Virtuosity,' in *The Cambridge Companion to Rhythm*, ed. Hartenberger, 75–89.
[653] Images available at 'Anne Teresa De Keersmaeker - Ictus - Vortex Temporum - Archive 2018,' *Festival d'Automne*, accessed Jan 2, 2024, https://www.festival-automne.com/en/edition-2018/anne-teresa-de-keersmaekerbrictus-vortex-temporum.
[654] Corinna da Fonseca-Wollheim and Siobhan Burke, "'Vortex Temporum,'' a Sensual Blend of Music and Dance,' *New York Times*, Oct 16, 2016.

term obstacles to a satisfying ensemble performance of the song, including the different points ensemble members will begin to experience concentration fatigue, with the risk of rhythmic drift as colleagues step in to pick up the slack. These factors combine to make this passage more rhythmically difficult than a comparable example — one which initially struck me as much more utopian…

A: I sense a digression coming on…

B: Please bear with me! The passage is a short part of *Soma: oder die Lust am Fallenlassen*, a 2015-17 work for large ensemble and solo percussionist by Stefan Keller. Before the section I'm interested in, the performers have negotiated pages of athletic but conventional metric modulations where small-unit thinking is not only appropriate but essential and unavoidable, because the soloistic percussion part almost invariably plays the small units. (The composer is also a tabla player.) In this example the full ensemble is playing, in pulsing microtonal chords that clearly track the crotchet beats, and sporadic flourishes, but to save space I only give the percussion part:

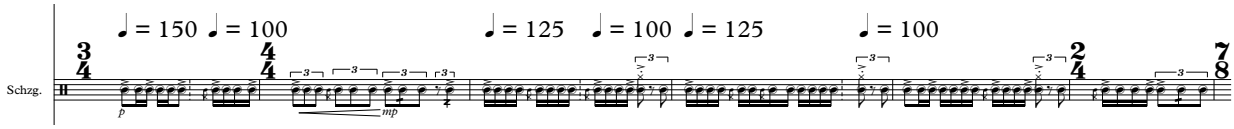
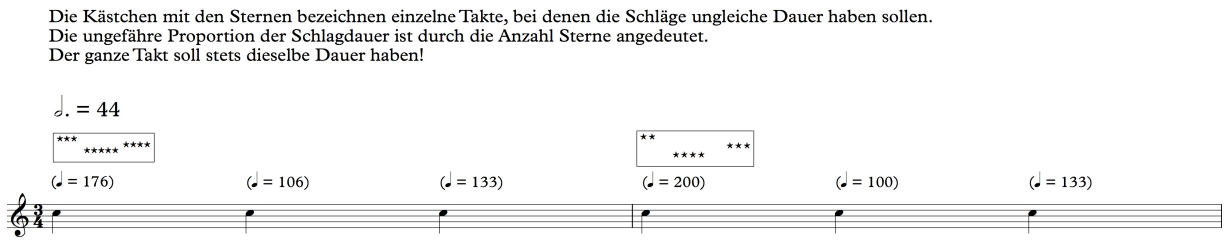


Figure 79: Stefan Keller, *Soma: oder die Lust am Fallenlassen* for large ensemble and solo percussionist (2015-17), bars 81-86, percussion part only.

Although everyone needs to stay on their toes in these passages, these are 'only' workflow difficulties: aided by the explicit subdivision in the percussion part, we all can place our attacks with confidence if we count in groups of fast isorhythmic 4s and 5s, and so on, just like in our *Unsubtle Etude*. But then comes a surprise. I give the composer's explanation of his unusual metric notation, as supplied in the performance instructions, then a short section of the passage:



Translation: The little boxes with the stars describe single bars in which the beats have unequal durations. The approximate proportion of the beat durations is indicated by the number of stars. The whole bar should always have the same duration!

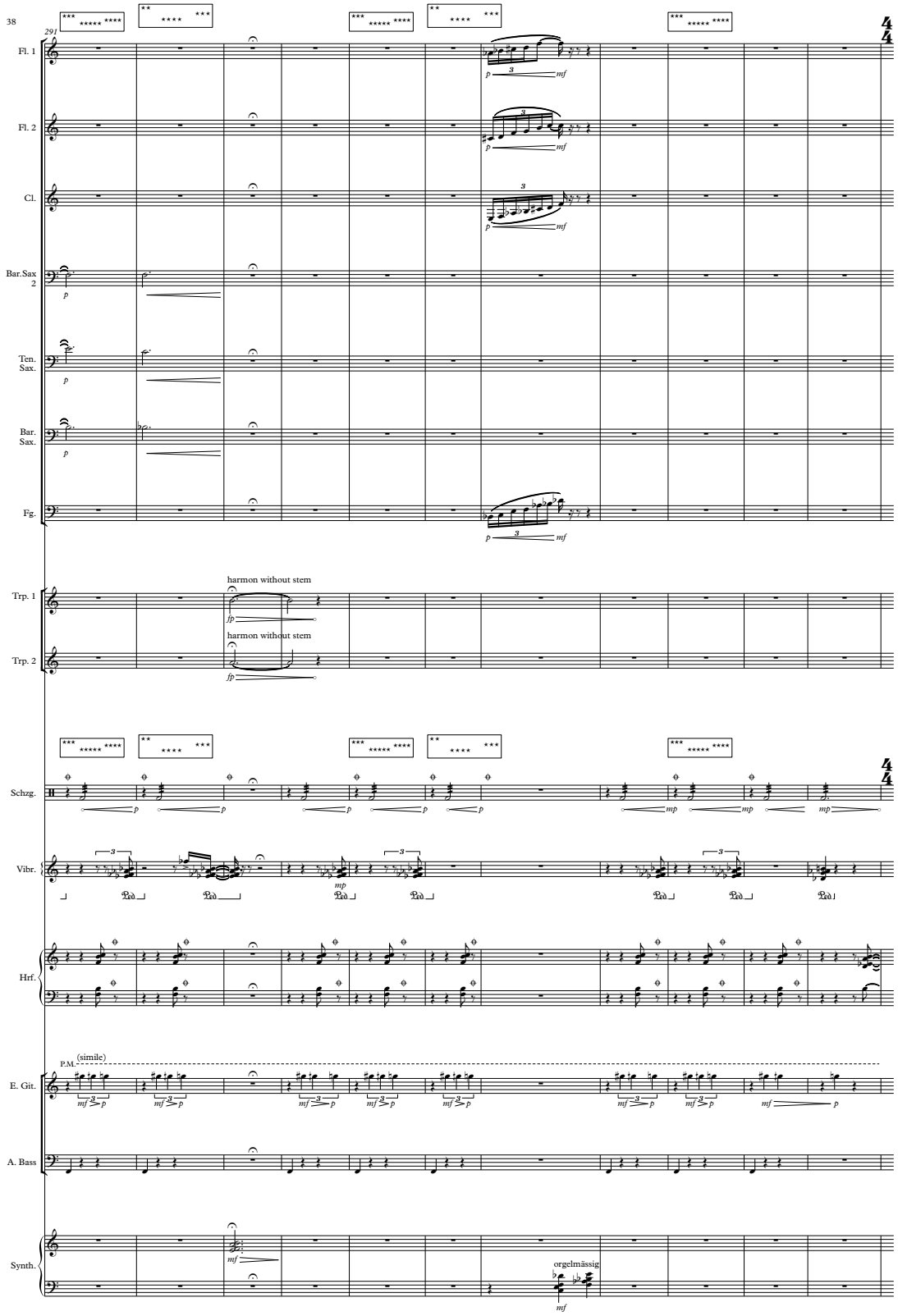


Figure 80: Keller, *Soma*, stars and boxes. Extracts from Performance Instructions and full score, bars 291-301. Score in C.

The bars with the stars encode a rubato in the etymologically-literal sense (i.e. as 'rubato' hardly ever actually plays out in the performance of nineteenth-century music): the beat — here notated in whole bars — remains a constant 𝅗𝅥.=44 (=every 1.35 seconds) while the sub-beats steal time from each other. The notation continues in this vein for several pages.

A: It looks like a very extreme waltz rhythm to me — as if someone were trying to explain to a Martian how an exaggerated *Wiener Nachschlag* sounds.

B: It's disconcerting because, until this moment, we have been thinking in (Reina- and Cagwin-approved) small-unit isorhythmic cycles — then suddenly it's not so obvious how we should think. But think we must, because, as in the Mayr example, the composer is waving a red flag — *there is rhythmic interest here! Pay attention!* That's signalled by the use of very simple musical material that remains thoroughly recognisable as it is deformed: the electric guitar part, for example. It's certainly not rhythmically arbitrary. And once again, we are not in a classically 'complex' rhythmic context: this does not resemble a score by Ferneyhough, Dillon, or Mahnkopf. The internal metric structure of each starry bar looks like a miniature version of **Option 4**, only with one pulse per tempo change instead of four.

A: I presume you've conducted this. So let's go straight to how you approached the passage.

B: First I looked at the problem in terms of **solo intrinsic rhythmic difficulty** (my closeness to a hypothetical clicktrack.) Looking at Keller's performance instructions, let's call his first bar δ and his second bar ε. Although he politely uses the word *ungefähr* (approximate), the number of stars gives the exact desired proportion of the beat lengths. In δ we have 3+5+4 stars, which can be considered as 𝅘𝅥𝅯s in a bar of $\frac{12}{16}$; in ε we have 2+4+3 stars, which can be considered as $\overset{-3}{\text{𝅘𝅥𝅯}}$s in a bar of $\frac{9}{12}$. Pencil and paper reveals — via the simple tempi/ppm equation in 2.3.4.2 — that the composer has thus given us the same information in two ways, although he's rounded off the tempi to whole numbers: I bet that in his original sketches the overall tempo marking was 𝅗𝅥.=44.444… and the tempo marking of the last pulses of δ and ε was originally ♩=133.333…

A: That's just splitting hairs, surely?

B: Musicians often scoff when they see tempo markings ending in decimals or fractions, but that's to miss the point. These markings aren't there because anyone thinks there'll be much perceptible difference between ♩=133 and ♩=133⅓.[655] Rather, they exist to give the performer a hint that there's a tempo relationship to be considered: *look! there's something to hang on to here!* So I usually find them welcome. In fact a much bigger problem for me is restricted information — the cases where I have to guess what a composer wants. That can create vexing **reverse triage** situations, particularly where a composer has 'helpfully' intervened in matters that — to speak frankly — I regard as my territory. For example, in the case of Magnus Lindberg's *Jubilees* for ensemble (2002) I found it necessary to perform 'reverse triage' and laboriously reconstruct numerous metric modulations that the composer — perhaps conscious of his own limitations as a conductor — had notationally suppressed. I didn't do this because I was fretting about tiny differences of tempo in this exuberant piece, but in order to *reduce* my workload: it is much less time-

[655] There are also cases where a decimal in a tempo marking has direct use (i.e. not to mark a relationship with another tempo), such as when synchronising music with video. Additionally, in some purely musical contexts we can defend the distinctness of fractional tempo values: the base tempo of the Boston Modern Orchestra Project's recording of John Adams *Chamber Symphony*, movt. 1 (see 7.2.1) is ♩=120.5, and not 120 or 121.

consuming for me to produce a quintuplet against a reference tempo than to reliably corporealize two seemingly-unrelated tempi. (In that case it was the sheer number of such tempo changes that made the workload irksome.)

A: OK, so you started by re-spelling δ and ε in conventional terms…

B: Yes. And they look perfectly simple:

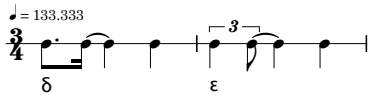


Figure 81: Keller, *Soma*, stars and boxes re-notated.

The reason the composer didn't write the whole passage that way, of course, is the notational Armageddon that this would have unleashed. Imagine how outlandish the triplets in the electric guitar would look if they were brought into line with these groupings! In some cases maintaining conventional notation would have been (just about) feasible:

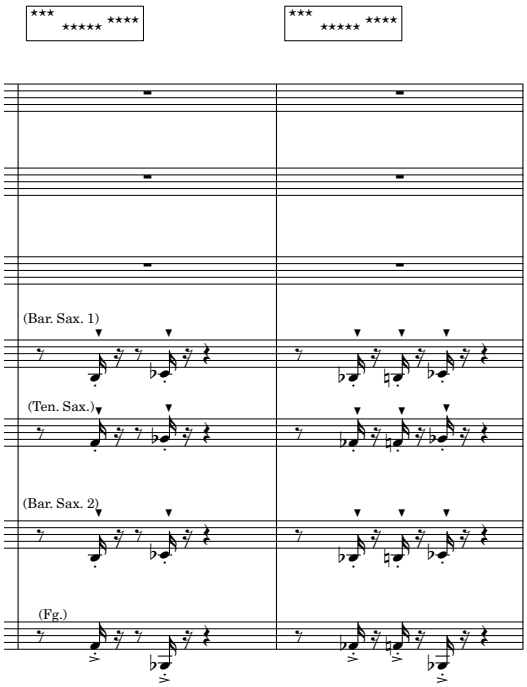


Figure 82: Keller, *Soma*, bars 325-326. Woodwind parts only, all 𝄢 and *ff*. Score in C.

This passage of sharp attacks for low saxophones and bassoon might have been written as:

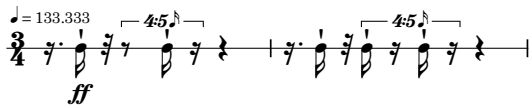


Figure 83: The same passage, rhythmically re-notated.

But it's still a head-scratcher — and that's one of the most tractable examples I could find. (I haven't tried to replicate the durations of these *staccatissimi*, only their onset positions.)

A: Well, the musicians are booked to play nonetheless. So how did everyone cope?

B: Considering the metric structure alone as a **solo difficulty**, we can note that the small units of δ and ε run at 𝅘𝅥𝅯=533⅓ and $\overset{3}{\sqcap}$𝅘𝅥𝅯=400, and that the larger figure approaches the proposed workzone speed limit in our rule of thumb. But your question is about **ensemble difficulty**, and it's immediately clear that to advise everyone on stage to think subdivisionally here would be a non-starter — because the internal clock speeds required would be far in excess even of the hummingbird's wings in the Mayr example.

The solution we found was to *divide the responsibility for time-giving.* And in this respect Keller's elegant notation had done most of the work for us. I thought throughout in a steady 𝅗𝅥=133⅓, or near enough. For every δ bar, my hands indicated  , and for every ε I showed  . Although I wrote it that way into my score, I tried to eliminate any syncopated character in my gestures (the shoulder- and elbow-twitching tics that indicate 'off-beats'), and to project them as true 'beats.' By doing so I tried to relieve the players of the need to undertake one level of subdivision; they learnt my beat timings mimetically — through what Hartenberger calls 'simply' corporealizing the passage. For me there would have been no benefit to doing likewise, since my rhythms were truly simple and I could score very highly on the true-to-page metric of success via conventional subdivision. (That wasn't what principally motivated me, of course — I wanted to provide the players with a reference that would be maximally reliable for *their* corporealization processes.) The players then were free to do what players conventionally do — to execute their rhythms after appropriate triage, marked up with the usual lines above the stave — albeit with a greater-than usual concentration on the conductor. Incidentally, I had to swallow some humble pie here, since I discovered — before the rehearsals, thankfully — that I was unable to prepare in my normal way. In the interest of mutual professional respect I usually aim to be prepared to sing a reasonably good approximation of anyone's part while showing my beats. But I couldn't manage to do that acceptably for all the rhythms in the long passage with the stars: either my singing or my hand let me down. Later, out of curiosity, I programmed the passage into Click-Tracker to experience the passage from the players' point of view, and I found their tasks tricky but manageable. It seemed that, given my limitations and the players', splitting and distributing the workload was the way to go. The careful accounts by Pace[656] and Schick concern solo executions of polyrhythms where this approach obviously wasn't an option. But they only had themselves to play in time with, so they were free to set their own standards of rhythmic acceptability (given the absence of a *Polymetric Police* force, by analogy with Tidhar et al.'s *Temperament Police*.) And while these standards were impressively high, the authors didn't need to worry about negotiating the differing tolerances of colleagues.

A: Glad you found a way to cope. But why have we digressed into this example? We haven't found a satisfactory approach to the Mayr piece yet.

[656] Pace, 'Notation, Time,' 179-190.

B: Because I think we might apply lessons from it. Usually we imagine that when a rhythmic performance is really tight, it's because everyone is feeling the whole groove in the same way. That was the case in the 'workflow' sections of the Keller, where it was helpful if as many musicians as possible thought intensively in small units. And it's a good default strategy for negotiating most metric modulations; it usually makes a conductor's life easier if other players share the preparatory cognitive load: *let's all think in* n*-tuplets in the bar before* (and, although the results will always have some scatter, the conductor can gather them readily into a single heap — thus permitting the conductor to finesse and polish, and not to act as a mere traffic cop.) But the Mayr case seems different. What if, instead of looking for an approach that we would recommend to every member of the ensemble, there might be a strategy where we split the responsibility for time-giving among members? Maybe an ensemble difficulty calls for an ensemble solution…

A: Sounds like a recipe for over-complication and chaos to me. In the Keller example there was a built-in separation of metric structure and sounding content, so you had your strategy handed to you on a plate by a clever and practical composer. But the Mayr example is in unison!

B: Even so, we've established that we've already got a genuinely complex situation on our hands. And what I'm suggesting isn't so complicated, in fact. There's a clue already in the ensemble's setup, since it includes two musicians who traditionally play a time-giving role: the drummer and the conductor. (For simplicity, I'm not considering cases where, say, the flautist or marimba player take greater responsibility for rhythmic initiative, even though this is entirely possible; in orchestral contexts rhythmic impulsion 'flowing forward' from individual players and little sub-groups may even be the norm, particularly in cases where the conductor is inexperienced or under-confident.) There are various ways we might split rhythmic initiative here, and I'll just suggest one option. In this approach, the conductor concentrates on maintaining a mental flow of 375ppm — in internal ***ff*** — in the service of α and γ, and conceives every β as a 'rest bar' where these pulses can relax into internal ***pp*** or even stop. During these bars the conductor looks to the drummer, who takes responsibility for β — perhaps by small-unit thinking (in 500ppm) to establish a tight relationship between α and β, or through corporealization. The latter is now a more plausible strategy for the drummer, because only one pulse needs to be internalised and not three. Among the physical implications of this approach are that the conductor's beat during β will look less active and more indeterminate,[657] and that the drummer will need to take care not to play every β louder as they take the initiative.

A: Seems like the other players' heads would be going back and forth like spectators at a tennis match.

B: If you think it's overly ambitious for musicians to split their attention in this way, remember that the ways performers habitually manage flows of rhythmic initiative can be even more multiplex and labile. Think of how many evanescent temporal points of reference a contrabassist takes account of when placing a *pizzicato* in the tum-ti-tum accompaniments of an aria by Bellini: the singer, the conductor, the demands

[657] For brevity I have not discussed in the main text another option for the conductor: to conduct β in 2 or 4. This can be swiftly dealt with: 'in 2' provides no information for the crucial second pulse of β and so is little more than bobbing along to the music, while 'in 4' supplies too much information, too quickly — i.e. it is too fussy (a comparably rapid solution is often helpful in single uses, but not when the pattern repeats as often as it does here.)

of the score, their section colleagues… It's only that switches in the direction of our rhythmic attention are not usually spelt out so explicitly; we don't usually expect to receive unambiguous handovers like a pilot transferring from one area of controlled airspace to another. For fine musicians, I suspect that the main challenge of this approach would not be the task itself — running like Goldoni's Truffaldino between two bosses — and more of excluding the influence of others. This is because, as I argued in Chapter 3, classical performer training in the broad sense is heavily geared towards the development of consensus-building via the intuitive incorporation of multiple voices: *think like a chamber musician!*

A: You're saying that they *shouldn't* think like chamber musicians here?

B: It does seem like odd advice, I know. But that exhortation can be code for resorting to a default consensus-forming mode: a mode which feels natural but is actually the product of training (i.e. another *déformation professionnelle*.) The mode is an example of what Montero calls out as 'just-do-it' thinking — patterns of thought she diagnoses as seductive but rarely helpful. In the Mayr, and in many comparable NMP situations, notions of flow and ease — i.e. the maximal alignment of a performer with a composer's imagined line of thought — may not be appropriate. (How would you conduct a crossfade?) In the Bertelsmeier example in Chapter 6 I tried to show how, when an ensemble difficulty arises, several heads can be better than one. As long as they they share an overall heuristic, that is — and supplying an appropriate one in NMPT is the job of a **caretaker** (not necessarily a conductor, although I've taken on that role here.) We can draw a distinction between 'thinking like a chamber musician' and 'thinking like an ensemble musician,' and also note that this distinction doesn't map automatically onto the obvious *Besetzung* (line-up / instrumentation) of the project at hand: it might well be appropriate to 'think like a chamber musician' in large-orchestral contexts, or to 'think like an ensemble musician' in a duo or trio. Experienced performers can make these modal shifts very rapidly indeed, at times almost without noticing.

A: We seem to have exhausted the Mayr example. And, for once, you've actually decided how you think performers should approach a passage.

B: No, I really haven't! This is where a musicianship-led view of NMPT diverges strongly from an 'advice for performers' approach, such as the texts I mentioned in 2.4.1 ('Alternative approaches.') Performers preparing for a concert will find their own ways to negotiate the obstacles I've pointed out. Maybe they will all try to employ intensive small-unit subdivision and produce a version with a tight, math-rock feel. Or they might take a looser approach and make the passage sound floatier and harder to pin down metrically. They might allow the rhythmic initiative to flow mainly from a single dominant musician, or in a less-directed and more distributed way. Or they may find use for the explicit division of initiative I've suggested. As in the Dvořák 'problem' above, choosing such strategies and solutions is up to them and (with due respect to both composers) the success or failure of the results aren't our main concern here. A musicianship-led approach to training, by contrast, dares to do something that goes counter to a rehearser's impulse to resolve difficulties as rapidly and efficiently as possible…

A: Which is?

B: Lay the wound open! Don't try to resolve or conceal a point of difficulty, but rather meet it directly. The end product of musicianship-led NMPT is not the production of a series of polished mock-professional concerts, but rather the inculcation within trainees of cognition-in-action tools for wider use. Let's summarise a few of these, then take a break:

- Although the proposition should be taken seriously, the characteristic rhythms of new music are not arbitrary (2.3.4.3.) Accordingly, their pedagogy for performers should focus on the identification and resolution of rhythmic difficulties (2.3.4.1.) This implies the existence of metrics of success and failure. However, within new music practice and its pedagogy there exists an unresolved tension between two broad conceptions of rhythm with different standards for success and failure: the 'ideal kilogram' conception (whether encoded in a score, as in the 'true to page' standard, or otherwise), and the 'prompted by scripts' one. A NMP trainee who is exposed to a sufficiently varied repertoire will encounter both of these. Most materials that offer rhythmic 'training' presuppose the former conception. This explains their relative lack of take-up in an environment that increasingly favours the latter (4.2.) While the latter conception appears to be more sophisticated, it risks leaving trainees without points of reference beyond individual examples of practice (3.2.)

- The ensemble notion of rhythmic difficulty takes account of both conceptions. Although it does not thereby offer a direct solution to any difficulty, by encouraging NMP trainees consciously and explicitly to locate a performing challenge within the contextually-appropriate ensemble, it provides an apparatus to enable them to defend the robustness of their decision-making and hence to play with confidence. While this may sound abstract, it can be conveyed in simple pedagogical language, for example: *do you think you should try to play a strict quintuplet here, or to play together with the brass?* The composer's voice, while vital, is only one of the voices to which a NMP trainee should be encouraged to pay heed when considering these questions (5.1.)

- Rules of thumb are of key importance in building an arsenal of transferable rhythmic skills (5.6.)

Let's go and drink a strong coffee, because the next bit includes references to academic literature.

7.2 Further into the isochrony/non-isochrony opposition. Scenarios of rhythm.

B: (*returning, refreshed*) In this text I've given the academic literature on rhythmic perception short shrift because to a large extent it's ignored or dismissed new music's characteristic rhythmic practices, particularly in respect to its pedagogy, and no-one likes to be ignored or dismissed. Back in 1993 a paper talked of 'bridges unbuilt' between the literatures of music cognition and musicianship training,[658] and that's still the case to a great extent. (The snub is mutual — how often do academic papers get mentioned in lessons or rehearsals?) But at this point we can benefit from the insights of a burgeoning area of research — the new

[658] David Butler and Mark Lochstampfor, 'Bridges Unbuilt: Comparing the Literatures of Music Cognition and Aural Training,' *Indiana Theory Review* 14, no. 2 (1993): 1-17.

model of understanding non-isochronous (NI) metre, as developed by Rainer Polak, Mats Johansson,[659] and others. Polak has provided a survey paper of this field;[660] I'll attempt a summary of his summary. He observes that the 'proposition that regularity is at the core of musical meter' underlies both of the dominant models of understanding perceptual metre within Western academic discourse: the 'metric projection' model of Christopher Hasty,[661] and the pulse/beat 'entrainment' model of Fred Lehrdahl and Ray Jackendoff[662] as developed by Justin London.[663] He also notes that 'Africanist musicologists first developed the concept of a perceptual metric beat or pulse as derived from, yet being partially independent from rhythmic figurations,' starting from the 1950s, only for 'Western music theory [to] independently (re-)invent the rhythm-meter distinction and the concept of meter as nested pulse streams,' two decades later. Despite this, 'non-isochronous meter exists.'[664] As evidence, Polak amasses a large number of studies of real-world NI metric practice, mostly drawn from comparative musicology: in musics from Scandinavia, the Balkans, Turkey, the Near East, Southern Asia, Africa and its American diasporas, as well as 'Euro-American art music of the 20th century' (i.e. our subject matter, more or less.) Polak notes that 'earlier efforts to marginalize NI meters as exotic derivatives of "originally" ISO meters represent a speculative, probably Western-biased thought-figure.'[665] Pointing to ethnographic observations from Bulgaria, Mali, and Brazil, Polak notes that NI meters 'are experienced, by encultured listeners, as perfectly normal, easily accessible and simply natural.'[666] Furthermore — and this came as a surprise to me — empirical studies of tapping-along to simple rhythms, perceiving manipulations, and perception of ensemble synchronization in live performance of real music 'suggest that metric performance in NI meters does not fall behind analogous task performance in ISO meters.'[667]

A: *Metres…?*

B: Let's get one thing out of the way before we go further: we're not going to wade into an attempt to define what counts as rhythm, pulse, or metre. Metric / rhythmic hierarchies, or cycles-within-cycles, unquestionably exist — they're baked into our notation and used every day — and in our discussions of the Mayr and Keller examples we could rapidly have become bogged down in definitional debates. Instead, I've used the looser and more nuanced language of performers, for whom it's a given that multiple hierarchical layers are constantly in play in rhythmically-interesting music. We didn't wait for theorists of perception to tell us that the development section of Beethoven's Symphony no. 5, movt. 1, isn't simply in $\frac{2}{4}$, nor did we need reminding that we can exert significant control over how its groupings and sub-groupings are perceived. When I talk about using subdivision in isochronous contexts, for example, I mean

[659] Mats Johansson, 'Non-Isochronous Musical Meters: Towards a Multidimensional Model,' *Ethnomusicology* 61, no. 1 (2017): 31–51.
[660] Rainer Polak, 'Non-Isochronous Meter Is Not Irregular: A Review of Theory and Evidence,' in *Gegliederte Zeit. 15. Jahreskongress der Gesellschaft für Musiktheorie Berlin 2015* (GMTH Proceedings 2015), ed. Marcus Aydintan, Florian Edler, Roger Graybill, and Laura Krämer (Hildesheim, Zürich, New York: Georg Olms Verlag, 2020) 365-379. *Note:* I have been unable to source this printed edition; my page references refer to a pre-print copy (pages 1-11.)
[661] Christopher Hasty, *Meter as Rhythm* (New York and Oxford: Oxford University Press, 1997).
[662] Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge, Massachusetts: MIT Press, 1983).
[663] London, *Hearing in Time.*
[664] Polak, 'Non-Isochronous Meter Is Not Irregular,' 3.
[665] Ibid., 4.
[666] Ibid., 5.
[667] Ibid.

the feeling of stepping down a level in a hierarchy of events in time, where fast is at the bottom. I don't think it's necessary for a musician to define the levels in terms like rhythm, metre, hypermetre, and so on. It's the direction and the extent of the movement — up or down — that we feel.

Polak's key insight, for our purposes, is that there are cases where no fundamental small-unit isochrony exists, and so this hierarchical model doesn't straightforwardly apply:

> It has been suggested that the complexity of non-isochrony on one metric level needs to be balanced by isochrony on some neighboring level. In the case of NI beat cycles, the subdivision level suggests itself as a referential anchor, and while perhaps true when the subdivision is isochronous, this is not always the case, however. [Polak has previously given the examples of the 'drastically NI' or 'ovoid' rhythms described by Jean During in relation to Central Asian music, which he calls doubly non-isochronous: at the beat *and* the subdivisions level.] Moreover, the assumption of a fast subdivision as elementary reference level is inconsistent with [the fact] that, typically, a pulse at some medium (beat, tactus) level of the metric hierarchy provides the core metric reference.[668]

A: OK, but that research is about the perception of existing music, and we're talking about rhythmic training and solving problems when making music, right? So even if the 'core metric reference' is at the medium level, a performer might use the cognitive strategy of stepping down into subdivision — even if it's not perceived by a listener as such.

B: Yes, but, as we've shown, sometimes we can't. And this is where our reading of the Mayr situation is confirmed by Polak's final point:

> Finally, some performances based on NI beat cycles and most performances of NI subdivision cycles are too fast and too mathematically irrational to be advantageously framed by reference to some still faster layer of periodicity. [Polak gives the example of Tellef Kvifte's diagnosis of the impossibility of understanding NI meter in Scandinavian folk dance music as multiples of a common fastest denominator.][669]

Emboldened with so much evidence for the existence of real NI in musical practices around the world, we can now put our terms on a firmer footing. For us, with our focus on training, the key word in Polak's quote is *advantageously*. Most examples of 'workflow' rhythmic difficulties in new music performance look very NI indeed, but they are — from the performers' point of view — fundamentally ISO. This encompasses a large tranche of repertoire where a performer's subdivisional clock speed is high, but remains in the workzone. We encounter numerous examples when performing works by Messiaen and his many rhythmic epigones. In the past, researchers who discussed NI rhythms frequently made reference to Bartók's use of 'Bulgarian rhythms' — *aksaks* (meaning 'limping' or 'stumbling') — but that composer's isochronous smallest units usually trundle along too slowly to be of relevance to our discussion.[670] (Nevertheless, from a historical perspective, it's interesting to note that Bartók, writing in 1938, observed

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668 Ibid., 6.
669 Ibid., 7.
670 For example: in Bartók's *Six Dances in Bulgarian Rhythm* from the final volume of *Mikrokosmos* Sz. 107, BB 105 (1940), the printed tempi correspond to the following leisurely small-unit values: I: 350, II: 420, III: 400, IV: 400, V: 360, VI: 448.

that orchestral musicians 'not so long ago' were 'helpless' in the face of such rhythms.)[671] In Messiaen's *Couleurs de la Cité céleste* (1963) I'd certainly recommend that all players think in fast isochronous flows in athletic passages such as this one:

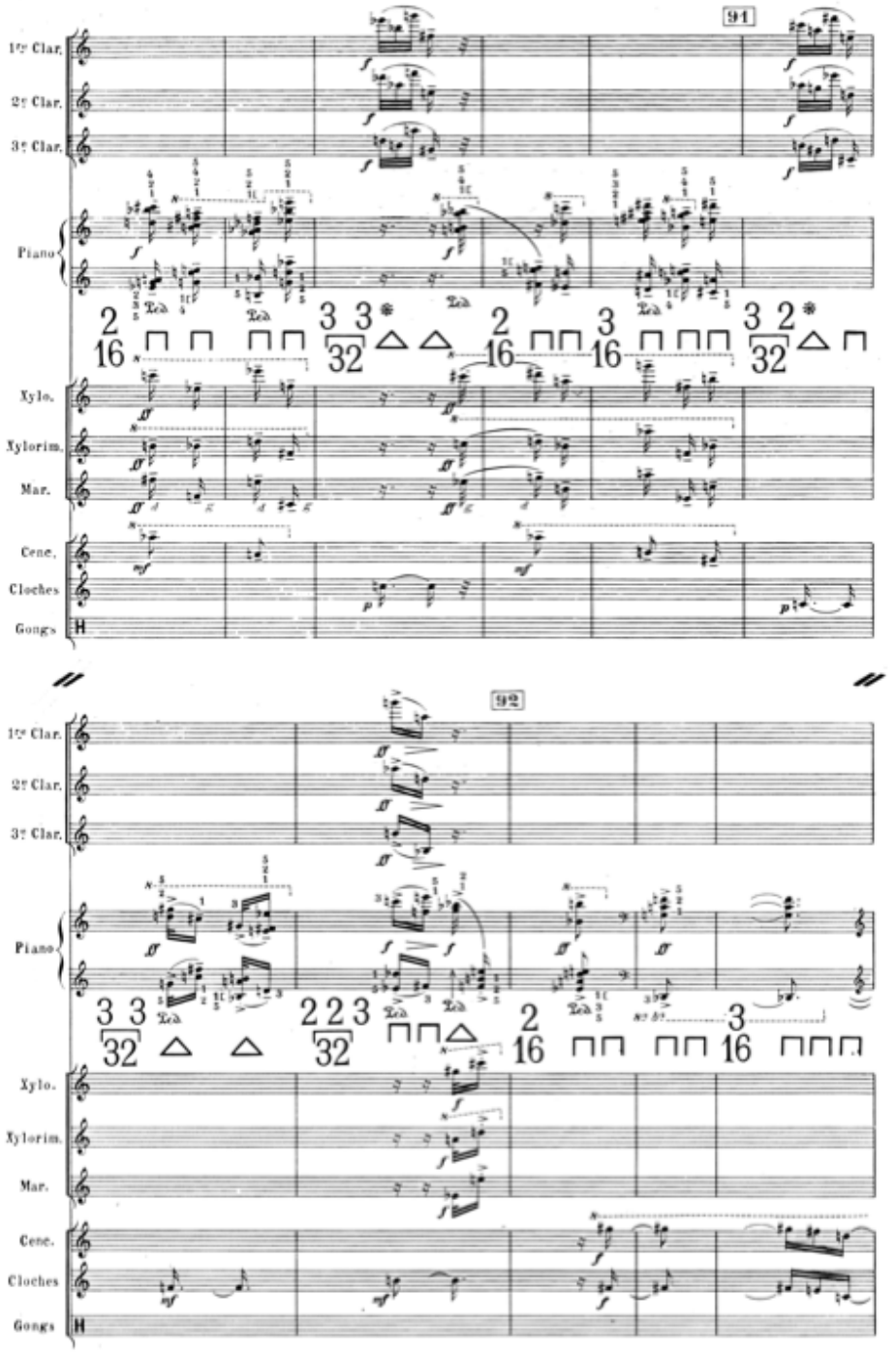

Figure 84: Olivier Messiaen, *Couleurs de la Cité céleste* for solo piano, three clarinets, brass, and percussion (1963), 2nd bar after fig. **90** to 3rd bar after fig. **92**. ♪=126, 'Un peu vif.' Score in C.

[671] 'It is astonishing how helpless orchestral musicians were, not so long ago, when presented with such rhythms. They had become so accustomed to hand-organ-like symmetrical rhythms that they could not grasp these rhythms at all, which were so unfamiliar to them, yet so very natural.' In Bartók's 1938 essay, 'The So-Called Bulgarian Rhythm,' quoted in Adam Sliwinski, 'The Concept of Rhythm: Composers in their own words,' in *The Cambridge Companion to Rhythm*, ed. Hartenberger, 160.

The small unit (𝅘𝅥𝅯=504) is approaching the cognitive speed limit in our rule of thumb. (‘*Un peu*’ *vif*, indeed!) Nevertheless, this is ‘only’ a workflow difficulty because it’s unambiguously advantageous for every player to try to think isochronously and in the same way here — so from our point of view this counts as an isochronous passage. If they don’t, the groups of 3𝅘𝅥𝅯s and 2𝅘𝅥𝅯s quickly become shapeless, diverging both from the player-to-player and the true-to-score metrics of rhythmic acceptability. A solo pianist who plays very similar notated rhythms in *Catalogue d’oiseaux* (1958), or even in the solo passages in this piece, might have the luxury of feeling the rhythms as rhapsodic birdsong (and therefore fundamentally NI) but the ensemble players need to actively resist this temptation. (It doesn’t help us to muse about whether this isochronous subdivision is perceptually available to the listener — although I’m tempted to echo Schoenberg’s complaint that his music was ‘not modern, just badly performed,’ and suggest that some of London’s scepticism about the imperceptibility of pulse in what he understands as new music may have arisen from listening to less-than-laser-sharp performances of that venerable repertoire.) On the other hand, solo intrinsic rhythmic difficulties are fundamentally NI, and so demand different coping mechanisms. ‘Fundamentally’ here doesn’t mean that the situation isn’t theoretically amenable to an isochronous treatment; it means that this wouldn’t be advantageous.

A: So, the differentiator is whether the smallest subdivisional unit exceeds the c.600ppm working speed limit.

B: And also our appetite to think in small units, which is context-dependent. Thinking in a way that feels intensive and fine-grained would clearly feel inappropriate in music that has a very different mood: for example, if we were playing a transcription of some of the woozy rhythms of Charles Mingus. But I think it would also feel inappropriate in a context where the character is exceptionally intensive: for example, in the hyper-nervy first movement of György Kurtág’s *Messages of the Late Miss R.V. Troussova* for soprano and chamber ensemble (1981). This is where it helps to think in terms of scenarios. We need to draw our experiences into groups, or we fall prey to the old ad hoc counsel of despair: *it depends on the piece*… In doing so we can proceed in reverse order to that of Chapter 6. We will start with **gridding**, and later move into NI scenarios.

7.2.1 Varieties of rhythmic gridding: drumming, flat-pack, graph paper, speed camera

A: Same name, same idea?

B: Yes. It has been often stated or implied that a performer’s ability to maintain a metronomically-steady pulse forms the foundation of all rhythmic work. Here is the composer Phillippe Kocher, an expert on polytemporal composition, and the author of *Dirigierende Machinen: Musik mit technikgestützter Tempovermittlung* [Conducting machines: music with technologically-supported tempo communication]:[672]

[672] Philippe Kocher, *Dirigierende Machinen: Musik mit technikgestützter Tempovermittlung* [Conducting machines: music with technologically-supported tempo communication] (Bielefeld: Transcript Verlag, 2021).

One of the first things a novice musician must learn is a sense for a regular pulse. The ability to accurately perform a (notated) rhythm, no matter how complicated or asymmetrical it might be, is based on this skill.[673]

While we might rephrase this in terms of a musician's ambition rather than their ability, since everyone accepts that perfect regularity is unachievable in the real world, the proposition seems pretty uncontroversial, since it corresponds to how we usually learn difficult things. Elaborate structures are built on simple foundations: children learning mathematics first learn to count, then add, then multiply, and so on.

A: I'm sensing a 'but'…

B: But children do not really learn their arithmetic from the ground up: if they did, they would start with set theory and the Peano axioms. They start with shortcuts, necessary fudges, and deliberately-restricted examples. So do 'novice' classical musicians. Our ability to maintain steady pulse is first developed in small musical gobbets (aural clapping tests, sightreading, etc.), which are later stitched together in somewhat larger sections via pedagogic / rehearsal interactions (*Let's take care not to drag / rush here.*) As we gain musical experience, our training becomes ever more closely linked to specific musical cases: to particular pieces, for sure, and also to the sort of authorless, shared, and unanimising features I pointed to in my attempt to characterise how orchestral training works in 3.2 (I called it mostly 'self-teaching,' and an 'emergence of complexity from noise.') After a certain point in our training pathway we are unlikely to be encouraged to work on, or to be assessed on, our long-term capacity to maintain steady pulse stripped of musical contexts. Hartenberger puts the point bluntly, but I think justifiably:

Classical musicians are not generally trained to play strict pulse-based music. Orchestral players, for example, develop an association with pulse from the historical development of the repertoire and learn to adjust regular attacks in music according to conductors' motions, the amorphous attacks of entire sections of strings, the varied articulation of wind and brass players, and the more precise attacks of harp, piano, and percussion instruments.[674]

Kocher talks about 'a sense for a regular pulse' being foundational, and few would question the proposition that if you want to play triplet crotchets that deserve the description in any meaningful sense, first you need to establish some non-triplet ones. But he's silent on a key question for our purposes: musicians should acquire a sense of regular pulse — yes please! — *but for how long?* Until death, or only until the next phrase? If isochrony really precedes, and is fundamental to, all other rhythmic skills, you might imagine that our rhythmic capabilities resemble DAWs, with an empty timecoded 'piano roll' projecting into an infinite — or at least very distant — future, ready to be further divided and subdivided at will. And that doesn't correspond to what we observe among training musicians at all. As Hartenberger notes, long-term or even medium-term maintenance of steady pulse doesn't feature in curricula or in normal teaching practice, nor does it usually form part of formal performer assessment.

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[673] Philippe Kocher, 'Polytempo Composer: A Tool for the Computation of Synchronisable Tempo Progressions,' *Proceedings of the SMC Conferences* (2017), 238-242. Accessed online, Bern Open Repository and Information System, Feb 3, 2024, https://boris.unibe.ch/92329/, 2.
[674] Hartenberger, 'A Different Kind of Virtuosity,' 77.

Nevertheless, it's trivial to devise solo exercises and self-tests in this area, and in fact I've been doing this since I was a teenager. I started by whiling away the time in dull lessons by staring at (or 'entraining myself with') the second hand of the classroom clock as it came to twelve o'clock, then looking away for my best guess of a minute. Gradually this turned into a form of endurance training, and one which incidentally primed me for the many ♩=60s I was later to encounter: I would record my personal bests (two seconds behind in five minutes! six seconds ahead in ten minutes!) I noticed how my performance tended to deteriorate slightly through the day, and that it was regrettable in this respect that concerts are usually in the evening. (Later, as a student, I was surprised to find that alcohol had only a small negative effect on my performance — of this task, at least.) When I started 'advanced' training (masterclasses, assistant conductorships) and took on my first professional engagements, I fell out of the habit of practicing this and other similar self-tests, only to return to them in my mid-thirties. During my formal training, if an instructor had suggested I work in this way I'd probably have been dismissive. Not that my instructors ever set such a boring-seeming task, of course, since in the conventional ad hoc training model I received they were more interested in delving into the interpretative details of the piece in hand. Indeed, I'm unaware of such tasks forming a significant aspect of institutional musicianship training anywhere — which, if you accept Kocher's characterisation of this as a fundamental skill, is a pretty notable omission. Even if a trainee chose to work in a similar way in private — and I have encountered quite a few who have told me that they do so — it doesn't seem likely that a sparky instructor will foreground this aspect of training.

A: No, I can't see the leaders of 'creative performer' courses handing out stopwatches and metronomes. I'm not sure I'd want to pay hefty conservatoire fees to be told to sit in a room and count, either.

B: Understandably. But, once again, the designation of some skills as basic and others as advanced holds us back, because the skill of maintaining steady pulse over very long periods with narrow tolerances is highly relevant to NMP. That's rhythmic **gridding**. You've already noticed the connection with the feeling of staying self-consciously and relentlessly in 12-EDO. In both cases, something that has commonly been presented as a performer's default mode is better seen as an experiential outlier — another 'ultimate extended technique' — and both have already been understood in terms of the history of technology.[675] The story goes that the expectation that a performer should embody these robo-skills emerged in tandem with the emergence of inhuman or superhuman regulating devices: with the development of the high-tension concert grand piano, of metronomes, drum machines, clicktracks, sequencers… In Foucauldian terms we could say that these regulators had a disciplining effect on the 'docile bodies' of performers.[676]

A: We're back to prisons again…

[675] Laboriously in accounts too numerous list, in which metronomic pulse or its parametric equivalent, equal temperament, are proposed as anti-human Enlightenment bogeymen or even encoding proto-fascist tendencies (in Duffin, *How Equal Temperament Ruined Harmony*, for example); elegantly touched on in Louis Andriessen and Elmer Schönberger, trans. Jeff Hamburg, *The Apollonian Clockwork: On Stravinsky* (Amsterdam: Amsterdam University Press, 2006).

[676] Michel Foucault, *Discipline and Punish: The Birth of the Prison* (New York: Vintage Books, 1977). The docile body is 'something that can be made; out of formless clay, an inapt body, the machine required can be constructed; posture is gradually corrected; a calculated constraint runs slowly through each part of the body, mastering it.' (135). It may be 'manipulated, shaped, trained' willingly (136).

B: Maybe you knew that John Adams thought of titling the first movement of his *Chamber Symphony* (1992) 'Discipline and Punish'?[677] Anyway, because they are arguably inhuman, and are certainly not everyday, approaches to making music, both varieties of gridding — pitch and rhythm — require a continual investment of vigilance and corrective energy to prevent the musical results from relapsing into the ebb and flow of everyday human temporal behaviour.

A: You're talking about music that keeps a continuous pulse over long stretches of time, right? The usual suspects: works by Terry Riley, Steve Reich, Philip Glass, and some John Adams. Minimali—

B: Don't say it — the term is even more detested than 'spectralism'! That extensive repertoire falls into a sub-category of gridding where the pulse is continually present to the body and the ear. We might call this sub-scenario **drumming**, with an obvious nod to Reich's 1970-71 work of that name, although it might equally be called **volharding** [persistence / tenacity], with a tip of the hat to Louis Andriessen and the Dutch 'nutcrackers' of the 1969 Concertgebouw protest.[678] Despite its conceptual simplicity, **drumming/volharding** isn't straightforward even if you know the music and its demands intimately. In John Adams' own conducting of the *Chamber Symphony*, movt. 1 (as recorded with the London Sinfonietta) the tempo flags worryingly; when placed next to expert, well-gridded, recorded performances by Alarm Will Sound (conducted by Alan Pierson) and Boston Modern Orchestra Project (conducted by Gil Rose) the contrast is cruel.[679] We can move past this quickly, because there is a rich store of documented expert performer experience and advice relating to this repertoire: in Hartenberger's own writings, for example. One interesting feature of these accounts is that, in pursuit of long-term symmetry, performers have often found it helpful to introduce physical asymmetries and seemingly-arbitrary changes of technique: Hartenberger talks of energy-shifting ('I find that it is necessary to have a certain amount of tension when playing […] In order to prevent tension buildup, I keep up the necessary energy by shifting the tension around in my body'), and describes a pianist choosing fingerings 'that force her to change positions in the middle of a pattern.'[680] Similarly, when I performed Reich's *Eight Lines* (completed in 1979 as *Octet*, revised and retitled in 1983), in order to maintain a rapid $\frac{5}{4}$ at my target ♩=192[681] for a taxing sixteen minutes, I found it helpful to plan points where I would change the region from which I wished the main rhythmic

[677] In his programme note, Adams writes that he had intended to entitle the movement 'Discipliner et Punire' [sic – Foucault's title is *Surveiller et punir*] before opting for 'Mongrel Airs,' 'to honor a British critic who complained that my music lacked breeding.'

[678] The 'Aktie Notenkraker,' an anti-conservative disruption of a Nov 17, 1969 concert at the Concertgebouw by a group of Dutch composers, including Jan van Vlijmen, Misha Mengelberg, Reinbert de Leeuw, Louis Andriessen, and Peter Schat.

[679] John Adams, 'Chamber Symphony,' London Sinfonietta, cond. John Adams, Nonesuch, 7559-79219-2, 1994, CD; Boston Modern Orchestra Project (BMOP), cond. Gil Rose, BMOP Sound, BMOP1078, 2021, CD; *Splitting Adams*, Alarm Will Sound, cond. Alan Pierson, Cantaloupe Music, CA21128, 2017, CD and digital album. In the Adams / London Sinfonietta recording the tempo variations are most obvious from bar 182 onwards (the change to $\frac{3}{8}$). Nevertheless, a critic naturally informs us that the composer's version 'must be considered [a] definitive account': Jonathan Blumhofer, 'Classical Album Reviews: John Adams' Chamber Symphonies - Built on Trust,' *The Arts Fuse*, Aug 3, 2021, accessed Nov 3, 2023, https://artsfuse.org/234114/classical-album-reviews-john-adams-chamber-symphonies-built-on-trust/. As in my comments about the Deutsche Grammophon recording of *Gruppen* above, I only criticise named performers when I am sure that I am 'punching up.'

[680] Hartenberger, 'A Different Kind of Virtuosity,' 82-83.

[681] The indicated tempo range is ♩=184-192: many performances, such as the Ensemble Modern's 2001 recording, select an even faster pace (♩=c.204): Steve Reich, *Eight Lines* / *City Life*, Ensemble Modern, cond. Brad Lubman, 2002, RCA Red Seal, 74321 66459 2, CD.

impetus to flow: from the elbow, wrist, or shoulder. This is yet another example of the value of Montero's 'anti-Just Do It' stance.

A: Why do you call **drumming/volharding** a sub-category? Surely the only contexts where you'd really need to keep super-steady pulse are when you actually hear that pulse constantly? If you can't hear it much, surely triage reassures us that we don't need to worry about it?

B: Because there are also cases where we feel motivated to keep a super-steady pulse going during silences, or behind music that sounds quite different, over long periods. Motivated artistically, I mean, and not just by true-to-page scruples (e.g. this rest bar is a $\frac{7}{4}$, so I must count seven precisely equal beats). I can think of three further sub-scenarios of gridding where this applies, and I bet there are more to discover. Their associated strategies can all be summarised in two words: *plan ahead!*

A: I'll keep count.

B: The first describes situations where a groove is gradually assembled from its constituent fragments. The fragments are only recognised as such in retrospect — *oh, that's how the cogs fit together into the machine!* In order for this effect to be perceptually cog-ent, the little cogs need to be presented at exactly the same speed, and with the same character, as the final groove. And to achieve this, the performer should already be internally thinking the final groove when performing the fragments. We can call these self-assembling grooves, or **flat-pack** for short. In Julia Wolfe's *My lips from speaking* for six pianos (1993), the first really head-banging groove isn't heard until around ten minutes into the piece, when the hard-won source material — the opening riff from Aretha Franklin's *Think* (1968) — is presented explicitly. Documenting his approach to the duet arrangement of this piece,[682] the pianist Timo Andres ('joined by my [pre-recorded] doppelgänger') writes:

> The music is also constantly, almost cartoonishly syncopated, the parts lining up, or often *not* lining up, at unpredictable moments. This means it has to be rhythmically ultra-precise — it's a delicate illusion that can be destroyed by mere milliseconds of variation in timing, causing the whole thing to sound like a haphazard jumble. What I was striving for in this performance was to supersede the 'counting like hell' feeling that can plague performances of such rhythmically intricate music, and give it something of the loose, rolling groove of its source material — leaning into the syncopations, easing off the strong beats.[683]

Andres is writing from a position of Apollonian grace here, and we might observe that before we reach this point, 'counting like hell' is a pretty good preparatory strategy in such contexts. I already proposed the rule of thumb *sounding* ***pp*** ⟹ *internal* ***ff*** / *sounding* ***ff*** ⟹ *internal* ***pp***, and it's clear from the video of Andres' superb performance that he too makes extensive use of very sharp internal ***ff***s during many silences and in the

[682] 'My Lips From Speaking by Julia Wolfe performed by Timo Andres,' Kettle Corn New Music, YouTube, Apr 14, 2021, accessed Feb 2, 2024, https://www.youtube.com/watch?v=w-Wn3tFMeUA.
[683] Timo Andres, 'Wolfe at the Door,' *Andres*, Apr 16, 2021, accessed Feb 2, 2024, https://www.andres.com/2021/04/16/wolfe-at-the-door/.

regulation of the numerous syncopated ties over barlines/beatlines, even while he conceives the overall character as a 'loose, rolling groove.'

I've found the **flat-pack** scenario useful when performing comparable repertoire, including works emerging from the Bang on a Can organisation (1987-), and in pieces by composers such as Anna Meredith, Richard Ayres, Oscar Bettison, and others, all of whom have an appetite for setting up, interrupting, and overlaying grooves. But it can be equally applicable to music that sounds quite different. Salvatore Sciarrino's *Omaggio a Burri* for violin, flute, and clarinet (1995) sounds nothing like the Wolfe example. However, the performers' strategy is broadly the same. Sciarrino points the way with the tempo marking 'al tempo degli orologi (♪ sotto 60).' First we hear little murmuring fragments in isolation, which gradually develop into clock-like ticking: a fateful *memento mori*:

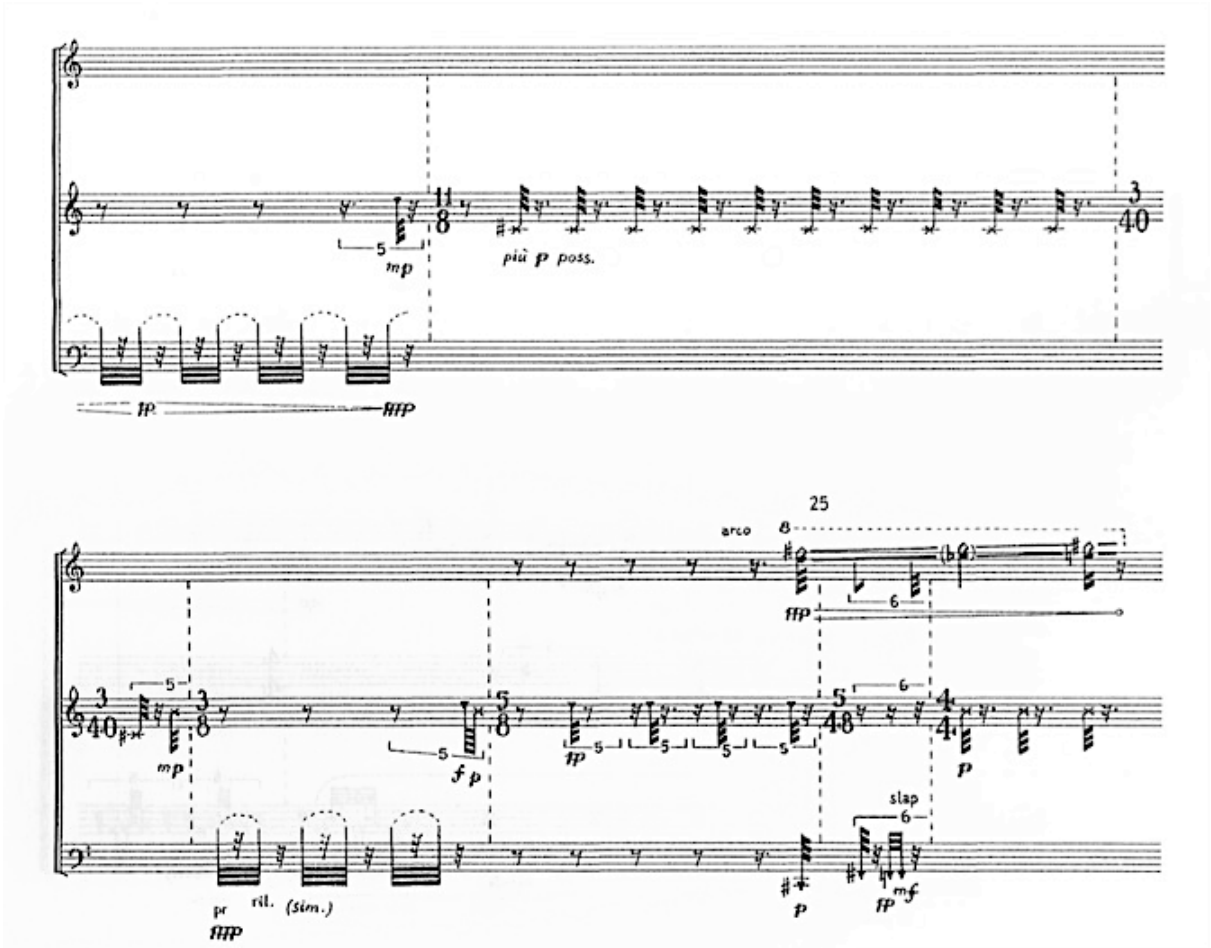

Figure 85: Salvatore Sciarrino, *Omaggio a Burri* for violin, alto flute, and bass clarinet (1995), bars 20-26. Transposing score: violin (top stave), alto flute in G (middle stave), bass clarinet in B♭ (bottom stave).

Not only the ♪ ticks themselves, but their subdivisions — the quintuplets of the $\frac{3}{40}$ bar and the sextuplets of the $\frac{5}{48}$ bar, which run at a workzone-friendly 300 and 360 ppm respectively — call for intensive advance inner preparation, perhaps starting 5 or 6 seconds earlier (!) in the case of the alto flute in 21-22. These little interruptions reoccur in varied forms; as they do so, each distinct gesture-group should

have a consistent identity, or signature. The stakes are high, because if we do not make them distinct there is very little musical material left: just a few random clicks and whirs.

That the same broad approach feels appropriate when performing works by composers as profoundly different as Julia Wolfe and Salvatore Sciarrino (and we could add another contrasting work here — the techno-inspired *Ecstasio* from Thomas Adès' *Asyla* for orchestra (1997)) reminds us that scenarios are about inner performer experience and not about composers' sound-worlds or aesthetic priorities. The presence of clock-like sounds in a piece isn't an automatic cue for gridding; I wouldn't grid in the second movements of Beethoven's Symphony no. 8 or Haydn's Symphony no. 101, even though they sound very clocky. Nor would I assume that gridding applies in the many cases where a composer seems to have taken a casual approach to their metric notation, as in the DAW-inspired grids of unvaried ♩=60 that started to seep into notational practice around the 1990s. Indeed, in such cases my default approach is the reverse: since I'm always hungry for rhythmic interest, I actively look for opportunities to deform the gridlines.

A: OK, **flat-pack** is your first sub-scenario of **gridding**. Next?

B: A related one: **graph paper**. We usually imagine that a composer makes use of a notational grid in order to align polyrhythms and make them legible and reliably reproducible for performers. The first movement of Ligeti's *Concerto for Piano and Orchestra* is a classic example of this notational strategy. On my performing score I've marked the overlapping rhythmic strands with different colours so that I can follow them as they jump from instrument to instrument, and so make sure that they line up precisely:

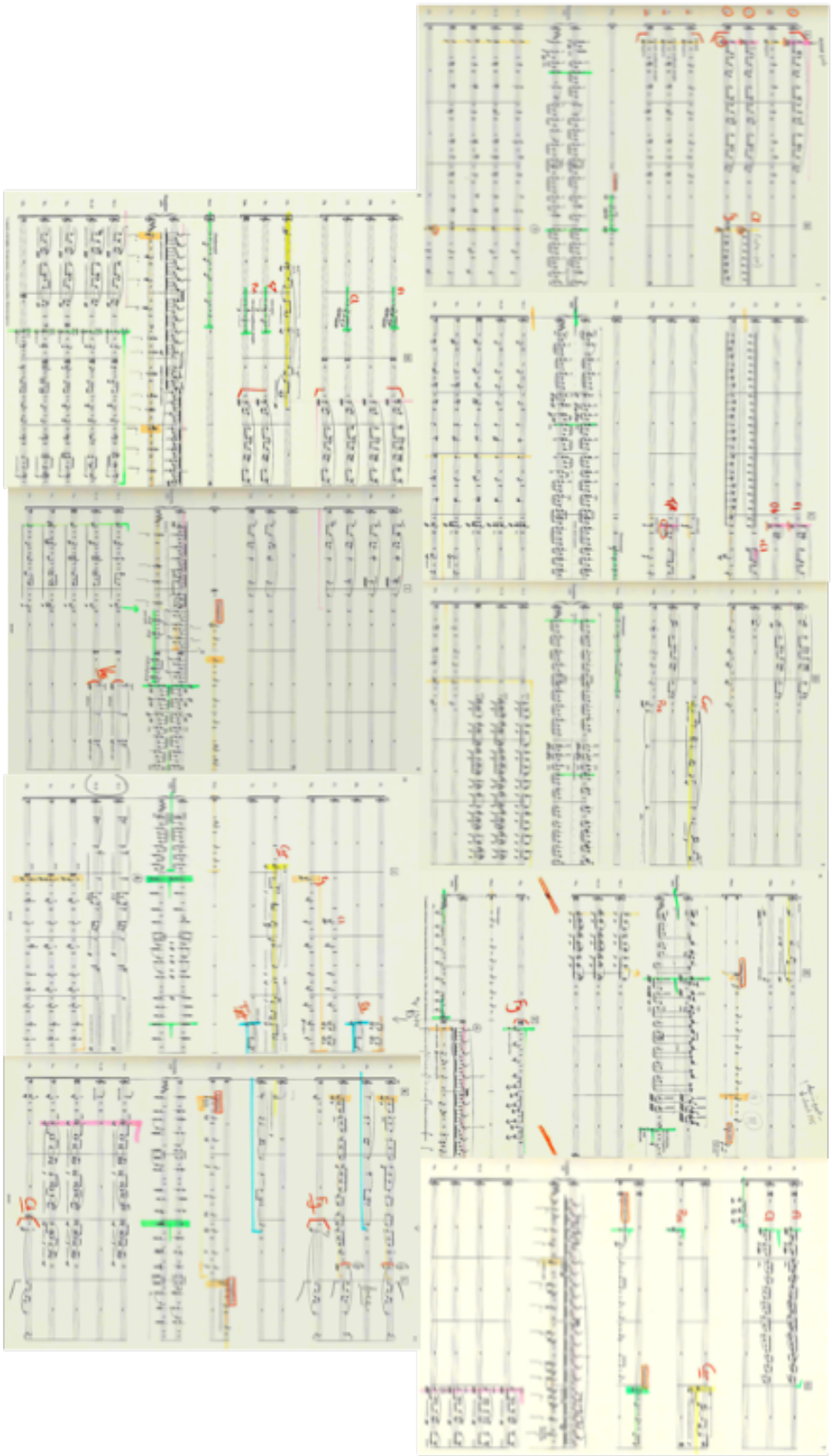

Figure 86: Photomontage of the author's conducting score of György Ligeti, *Concerto for Piano and Orchestra* (1985-88), movt. 1, pages 3-11. Resolution degraded for copyright preservation. Colours: green=the cycle (12/8)♩.♩.♩.♩ ♩.♩.♩.♩ ♩ ♩ ♩ (as in Pno, bars 1-3); orange=the cycle (4/4)♩.♩.♩.♩ ♩ ♩ ♩.♩ ♩ (as in strings, bars 1-3); pink=movement in groups of 3 ♪s; yellow=movement in groups of 5 ♪s; blue=movement in groups of 7 ♪s.

But that piece is a pretty obvious example, since it wears its polyrhythmic character on its sleeve, and also a relatively straightforward one in terms of how the performers' goal is defined (*keep it together, don't rush or drag!*) even if achieving that goal is no picnic. Let's choose an example where a rhythmic grid plays a more cryptic role. It's in a piece I've already referred to as a representative example of extended instrumental practice (1.2.8), *blooming brume* by Malin Bång:

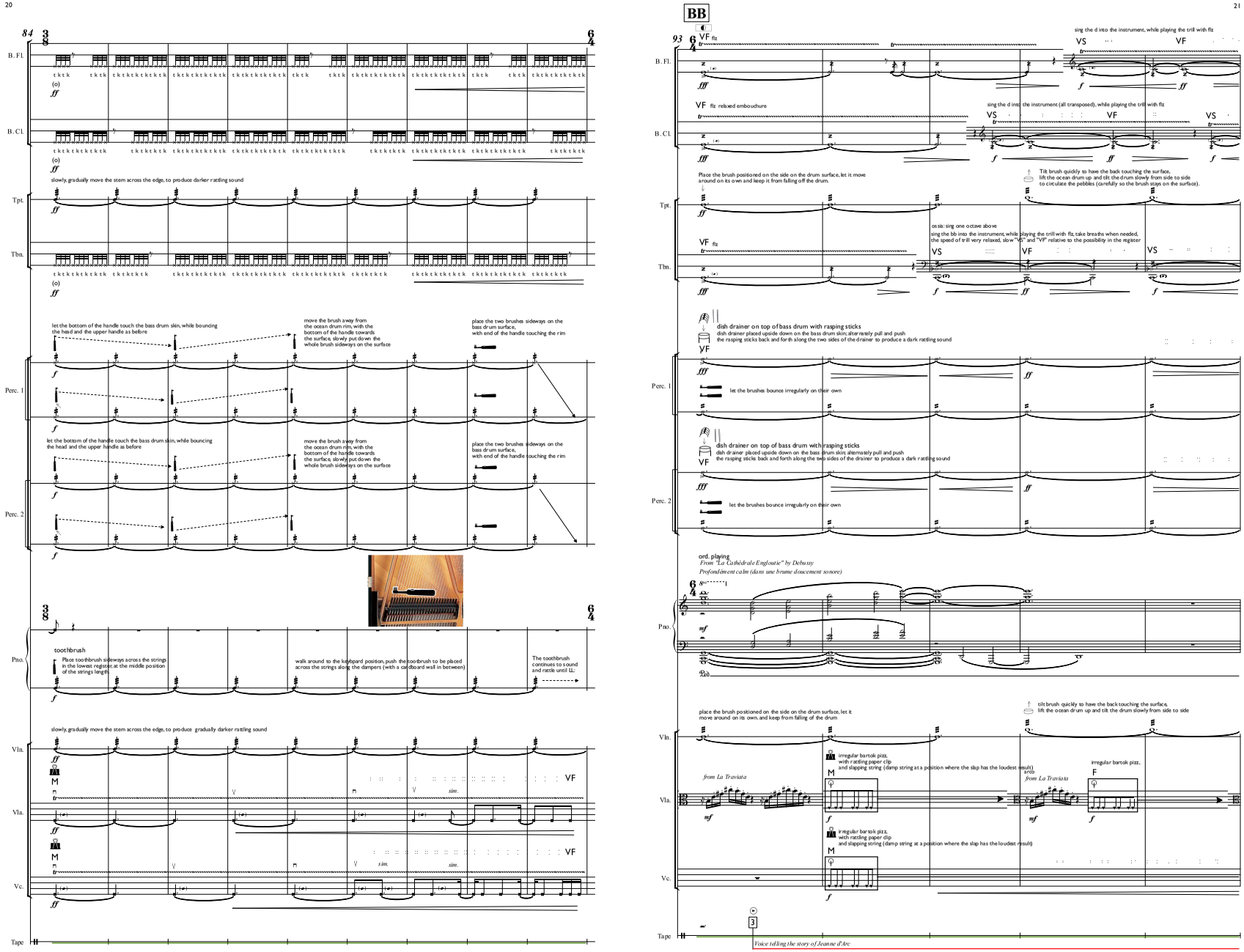

Figure 87: Malin Bång, *blooming brume* for large ensemble (2020), bars 84-97.

Noisy sounds are everywhere here: electric toothbrushes are clattering against ocean drums, metal clips are buzzing against string instruments, dish drainers are being rasped, and there's a loosely-synchronised tape part. Consequently, you might think that focusing on maintaining steady pulse is a pretty low priority in comparison to the Ligeti example. It might even be considered a failure to apply triage, of the sort that I accused Reina of committing in his reading of Donatoni's *Movimento*. But consider the three elements that have a sharper rhythmic character: the ticking factory sounds in the wind (bars 84-92), the Debussy quote in the piano (93-96), and the Verdi quotes in the viola (93 and 96). (At other points in the score these are presented in all combinations and with various extensions.) If we 'naturally,' or 'musically,' give way to the demands of any one of these elements, the integrity of the others will suffer. So we keep **gridding**, even though this means playing the Verdi and the Debussy passages at noticeably different tempi to those I would select if I was performing the original pieces. This is a collage, but one with with a high degree of temporal organisation and surprisingly narrow tolerances; although the sound and poetic idea is dreamy, the score is not a cue for a loose improv session.

A: Moral: ironclad grids can underpin the dreamiest of soundscapes, as well as scores by the usual polyrhythmic candidates. And your third gridding sub-category?

B: **Speed camera!** This very common scenario arises where the appropriate tempo (more precisely, the tempo tolerance zone) is determined by the physical characteristics of an instrumental technique. This is a well-known feature of performance practice in earlier repertoires: the tempo of a Mendelssohn scherzo, for example, may well be set at the point where the string players' bows naturally come off the string. It is particularly relevant to new music, though, due to many composers' focus on hyper-specific instrumental gestures (4.2.) Commonly-encountered examples include the maximum pace of double- and triple-tonguing in wind and brass instruments, and of repeated pizzicati on string instruments or piano notes. More 'new-musicky' examples include the possible speed of repetition of tongue slaps, jet whistles, various wind 'pizzicato' effects, assorted string jeté techniques, and indeed most of the Lachenmann (and Lachenmann-imitator) family of techniques. There are numerous examples that are closely associated with a particular composer's practice or a very specific technique; in Sciarrino's highly personal writing for flute, the tempo often arises inevitably from the desired techniques. In Keller's *Soma* (7.1), the maximum tempo of several passages is given by the maximum speed that the percussionist is able to execute double-kick bass drumming — a 'machine gun' technique commonly used by death metal / grindcore drummers to show off their skills, but rare in new music.

A: Those are speed limits in the usual 'do not exceed' sense. How about minimum speed limits?

B: They are common too. They may be given by the limits of lung capacity for wind and brass players, or singers (Claude Vivier's *Bouchara: chanson d'amour* for soprano and ensemble (1981) is a particularly taxing example of the latter), the length of a slow bow, or — again — highly specific factors such as the maximum length of a piano's audible pitch-bend when played with a plectrum and a glass rolled on the strings. Whatever the technique in question, though, and whether the tempo-determining technique is a maximum

or a minimum limiter, a **speed camera** situation arises when that technique arrives *after* material that has wider tempo tolerances.

A: Meaning?

B: Here's how the scenario plays out if it's not properly anticipated: I'm driving down the road at a pace I think is acceptable, then I notice (too late!) the speed camera. I slam on the brakes (or, in the case of minimum speed limits, the accelerator.) If I'm lucky, the car behind doesn't hit me (or, in the case of minimum speed limits, I don't hit the car in front.) Now, if the tempo-determining technique is in my own part, on my own instrument, I really only have myself to blame for the accident or near-miss.[684] More frequently, though, the technique is played by a colleague.

A: I think a lot of musicians will have had that experience: the conductor, or a leading chamber player, starts at a tempo that seems plausible enough — but we sit there fuming, knowing that in a few bars we have to enter with the double-tonguing (or whatever) and that we have been set up to fail.

B: We'd have to wait to issue a speeding fine to our colleague after the concert. (And in reality, we almost never do, due to the taboos described in 2.4.2.) This problem is an **ensemble difficulty** that needs to be solved through communication and forward planning; we need to check our speed before the problem arises. (An effective speed camera is placed before the road passes through the sleepy village.) And that means — yet again — rejecting the siren song of 'just do it' and 'go with the flow' in favour of conscious intervention on our performing practice. The initial pace may feel unnaturally slow or fast, but is later revealed to be appropriate. In this respect it is very similar to **flat-pack**, and the solution is the same: audiate and feel the arrival groove, and/or the tempo-limiting technique, well before it arises.

A: Why not just alter the tempo when the troublesome technique arrives?

B: That might be appropriate in some cases; we often make adjustments, putting in mini-fermatas and so on. But that would no longer count as **gridding**. If we change scenarios, let's be clear about it. And sometimes that isn't an option. There's a sub-category of the sub-category **speed camera** when the regulator that comes in later is not a colleague at all but a machine. An example is found in Olga Neuwirth's *Masaot / Clocks Without Hands* for large orchestra (2013, rev. 2015). First, a swirl of Mahlerian / klezmer gestures is assembled (a careful performer will favour a **flat-pack** approach here, rather than falling prey to

[684] In his discussion of his approach to Stockhausen's *Klavierstück X* (1962), Gabriel Jones gives a description of how a careful solo performer might discover a speed limit. 'As with *Klavierstück I*, the "as fast as possible" tempo is contingent on the performer's priorities with respect to expression, precision, and reliability. However, determination of tempo according to the smallest note values, whether approximate or empirical, is no longer straightforward, with the performer required (theoretically at least) to consider the relationship between the duration of the superordinate note values, and the quantity, technical difficulty, and particularity of the materials they govern. Most performers will begin with an arbitrary base tempo, according to which all of the note values can be counted. All *accelerandi* and *ritardandi* can then be planned and transcribed into additive series of demisemiquavers and smaller subdivisions thereof—in accordance with Stockhausen's approximate time-space notation—and then practised according to the base tempo. The base tempo can then be incrementally increased until an "as fast as possible" limit is reached,' Gabriel Jimi Jones, '"Irrational Nuances": Expression, Interpretation, and Performer Agency in Stockhausen's *Klavierstücke*,' (doctoral thesis, University of Leeds, 2022), 201-202.

the rubato demands of each little phrase.) Then, at a critical point, pre-set amplified mechanical metronomes, placed on stands with their waving arms very visible to the public, enter at — one hopes! — the identical prevailing speed. Let's call this sub-sub-scenario a **speed bump**, or what the British aptly call a 'sleeping policeman'; hit it at the wrong speed and you risk damage to your suspension — or at least your professional ego — as you hurriedly make the required tempo adjustment. While the three metronomes in *Masaot* pose a uniquely visible challenge, similar speed bumps are quite commonly encountered when we are asked to interface our warm bodies with cold technology: when using a click-track for only part of a piece, synchronising a passage to video, or aligning live material to a sample that has a recognisable rhythmic character, such as in the intricate interplay of catchily groove-like samples and live playing in Ondřej Adámek's *Ça tourne ça bloque* for ensemble and sampler (2007-08). I once was asked by a student composer to align a passage lasting several minutes and containing multiple tempo changes and irregular meters to a countdown stopwatch theatrically projected on a huge screen, placing a final thud on 0'00" exactly. (Never again!)

A: That makes three sub-scenarios of gridding, plus an extra sub-sub. Time's up.

B: Let's summarise rhythmic **gridding**, then. There are no prizes awarded for the precise maintenance of isorhythms, or a metronome would win every time. Nor are we obliged to accept the proposition, with which we started this section, that steady pulse is necessarily the foundation for all other rhythmic work. However, we encounter, and need to be prepared for, situations that call for gridding very frequently, since they arise not only in obvious cases of **drumming** but also in the sub-scenarios **flat-pack**, **graph paper**, and **speed camera** / **speed bump**.

In the majority of these cases we can draw a sharp distinction between the roles of composer and performer, and so we should take particular care that we don't confuse composers' narratives with advice for the performer. For example, Grisey notes that 'absolute, mechanical periodicity tires the listener as much as a ceiling or wall composed of perfectly equidistant tiles' and that '[w]e have all noticed how the periodicity of the synthesizer or computer in its perfect redundancy merely induces boredom and inattention.' Hence, '[t]he whole art of the composer who works in an electronic studio, analogue or digital, consists of making this excessively redundant material more flexible.'[685] And that's exactly what Grisey does in the first movement of his *Vortex Temporum*: although there is a constant flow of even 𝅘𝅥𝅯s (at 520 ppm, incidentally — that's more evidence for our rule of thumb about the upper limit of the workzone) the phrase lengths and subgroupings change constantly and unpredictably. But the appropriate performing strategy here is precisely the *reverse* of the composer's: Grisey has bent his material in the direction of flexibility, but if we do likewise it will rapidly become shapeless. Instead, we should act as a corrective, or even a therapeutic, influence, and keep on gridding!

A: *Therapeutic?!* Tell us more, O healer…

[685] Grisey, 'Tempus,' [*Contemporary Music Review* version], 245.

B: I don't insist on the comparison. But perhaps you remember George Benjamin's description of his personal Chinese wall that he places between his activities of composer and conductor (4.2)? Other composer-conductors have performed acts of rhythmic self-therapy. Consider how the conductor Richard Strauss brought welcome peppiness and rigidity to the swoonier moments of the composer Richard Strauss' *Don Juan*. Or, in reverse, how the conductor Pierre Boulez brought corrective *souplesse* to some of the composer Pierre Boulez's spikier rhythms. These are examples where it was profitable to take an anti-flow, or anti-natural, approach. Two heads can be better than one…

A: I feel we are moving away from musicianship, and into interpretative advice about individual works.

B: Fair point. The more general observation is that any **gridding** that isn't simply solo **drumming** involves transfer problems, which I call ensemble difficulties. I've already likened these to a relay team having trouble handing over the baton. In the film *Tár* (2022), the downfall of Cate Blanchett's atrocious maestra is signalled by her having to do just that: she is handed a click-track headset to perform a computer game soundtrack. Much earlier she had given a pompous interview about the control of time in conducting ('But time is the thing… Time is the essential piece of interpretation. You cannot start without me. *I* start the clock. My left hand shapes, but my right hand, the second-hand, marks time and moves it forward,' etc.) so this is a tragicomic moment: you can practically hear her wail 'Othello's occupation's gone!'[686]

A: You've already proposed that this front-led view doesn't even describe symphonic practice well, let alone new music.

B: Right. In new music we are habitually quite willing to play with explicit changes of temporal initiative and control, even within the course of a performance. It was one possible approach to the Mayr difficulty. Indeed, such play can be the source of deep satisfaction: not a problem but an opportunity. Harrison Birtwistle's *Cortege* (2007) for fourteen musicians is unconducted — the composer having noted (with reference to its source work, *Ritual Fragment* (1989)), that 'conductors are overrated.' When offered to fine performers the preparation process for this multi-tempo work is a delight to witness: gradually and cooperatively the appropriate time-giving strategy at each point emerges, with the 'master of ceremonies' on bass drum only occasionally leading the ensemble (a network of whispers is heard: *Can you help me there? I'll give that bar*…), a skilled ensemble never falling prey to the directionless impulse (*let's feel it together*) that is so rarely helpful in new music. In that piece the performers — particularly the ones who are accompanying the player who occupies the changing solo position at the front — make extensive use of gridding (at different simultaneous speeds), even though — once again — there is very little material that sonically

[686] 'O farewell,
Farewell the neighing steed, and the shrill trump,
The spirit-stirring drum, th'ear-piercing fife;
The royal banner, and all quality,
Pride, pomp, and circumstance of glorious war!
And O you mortal engines, whose rude throats
Th'immortal Jove's dread clamors counterfeit,
Farewell! Othello's occupation's gone.' William Shakespeare, *Othello: Revised Edition – The Arden Shakespeare*, ed. E. A. J. Honigmann (London and New York, Bloomsbury, 2016), 3.3.350-357. Reference is to act, scene, and lines.

resembles the usual pieces that call for drumming/volharding. From the listener's point of view most of this apparatus is concealed, and the whole performance appears to work by magic. An alert listener, like a watcher of a magic show, is therefore hypersensitised to the smallest cues that might reveal how the trick works. This sensitivity and anticipation, which cannot be conveyed on a recording, becomes a key part of the performance; the listener is not being duped but tantalised and seduced. To set these real human interactions apart from 'the piece itself' would be to recall London's failure to distinguish between real-world experience and eyes-screwed-shut sound in his attempt to give a critique of 'the music' (2.3.4.3.)

A: I'll summarise the summary: gridding isn't the dumb option, nor is it the default.

B: I'd go further. All our perceptible bodily rhythms are (on our definition) fundamentally *NI*, if we were to consider them as part of a new music performance. Anyone who would describe our breathing, gait, or heartbeats as regular is working with much broader rhythmic tolerances than those that are usually appropriate to new music performance practice. And, although in my naivety I scoured the literature in search of this grail, no-one has identified a single mechanism in the human brain or nervous system that is analogous to a computer's system clock; something that would support the notion that somewhere, deep down, there exists a fast oscillator that would render NI-seeming rhythms fundamentally isochronous. Instead, we get a picture of the simultaneous existence within us of multiple semi-independent,[687] intersecting and sometimes contradictory time-cycles,[688] and that (perhaps unsurprisingly) 'the interesting cases of timing—such as dance and playing a musical instrument—are not "done" in the cerebellum, but rather are an emergent property of system dynamics.'[689] When we perform music that is intended to sound 'tight' (i.e. in drumming/volharding scenarios) we naturally want to feel rhythmically concentrated on the task in hand; it's a dis-concerting thought that our hands, hearts, breathing, endocrine and circadian systems, etc., are marching to their different drums. When Hartenberger and other experienced performers of such music talk about shifting the imagined locus of rhythmic impetus around the body, the rationale is not only to avoid localised build-ups of harmful physical tension, but also to patrol and 'check in on' the various systems that comprise our internal rhythmic ensemble. If we do not, we tend to drift off course. Evidence for such shifting among expert performers supports Montero's pro-intervention, anti-'just-do-it,' approach to cognition-in-action.

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687 Anna Fiveash, Simone Dalla Bella, Emmanuel Bigand, Reyna L. Gordon, and Barbara Tillmann, 'You got rhythm, or more: The multidimensionality of rhythmic abilities,' *Attention, Perception & Psychophysics* 84, no. 4 (2022): 1370-1392.

688 Peter Vuust, Line Gebauer, and Maria Witek, 'Neural underpinnings of music: the polyrhythmic brain,' *Advances in Experimental Medicine and Biology* 829 (2014): 339-356.

689 Stewart Copeland and Daniel Levitin, 'Timing, Tempo, and Rhythm: Evidence From the Laboratory and the Concert Stage,' in Clemens Wöllner, and Justin London (eds.), *Performing Time: Synchrony and Temporal Flow in Music and Dance* (Oxford, 2023; online edn, Oxford Academic, Mar. 21, 2024), accessed July 22, 2024, 381. For context: the drummer and composer Copeland had asked a similar naïve question to mine to the cognitive psychologist Daniel Levitin: '*Copeland*: Is it known what part of the brain represents the passage of time? *Levitin*: Yes and no. I'd rephrase the question to start, if I may, because we're tending to think less in terms of parts of the brain and more in terms of distributed neural circuits. So, 10 years ago, we would point to a part of the brain and say, tempo is here. We used to think that the 'machine room in the brain' you invoked was composed of timekeepers in the cerebellum and in the basal ganglia […] To oversimplify, the machine room/cerebellum keeps track of the timing, and predicts the temporal consequences of events […] and the basal ganglia become involved to help coordinate specific movements at specific times […] Those two structures are still believed to be involved, but they might be doing less of the work than we used to think. Rich Ivry […] has been studying timing and the cerebellum for more than 30 years. He's come to believe that some of the more interesting cases of timing—such as dance and playing a musical instrument—are not 'done' in the cerebellum, but rather are an emergent property of system dynamics.'

7.2.1.1 Gridding across transitions: duck-rabbit, verbalisation

B: Before we move on to NI scenarios, let's consider contexts where gridding applies to transitions between a reference pulse and tuplets that we want to make maximally even. These transitions are equivalent to metric modulations. Considered as a whole — the departure and the arrival speeds together — these are on our definition fundamentally isochronous, because the smallest shared unit lies below the threshold of our c.600ppm rule of thumb. If it doesn't, it's a tuplet/metric modulation 'in name only' and may be triaged away, or considered in NI terms (see 7.2.2 below.)

A: It's all very well to say that (some) tuplets and (some) metric modulations 'are equivalent,' but they don't usually feel that way.

B: True. As we noted in 2.3.4.1, it's one thing to accept the equivalence of [♩=60] 𝄞 ♩♩ ♩³♩♩ and [♩=60] 𝄞 ♩♩ | [♩=90] 𝄞 ♩♩♩ in our brains, and quite another to feel it in our guts. The reasons for this relate to the individual experience of the performer. While everyone is likely to recognise the 60/90 relationship as a 2:3 (although other relationships, such as 64/96, might be missed), how it will play out in reality is harder to predict. Before being faced with the relationship in a particular musical context — i.e. as a default expectation — a performer who mostly plays pre-twentieth century music is likely to see it as purely advisory and relatively unimportant, because tempo has historically been treated with much wider tolerances than the realisation of tuplets, while an older new music specialist (a player honed on Stockhausen and Carter, for example) would probably see it as mandatory and urgent. A younger new music specialist, whose ad hoc NMPT has primed them to wait for each project to set its own rules, might have no natural default in this regard. The scenario notion can help here: in the realisation of any score where it seems as though metric modulations should be treated literally as tuplet equivalents, we can use **duck-rabbit**.

A: I know the famous optical illusion:

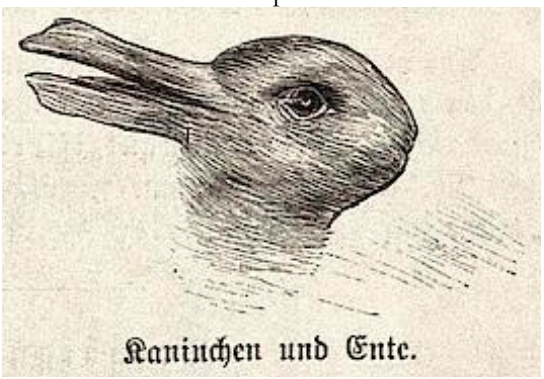

Figure 88: The duck-rabbit illusion, 1892.[690]

I suppose you mean that in such situations, tuplets and tempi have that dual character as they exchange identities.

[690] 'Kaninchen und Ente,' [Rabbit and duck], anonymous illustrator, *Fliegende Blätter* comic weekly newspaper (Verlag Braun & Schneider, Munich, 1892), 2449-2474. Universitätsbibliothek Heidelberg, accessed online, Jul 20, 2024, https://doi.org/10.11588/diglit.2137%230147.

B: Yes, but we knew that already. What we don't usually practice is the discipline of switching between 'duck' and 'rabbit' at will. But that's just what we need to do in such musical contexts: we need to manually override our internal categorisation of an isochronous flow as a tuplet/duck or a tempo/rabbit. If you want score examples, the obvious place to look is almost any score by Elliott Carter (e.g. the *Triple Duo* (1983)), but we can find many earlier examples in Schoenberg (e.g. *Suite* op. 29, IV, bars 53-64) and even Brahms (e.g. *Variations on a Theme by Joseph Haydn* between variations VII and VIII), and in newer music **duck-rabbit** situations are far too numerous to list here. There are plenty in scores I've already referred to here, including the first of the Keller extracts (7.1), and the body-percussion passages in Robin Hoffmann's *Stimmungsbarometer* (6.3.3.1). These are most easily recognised, and surely deserve our care the most, when one rhythmic layer is intended to sound isorhythmically through a tempo transition (e.g. *the pizzes stay in the old tempo.*) Because they are so common I'll offer a generalised exercise intended to help us take control over the switching process. Although the exercise looks very simple, I don't find it easy. I'd recommend practising it initially with a metronome set to 90 throughout. After a short break, set the metronome to 120, and try again. Only then attempt it without support:

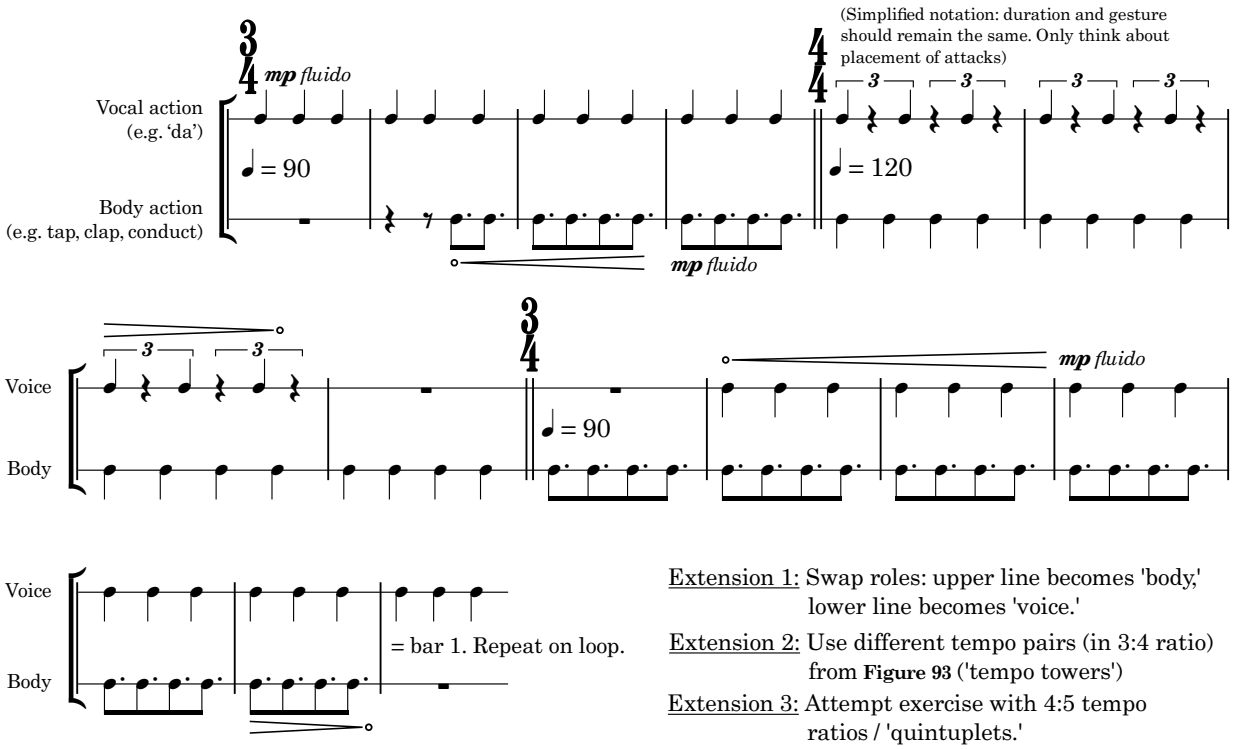

Figure 89: Exercise: duck-rabbit.

A: OK, that exercise might build some mental flexibility. But it doesn't address the more basic question of how in general we should improve how we execute such strict pulse relationships, whether they're expressed in tuplets or tempi. Boulez tells us to 'really think' quintuplets, but doesn't offer any advice on how we should do that either. Some might call it rigour, but without a method it sounds more like nagging to me.

B: As we've seen, konnakol (the spoken component of solkattu) has been proposed as the answer. It leverages patterns of speech which are intended to be both memorable and isorhythmic. These patterns are usually fast and chattering, and so they encourage us to subdivide slow tuplets, which we've also proposed to be a good elementary strategy. We also know that Western musicians have often used words to stand in for tuplets, but unlike Karnatic approaches, these are intended simply to replicate the sounding tuplet unanalytically, be it fast or slow. These words are only used in preparatory contexts (they certainly would never be actually voiced in performance, as they are in konnakol) and indeed are often seen as a bit of a joke. For example, among a certain generation of (mostly male) British orchestral musicians, a septuplet was 'Gina Lollobrigida.' The less shapely 'hippopotamus' was sometimes used for quintuplets. In distinction to Karnatic approaches, these words are not usually used as aids for subdivision. I've never witnessed a big slow 'hip-po-po-ta-mus' being split into a double speed HIP-po-PO-ta-MUS-hip-PO-po-TA-mus, and for good reasons.

A: Hang on, are you seriously arguing that 'Gina Lollobrigida' was the reason that generation of musicians didn't have septuplets — whether considered as tuplets, pulse ratios, or as written metric modulations — 'in the habits' (in the words of Boulez)?

B: Not exactly. But we can glean information about the default breadths of musicians' rhythmic tolerances from their choice of terms. The jokey names don't bother me — indeed, I see them as a mnemonic advantage, and I've done likewise in this text. The problem is encoded in their phonology. Take the name of the screen siren: Italian is commonly described as a syllable-timed, or 'machine gun,' language with equal syllabic lengths. So it might seem a promising place to look for a reference for an even tuplet. However, it is more accurately located in 'the no-man's land between stress-timing and syllable-timing';[691] the double *l* of *Lollobrigida* adds a heavy syncopation, and the *r* in the syllable *bri* adds a small extra weighting. Even if the musicians said the name in a British way, which is likely, it's still a poor reference: the reduplication of *lo* risks a lack of distinctness between the third and fourth units, and the use of two words forces a 2+5 (and also 2+2+3) mental division. As for *hippopotamus*, out of thousands of five-syllable words,[692] why on earth would you choose one that creeps in with a voiceless glottal fricative, confusingly duplicates a syllable in the middle, and ends with a time-adding alveolar sibilant? These words are fundamentally non-isochronous (on our Polak-influenced definition) and encode inappropriately broad tolerances. If they represent what you consider to be appropriate isochronous references, you may as well put your pendulum metronome on a slope. So in this respect they confirm Boulez's observation.

A: Silly Brits, eh? Maybe they should have chosen *inexcusable* and *decomposability*.

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[691] Bettina Braun and Sabine Geiselmann, 'Italian in the No-Man's Land Between Stress-Timing and Syllable-Timing? Speakers are More Stress-Timed than Listeners,' Interspeech 2011, 12th Annual Conference of the International Speech Communication Association, Florence, Italy, (Aug 27-31, 2011), accessed online, Jul 2, 2023, https://kops.uni-konstanz.de/entities/publication/5cb7c73c-24e7-4cf3-a702-a58b5f8648ff.

[692] According to Wiktionary (Jul 3, 2023), English has 4253 pentasyllabic, and 413 heptasyllabic, words. https://en.wiktionary.org/wiki/Category:English_words_by_number_of_syllables.

B: Other languages have done even worse. Speaking of decomposition, the French tendency to *décomposer* (subdivide) a septuplet into *un-deux-trois-quatr'-cinq-six-sept* gains the benefit of keeping count, but erects a remarkable number of phonological hurdles, particularly between the fourth and fifth elements. Mora-timed languages, such as Japanese, are appallingly subtle and therefore quite unsuitable for this purpose: the Japanese for Japan (日本 in the kanji writing system) can be pronounced with three or four morae (roughly: *Ni-ho-n* or *Ni-p-po-n*), each calling for alternative spellings in the hiragana writing system. For similar reasons, don't reach for isochronous references in Sanskrit or Ancient Greek. Even that bold ιπποπόταμος will yield a muddy rhythmic response.

A: I'll be sure not to. Sounds like I should brush up my Tamil, though.

B: There are other options. Finland has produced a lot of very precise and energetic conductors. Some have ascribed this to the teaching of Jorma Panula, to a generally egalitarian approach to education, or to a national spirit of resilience and grit ('*sisu*.') But they have a secret weapon — their laser-sharp stand-in for a quintuplet: *sekatavara*. (It means something like 'miscellanea,' which isn't too bad as a quintuplet reference itself.) Speakers of Finnish have an unfair advantage here because stress in their language is non-phonemic and always falls on the first syllable. That's handy if, like musicians, you like to know where the downbeat is. Better still, that stressed first syllable is marked with a unique vowel, while the remaining syllables share a vowel sound but are marked with different initial consonants (k, t, v, r) so they may be mentally distinguished. There are no reduced vowels (as in the commonest sound in English, the schwa (ə)) that might cause us to mumble and skip quickly over a syllable, and no final consonants to trip us up.

A: OK, I'll learn Finnish…

B: Rather you than me (and anyway, phonologists don't agree about whether isochronous syllable-timing really applies to Finnish.)[693] No, the broad point I'm trying to make is that the example of konnakol should encourage us to take rhythmic verbalisation seriously in 'advanced' rhythmic contexts with narrow tolerances as well as in 'basic' contexts with broad ones. In the absence of a governing 'system clock' fast isochronous oscillator, verbalisation is actually the only option I can think of that might help us do fine work on rhythms in the musicianship sense — i.e. separated from particular actions on instruments. It seems likely that one reason that Western musicians don't usually do so is that verbalisation is heavily associated with early-years musicianship education: think of the Kodály rhythmic syllables (*ta ti ti*, *timka*), the extended-Kodály 'fruit' system (*strawberry*, *watermelon*), the Suzuki method's rhythmic rudiments (*Piccadilly Circus*, *fatter-than-a-caterpillar*), and the Gordon syllables (*du-be, du-ba-bi*).[694] Indeed, I think we should take verbalisation seriously enough to take a critical view of the assumption that the sophistication of konnakol's structures, and the virtuosity of many of its performers, automatically make it the best fit for new music, particularly when attempted by native speakers of non-Dravidian languages.

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693 Kari Suomi and Riikka Ylitalo, 'Syllable weight and segmental durations in Finnish,' *PHONUM* 9 (2003), 37-40, accessed online, Jul 4, 2023, http://www.ling.umu.se/fonetik2003/.
694 Richard F. Grunow, 'The Evolution of Rhythm Syllables in Gordon's Music Learning Theory,' *Visions of Research in Music Education* 16, no. 37.

A: What's the alternative?

B: NMP trainees are an international and polyglot bunch. So a **caretaker** can encourage them to look within their own language structures and find their own words or syllables to fit the task in hand. That process is itself an instrument-independent **sensitisation** exercise that leads to increased **flexibility**. Trainees who look up the word *isochrony* in most general resources, including Wikipedia, will find results relating to linguistics first and not music.

A: Fitting 'the task in hand' sounds a bit vague.

B: As a first step I would recommend finding verbalisation that feels maximally isochronous for the individual: i.e. trainees' own equivalents of 'sekatavara.' This needn't be in their first language — in fact, it probably won't be, because linguistic isochrony is rare — it just needs to trip off their tongue. These words or syllable-groups can be practised and checked with a metronome. Thinking along similar lines to the Swiss Army knife for pitch in Chapter 6, I'd suggest deliberately restricting the number of verbalised isochronous tuplets in a trainee's arsenal. In fact, I'd recommend only working on 5:4s, 7:4s/7:8s, 9:4s/9:8s, and 5:3s. For each tuplet (or pulse ratio, if you prefer) I would use a three-stage process: 1) select an isochronous verbal reference, 2) practise it directly in a duet with a metronome, swapping the roles of 'tuplet' and 'reference,' then 3) apply it to the 'duck-rabbit' exercise of **Figure 89**. For this exercise you'll need an electronic metronome that can play a 'downbeat' sound to mark the beginnings of groups of 3, 4, 5, 7, and 9 pulses. (Most metronomes these days have this function: if you're choosing, note that most people seem to prefer ones that have the 'downbeat' pitched higher than the other pulses. You could even treat yourself to two metronomes, so you don't have to keep altering the settings in Stage 2.)

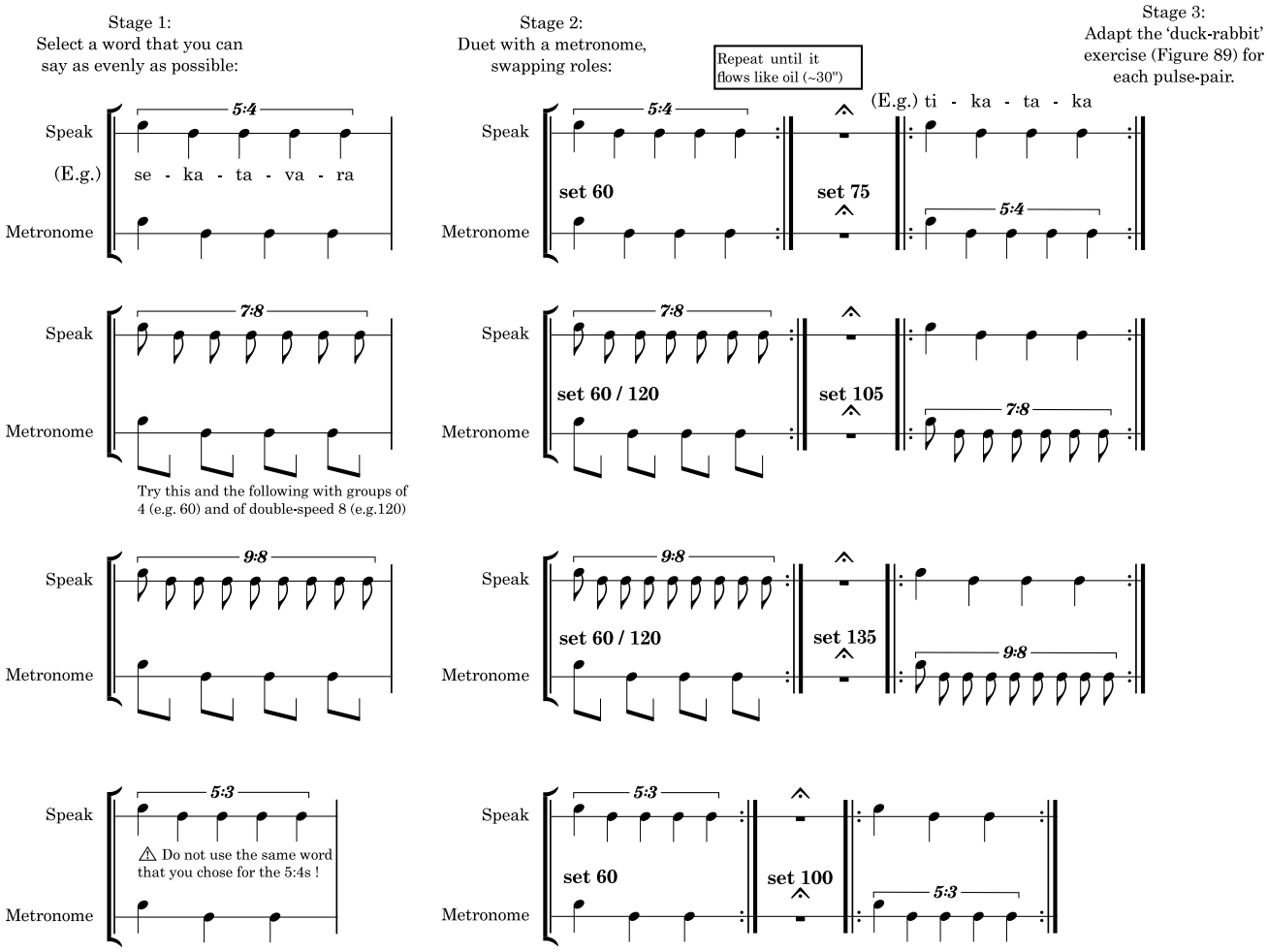


Figure 90: Exercise: develop four distinct verbalised pulse-pairs.

I've used ♩=60 as the reference tempo here, but of course this should be repeated at a range of tempi. (The calculations are simple: in each case, divide the reference by the second number in the ratio, then multiply by the first, so for 5:3 at ♩=72, it's 72 ÷ 3 × 5 = 120.) While new music contains numerous more exotic tuplets (and metric modulations) than the four given here, restriction helps us concentrate on maximal isochrony here, so that in every case the tuplet may 'flow like oil.' Additionally, restricting the number of elements to learn increases our sense of their distinctness from each other. In this way it is similar to the 'multi-tool descents' exercises of **Figures 58-60** in our pitch dialogue. The aim of all these exercises is to build blocks of 'cognition-in-action' and so avoid lostness. In the pitch case I pointed to the risk that the 11th harmonic of a fundamental (our route to a secure quarter-tone) becomes confused with the 7th of the fundamental that lies a tempered major third lower. In this case we have to be careful not to confuse the 5:3 with the 7:8, because they are quite close: in tempo terms, 100 versus 105.

A: And then I suppose you can **lean** on these blocks as required: if asked to execute internal syncopations, or even to perform mini-accelerandos and ritenutos, as in 'feathered beam' notation.

B: Exactly. In these cases, even if the resulting sound and even the gesture might be non-isochronous to a listener, our musicianship approach would remain isochronous: a violinist's bow might skitter forward to

execute a feathered beam while the player remains internally 'ticking along' at the subdivision that is most useful for the context. But then we can take the next step, and use verbalisation as a springboard into rhythmic scenarios that are fundamentally non-isochronous. Since that's a significant difference, let's call for a new heading.

7.2.2 Fundamentally wonky grooves: non-isochronous rhythmic scenarios

B: (*continuing*) Maybe you remember that my first instinct when responding to that Boulez quote about 'really feeling' a quintuplet was to counter it by thinking about the micro-timings encoded in Janáček's text-setting. With our tighter characterisation of what a NI rhythm really is — it's not any old $\frac{5}{8}$ or aksak — we can see that Janáček's scores include shortcuts and mnemonics for fundamentally NI rhythms. If we are happy to use verbalisation to guide our production of even tuplets, let's also be open to their potential use to guide NI rhythms too. I suspect that almost any desired micro-timing and inner grouping — even some quite weird ones — can be well matched using verbalisation.

A: I'll need an example.

B: OK, but remember, the details are particular to the idiolect of each musician, so this might not work for you in quite the same way that it does for me. Let's deform a septuplet. In contradiction to London's 'well-formedness constraint,' which insists on maximally even lengths of subcycles, I find a reasonably good support for the isochronous grouping 3+1+3: *customer-to-customer*. Now, suppose I want to move into NI by gradually elongating the central 'group of 1': I shift to *customer-and-customer*, then *customer-sees-customer*, all the way to an (almost isochronous) 3+(tied)2+3: *customer-meets-customer*.

A: Why bother?

B: Because I want to get a handle on the rhythms that are perilously, or enticingly, close to isochrony. These are groove-like but fundamentally NI, like the off-kilter unquantized drum patterns of J Dilla. I don't want just to admire them from the outside, but to work with them as units of cognition-in-action, which means I need to be able to access them when I wish. While the timing shifts encoded in my verbalisations are certainly 'subtle,' I nevertheless find them to be replicable within quite tight tolerances. If I attempt to convey these rhythms with conventional notation, the tolerances seem to widen, not narrow, and the notation rapidly becomes outlandish:

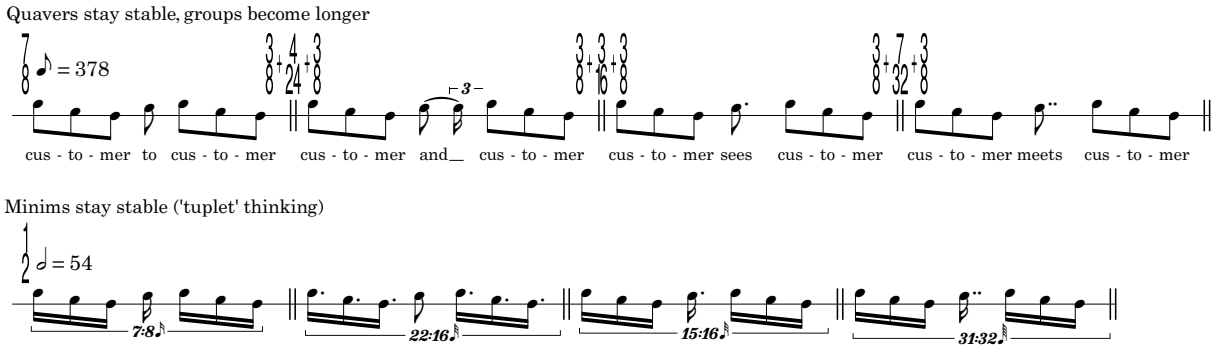


Figure 91: Exercise: deformations of a septuplet through verbalisation.

The notation does have a function as a record of the activity, rather like a linguist recording a rare language in the International Phonetic Alphabet. But for musicianship purposes it is much less effective as a stimulus to action than simply setting a metronome to 54 and verbalising the four phrases — or rather, a comparable set of phrases in the trainee's own language and idiolect. The goal is to build sensitivity to difference, rather than developing the mental gymnastics involved in decoding these tuplets (although — as I've stressed throughout — the ability to decode is also a handy skill, since I'd bet that even some battle-scarred new music specialists might mistakenly think on first encounter that the 𝅘𝅥𝅯s in the 22:16 bar run slower than the preceding 𝅘𝅥𝅯s in the 7:8.) As in the Swiss Army knife for pitch, this way of working foregrounds musicianship as an activity with its own definite identity. We might almost suggest that it seems to precede the point where the roles of composer and performer divide, since while my examples are 'thought up' in a sense and offered to musicians for execution, they'd hardly merit the status of compositions. That's about as far as I'd go into claims about 'basic' musicianship. I'll just note in passing that this way of working has similarities with Oliveros' 1975 teaching proposal (3.2) in which she used the phrase without fear. We might even rescue the quaint word 'rudiments' from the 'Little Red Book' (4.1.) (Drummers, of course, never abandoned the term.)

A: You're getting too abstract. Back to 'applications,' please.

B: OK. Let's look at some rhythmic scenarios where it's advantageous to use fundamentally NI thinking.

7.2.2.1 Pulses out of the blue: jumpcuts and tempo towers

B: (*continuing*) In all that talk about gridding we discussed maintaining steady pulse, and moving from one steady pulse to a related one, but we never discussed how we actually arrive on a tempo to start with. Unless we always start by referring to an external reference, like a metronome. After all, it used to be so simple, didn't it? Or perhaps not…

In his *Memoirs* Berlioz recounts an exchange with Mendelssohn that took place in Rome in 1831. 'What on earth is the point of a metronome?' Mendelssohn had asked; 'Any musician who cannot guess the tempo of a piece just by looking at it is a duffer.' Berlioz said nothing, but later enjoyed Mendelssohn's annoyance when, looking at the newly completed manuscript of the *Roi Lear* Overture, Mendelssohn turned to Berlioz and said 'Give me the right tempo.'

'What on earth for?' replied Berlioz, 'I thought you said that any musician who couldn't guess the tempo was a duffer?'[695]

If we were to go by the ubiquity of metronome marks in new music, the naturalness of tempo choice that the early Mendelssohn advocated might seem to have been abandoned long ago, with Berlioz emerging as the undoubted victor. The tempi in Stockhausen's *Punkte* for orchestra (1952-62, rev. 1966) for example, are unguessable from looking at the material alone, whether or not you are a 'duffer.' However, versions of the Berlioz-Mendelssohn clash continue to play out in new music contexts, most vividly where a composer wants to create the effect of music that sounds 'at the wrong speed.' That's a very tricky feat to pull off, since the effect relies on a recognition that the material 'wants' to go at a certain tempo (i.e. Mendelssohn's initial point), and also that we can override that through the use of external references (to extend Berlioz's argument.) I haven't encountered many examples of this being done successfully: one exception is Nicole Lizée's *Black Midi* for ensemble, soundtrack, and video (2017), where the impression of cartoonish overspeed is emphasised by the video element. We could call this rare pair of scenarios **roadrunner** (for 'too fast!') and **treacle** (for 'too slow!'), and note that their effective performing strategy will involve a touch of play-acting to drive the point home. These scenarios certainly don't apply in any music that sounds very fast or slow; I wouldn't, for example, use **roadrunner** when performing John Adams' *Chamber Symphony*, movt. 3 ('Roadrunner') — instead I'd keep as cool as possible and take a 'therapeutic,' against-the-grain, stance.

A: What's this got to do with non-isochronous rhythms?

B: First let's recall that we've rejected attempts to define our terms as levels on the conventional hierarchy of hypermeter, meter, pulse, and rhythm. Our experience of dealing with metric modulations, where 'old' subdivisions become 'new' governing pulses (and the reverse), has long ago put paid to any sureness about the meaningful placement of such levels. So has the habit of thinking in small (fast) rhythmic units, which tends to deprioritise our focus on larger (slower) chunks. In this spirit of terminological dissolution, I'd point out that there's a lot that links the experience of moving between two unrelated 'tempi' with the kinds of fundamentally NI 'rhythms' that Polak discusses.

A: *Unrelated?*

B: Unrelated in the sense that the fastest shared unit exceeds our c.600ppm rule of thumb, and/or in the sense that in this moment we don't want to feel or convey the sense of a connection. We want to be able to perform such transitions reliably, and that's where Polak's observations — that real NI rhythms exist and can even be 'normal' and 'easily accessible' — can give us confidence. I call the scenario where we jump without preparation between two unrelated tempi **jumpcut**, because it resembles the deliberately unnatural film editing effect where a single continuous shot is broken by removing a piece of footage,

[695] Hugh MacDonald, 'Berlioz and the Metronome,' in *Berlioz Studies*, ed. Peter Bloom (Cambridge: Cambridge University Press, 1992), 17.

creating the feeling of jumping forward in time.[696] Potential jumpcut situations are very common indeed in new music, to the extent that — as in film editing — it is not always entirely clear whether the effect is desired or accidental. But scenarios are things that an empowered performer *elects* to use. Not every unrelated-looking tempo transition needs treatment as a jumpcut. It is a special effect, but not a novel one. We could name this glorious moment from *Petrushka* as its ancestor:

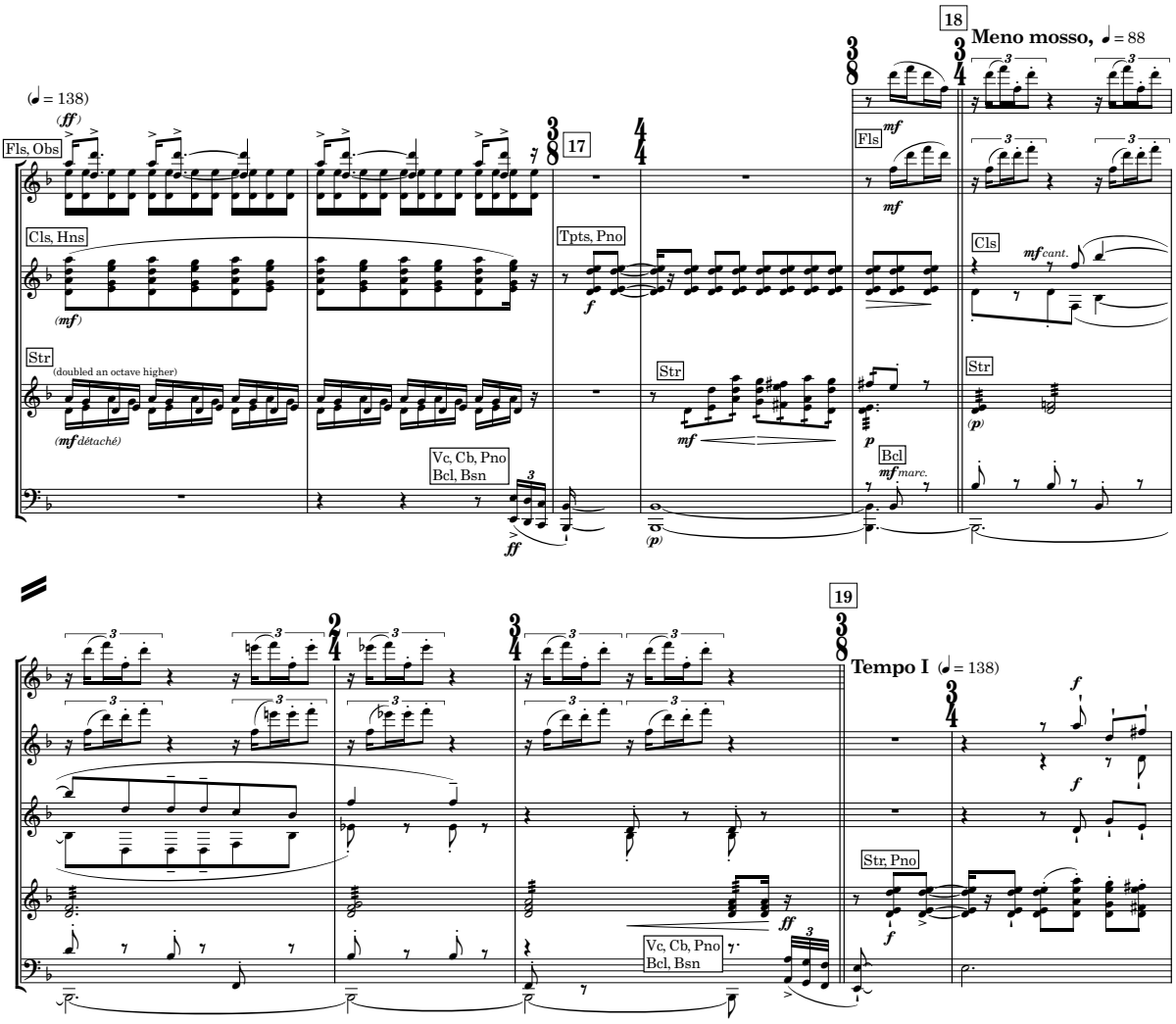


Figure 92: The ancestral jumpcut: Igor Stravinsky, *Petrushka* (1911 / 1947) 'The Shrove-tide Fair,' 2 bars before fig. 17 to 2 bars after fig. 19. Short score, many details omitted.[697]

This is composition as pure cinematography (a wide shot of the milling crowd, a sudden closeup on the organ-grinder, caught mid-grind, then back to the wide shot), and do to it justice we need to hit the slower tempo at **18** with absolutely no sense of preparation or transition. That means avoiding the easy option, which is to perform a metric modulation ←♩.=♩→. That would yield a *Meno mosso* of ♩=92 and enable the

[696] The invention of the effect is usually ascribed to Georges Méliès (1861-1938). It was popularised by Jean-Luc Godard, who used it extensively in *À bout de souffle* (1960).

[697] My short score is taken from the 1947 version. The 1911 score is intriguingly ambiguous at this point. The barring is different, the *meno mosso* is to ♩=100 rather than 88, and its moment of onset is sufficiently unclear that it seems conceivable that Stravinsky envisaged two simultaneous tempi prevailing for a brief period: the septuplets in oboes, horns and strings continuing in the old tempo while the 'barrel organ' of piccolo and flute enter in the new one. Stravinsky's modernising 1947 revision increases the jolting contrast of this moment as well as its practicality, but not without loss.

flutes to match the speeds of their short notes (552 ppm) instead of the awkward 552→528 ppm transition implied by the notation. It would also sound quite banal. These kinds of difference might be 'subtle' (to echo Justin London) but nevertheless they are matters of (rhythmic) life and death.

A: I'll assume you'll come back to my earlier question in a bit. What's your recommended strategy when dealing with a jumpcut?

B: I've found it helpful to internalise some sets of connected tempi which I can trigger reliably with minimal preparation. To me these seem to be reachable 'instantaneously' — even though I know that when we're talking about events in time that makes no sense, strictly speaking. Perhaps 'explosively' might be a better word, although the musical results might be quiet. I group these tempi into 'towers,' or siloes:

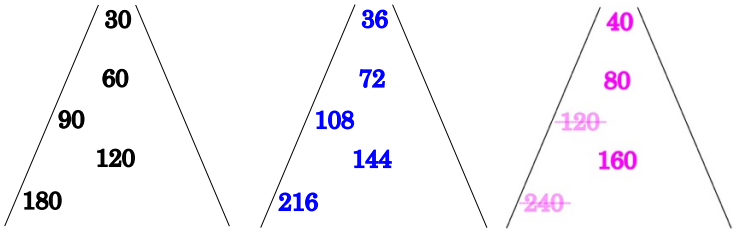


Figure 93: Tempo towers.

This is an avowedly unsystematic approach: 36 is chosen to lie between 30 and 40, rather than the more logical 35, due to my preference for tempi that conform to the familiar steps on mechanical metronomes (a preference I share with many colleagues; a marking like ♩=82 ought perhaps not to feel alien, but it does.) The towers could easily have been marked up with durations to emphasise the obvious relationships here (e.g. 𝅗𝅥=30, ♩=60, ♩³=90, ♪=120, ♪³=180); the reason they are not is because the towers are intended to be 'swallowed whole' (and regurgitated whole), rather than conceived in an intensively subdivisional way — even though it is the simplicity of their internal relationships that makes this possible. I do not need to decide which level on a tower I am on at any particular time: I can engage levels 60 and 120 simultaneously without insisting that one is 'the pulse' and the other 'the rhythm.' As in the Swiss Army knife for pitch, the interest here is less in what is included, and more in what is left out. The black and blue towers are my stronger references. Consequently, on the magenta tower the logical 120 is crossed through because I would never access it in this way: if asked to perform a metric modulation from ♩=80 to ♩³=120, I would instead jump directly to my (secure, black) 120. 240 is unused because it lies too far from the centre of my workzone — even though it is well within it for the purposes of thinking in fast isochronous flows. If placed in ascending order as an accelerando, my list of maximally-reliable tempo references resembles the odd and gappy 'scale' of the Swiss Army knife: 30, 36, 40, 60, 72, 80, 90, 108, 120, 144, 160, 180, 216. However, it is not used in this way. (I'll discuss gradual changes of pulsation later.)

There is a strong analogy here with our discussion of so-called absolute pitch (6.3.2), and the same caveats apply: the references that this discipline provides are neither 'absolute' nor 'perfect' but merely reliable enough. 'Reliable enough' refers to a performer's personal standard — the default professional expertise that we bring to projects — and not to the context-appropriate tolerances that emerge from a triage process.

Together these tempo towers form an **armature**. An armature is not a scenario; scenarios are situation-dependent while armatures feel internal and portable (5.3.) The key practical difference is that armatures can be developed without any specific new music context in mind.

A: So how would you develop this armature?

B: Partly through mere repetition with reference to a metronome, as in the discussion of **gridding** above. In this process I've found it useful to employ what Hartenberger called energy-shifting. Rather than always beating along to the metronome with my right hand, I'd shift to the left hand for a while, then vocalise, then tap the table, then 'internalise' by reducing the muscular involvement to the bare minimum (e.g. tiny pulses of tension around my neck and jaw.) But I'd also use references to memorable music — and not to any recent new music project whose pulsations happened to coincide with levels on a tempo tower. Instead, I'd choose to associate these levels with earworm-like reference points from repertoire that is as far removed from new music as possible.

A: For example?

B: The more highly-processed and machine-made the reference is, the better. Classical hits don't work for me because they usually admit of too much tempo variance; I'd instead look for drum machines and DAWs. I would suggest using a song with words rather than an instrumental, because this leverages the benefits of verbalisation. It's best to choose your own earworms, but I'll give a well-known example to give the idea. For a basic tempo-sensitisation exercise, find a pair of references that are close in tempo — say, two hits from 2012-13: Katy Perry's *Roar* and Taylor Swift's *We Are Never Ever Getting Back Together*. The former runs at 90bpm, the latter at 86bpm (or 180 versus 172, of course.)[698] Both songs, considered in isolation, are highly isorhythmic; they are also very memorable. If you know them, try exchanging the tempi and audiating the songs. They will feel eerily wrong. (Wrong, simply because we know them, that is — I don't think the musical material of either makes sufficiently-specific 'Mendelssohnian' tempo demands; the songs could conceivably have been released with exchanged tempi.)

A: I know plenty of performers who use memorable external references when they need to grab a tempo out of the blue. But they don't usually own up to it. In fact they sometimes seem embarrassed to admit it.

B: That's perhaps because, due to the composer-led ad hoc training model, they feel pressure to subscribe to 'just-do-it' thinking (4.2) — they feel that their stance as a performer ought to be maximally aligned with the composer's line of thought. This is often expressed in humblebrags: a performer declares that they want to be 'transparent,' or 'really get inside' the composer's music-making. In that way of thinking, when we're performing Sciarrino, it would be inappropriate to think about Taylor Swift; we ought to be filling our minds, and our trainees' minds, with Sciarrino's declared cultural associations: Arte Povera, limina of Being

[698] Tempi are rounded to the nearest whole number bpm. In their official music video versions, both songs are fractionally faster.

and Not-Being, and so on. But because I'm sufficiently happy with my status as a 'duffer' not to swallow that doctrine, I don't find the use of external aids embarrassing in the slightest. So once we've got past that barrier, we have two memorable references: *Roar* coincides with a level on one of my tempo towers, while *We are never…* is a **bend** lower. These references can be directly applied when launching an unprepared tempo, considered simply as ♩=86 or ♩=90. What's perhaps less obvious is that we might use *the difference itself* as a unit of rhythmic cognition-in-action.

A: You mean like an **ooch** in pitch — something you derived from the difference between a tempered and just major third, but then went on to use in multiple contexts?

B: Exactly! Both involve the feeling of small and deliberate inner motions, which we can represent to ourselves in various metaphorical ways: I've suggested thinking of the motion of a caterpillar along a branch, or a sip of espresso or wine, to help us judge a known degree of push or bend against a reference point. Whatever metaphor is chosen, it needs to carry the sense of a *controlled* dose. Maybe you remember my example of the Gerald Barry piece that contained very similar musical material, to be played at slightly different speeds to give the impression of incrementally-heightening hysteria (5.3)? (That was certainly a 'Berlioz' and not a 'Mendelssohn' situation.)

A: Haven't we become sidetracked? I asked, 'what's all this got to do with non-isochronous rhythms?' and I want an answer this time.

B: The relationships between the bpms of *Roar* and *We are never…*, and between the Gerald Barry tempi, are (on our definition) fundamentally NI. My experience, reinforced by Polak's findings, confirms that we can reliably work with such close relationships if we meet them head-on and recognise their NI status. Although the timings here are truly 'micro,' approaching them in this way helps maintain our awareness of their distinctness (i.e. our sensitivity):

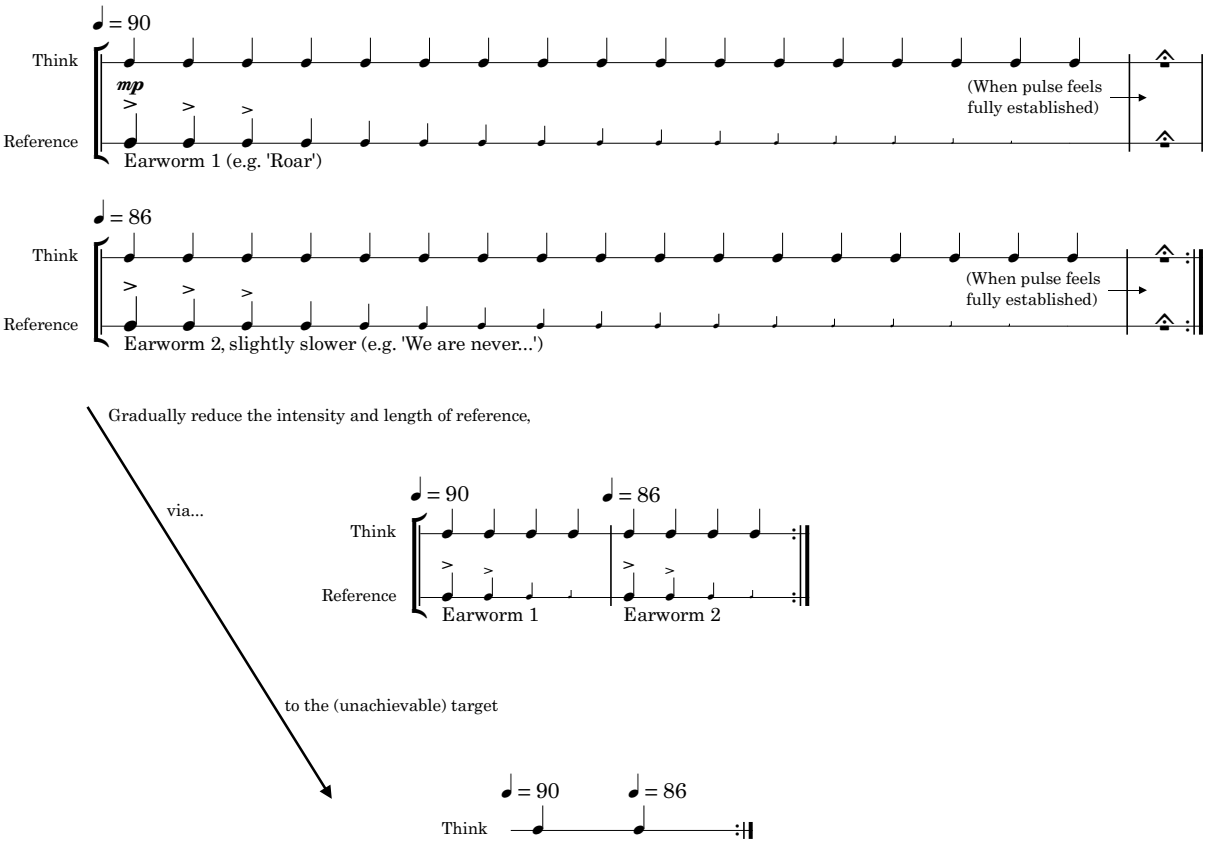


Figure 94: Exercise: developing reliable non-isochronous alternations.

A: Are we still talking about the **jumpcut** scenario?

B: Yes. These quasi-instantaneous or explosive transitions are, when first encountered, anti-natural — like jump cuts. When we need to pick a tempo out of thin air with minimal preparation time, even if there's no sounding music immediately prior, we are also in a jumpcut situation. Of course, with familiarity (or *enculturation*, in the jargon) such sudden transitions may become second nature, as Polak pointed out. In this case we need to intervene periodically to make sure that we are retaining the level of rawness we want to feel and project. If you have been influenced by models of rhythmic perception based on fundamental regularity (i.e. Hasty's, Lehrdahl and Jackendoff's, and London's) you might think that such intervention really means avoiding a relapse into what they propose as the human default mode: isorhythmic thinking. That would imply a broad tendency to 'straighten out' fundamentally NI rhythms into fundamentally isochronous ones. But that doesn't correspond to my observations of practice in new music contexts. When we were discussing the Mayr rhythm, I didn't mention that there was a moment of polite disagreement in the rehearsals between the drummer, who had previously played the song with the band prior to its arrangement for ensemble, and an ensemble member who pointed to a divergence between what the drummer was playing and what was notated (considered in the Boulez/Reina sense). The ensemble member observed that the drummer was tending to 'rush' the ♪s of β — executing them at roughly 174ppm rather than the 166.666…ppm of the notation. This wasn't a lazy relapse to a hypothetical isochronous default, such as playing β at the speed of $\overset{3}{\overline{\text{♪}}}$s (at 187.5ppm.) What he was producing was *more* NI (on our definition)

and would have been tricky to capture in notation without resorting to a **Option 4**-like tempo change or some nested-tuplet monstrosity. You might imagine that the drummer would win out, since — authorially speaking — the song existed and had been performed quite often before the arrangement I have given here, and also because he was carrying big sticks. As it turned out, the opposite was the case, and the drummer was grateful for the spine-stiffening reminder. This was not because he felt pressure to produce a 'reverse transcription' of the notation — he was a confident creative musician and no Parnassian naïf. He just agreed that it sounded fresher that way. Something similar often happens when a group of musicians becomes fatigued: when rhythms become 'sloppier,' they usually become more NI, not less. Think of an amateur orchestra playing the endless  s of Beethoven's Symphony no. 7, movt. 1, towards the end of a long day. Gridding is not a default performance mode.

A: I feel the end of a section coming on, so I'll do the summary this time. The rhythmic scenarios so far: **gridding** is where we work extra-hard on maintaining steady pulse, **duck-rabbit** is where we negotiate fundamentally isochronous relationships between pairs of pulsations, and **jumpcut** is where the relationship between the pair is non-isochronous. The latter two can be supported by strategies including verbalisation, tempo towers, and the use of external earworms. These are all post-triage situations where we have decided that we need to take special care of the parameter of rhythm/metre/pulsation. I can see what's missing: situations where the speed of pulsation changes gradually.

7.2.2.2 Gradual changes of pulsation

A: (*continuing*) And by now I can predict what you're going to say. We performers will work our socks off to 'get it right' when dealing with something that presents as a rhythm, particularly if it looks black (but not so black that we give up and become angry with the composer!) But when we're faced with an accelerando or ritenuto, anything goes.

B: I wouldn't have been quite so brutal. I think that performers often work carefully to realise *specific* accels and rits,[699] particularly when they're understood in those nineteenth-century terms that still are our expressive defaults.

A: What do you mean by 'expressive defaults'?

B: Well, a default accel ratchets up the excitement (think of a Rossini *stretto*, a Hungarian *csárdás*, or Grieg's *In the Hall of the Mountain King*) and a default rit pulls the car up into a cadential parking place. We generally take care of these phenomena by feeling and learning each variation of the default as an emotional and gestural whole. In these cases 'the music' and 'the metric' are indissolubly bound together and banked as such in our corporeal memory. Try audiating the metric of the accelerando in the Grieg without thinking

[699] In this section no distinction is made between terms like *ritenuto*, *rallentando*, *zurückhaltend*, *cédez*, or *slow off still more* (Grainger), nor between their quickening equivalents. The deliberately loose rehearsal-slang terms *accel* and *rit* are used here, even in contexts where a composer under discussion has used different terms, in order to emphasise that these phenomena have a degree of independent existence from the performer's point of view and — the gestural consensus notwithstanding — are not entirely context-dependent. **B** would have preferred to give arrows (e.g. ↗ or ↘) but these are hard to pronounce.

of the music! But in new music these changes can have entirely different meanings and work on very different scales. Georg Friedrich Haas, in *weiter und weiter und weiter…* for large ensemble (2022), writes an accelerando that lasts about 45 minutes across 275 pages of score. Unlike its precursors, including works by James Tenney and Alvin Lucier, this is by no means a minimalist piece; within the accelerando there is a profusion of emotional musical material with many changes of mood and overlapping lines. It doesn't just get more and more thrilling *al fine*!

A: And I'm going to guess that the metric structure and the conductor don't just start at the speed of a glacier and end up whirring like a hummingbird. There must be multiple points along the way where the notated metric needs to be re-spelt to make it manageable and remain in the **workzone**.

B: Yes, of course. Haas writes a succession of accels from ♩=30 to ♩=210; at each tempo-maximum the old crotchet becomes the new septuplet semiquaver and the cycle begins again. Each time this happens is obviously a variant on our **duck-rabbit** scenario; a tempo becomes a tuplet, but the audience shouldn't notice. For our pedagogical purposes, what's striking about the communication strategy in this score is that this very experienced composer, who has for the past couple of decades almost exclusively worked with elite ensembles and orchestras, finds it necessary to spell the point out for the first few notational 'step-downs': he repeatedly warns 'here only the notation changes, not the musical structure' and explains the metric modulation verbally and in great detail.[700] The fact that this explanation still seems necessary in a very recent piece may be taken as confirmation of your initial point that we don't usually treat progressive tempo changes with the same cool detachment as things that look on the page like rhythms. We invest them by default with embodied emotional content graded from base to summit, as in Rossini and Grieg, and that attitude would obviously be inappropriate in the Haas context.

A: But that's an extreme example.

B: Only in that the re-spelling procedure is repeated so often. **Duck-rabbits** during accels and rits are very common in new music, as are accels and rits associated with non-default affects. The classic demonstration of both is the Risset rhythm,[701] the auditory illusion that seems to be an endless accelerando, which has inspired plenty of compositions.[702] (The effect is best experienced in adaptations by Dan Stowell, who has generalised the procedure to permit the inclusion of different musical material.)[703] Every NMP trainee should listen to these entertaining tricks, since they put the expressive defaults of accels and rits into

[700] On page 72, for example, Haas writes 'hier ändert sich nur die Notation, nicht die Struktur der Musik; die vorangegangenen (schnellen) Viertel entsprechen jetzt präzise den (langsamen) Septolensechzehnteln, z. B. setzen Celli und Kontrabass ihre Skalengänge unverändert fort' ('here only the notation changes, not the structure of the music; the previous (fast) crotchets now precisely correspond to the (slow) septuplet semi-quavers; for example, the cellos and double basses continue their scales without alteration.')
[701] Jean-Claude Risset, 'Pitch and Rhythm Paradoxes: Comments on "Auditory Paradox Based On Fractal Waveform",' *Journal of the Acoustical Society of America* 80, no. 3 (1986): 961–962.
[702] E.g. Aphex Twin, 'Bucephalus Bouncing Ball,' *Come to Daddy*, Warp, 1997, EP.
[703] Dan Stowell, 'Scheduling and Composing with Risset Eternal Accelerando Rhythms,' *Proceedings of the International Computer Music Conference 2011*, University of Huddersfield, UK, Jul 31-Aug 5, 2011.

question more vividly than any words could. But Risset rhythms are not directly actionable in musicianship terms.

A: Why not?

B: Have you tried audiating two progressively-changing tempi at once? I'll stick my neck out here (I only have the one) and declare that — unless I've missed some pretty significant wetware upgrades — I don't think it's possible. There are numerous pieces which enact this effect sonically, such as most 'polytemporal' projects where multiple musicians play different tempo strands. There are even cases where the demand is put in the hands of a single player. In the former case players focus on their own line, and while they may also need to listen out for cues from colleagues in a different group, those cues are treated quasi-instantaneously, for orientation only. In the latter case, while two or more sounding layers might change progressively and independently, they are in almost all cases governed by an isochronous fast pulse which may be used as a reference. The passage from Ligeti's *Concerto for Piano* that I quoted in 7.1 above contained an example of this. I'll give it again, this time only the solo piano part, marked to make the perceived accelerando clear:

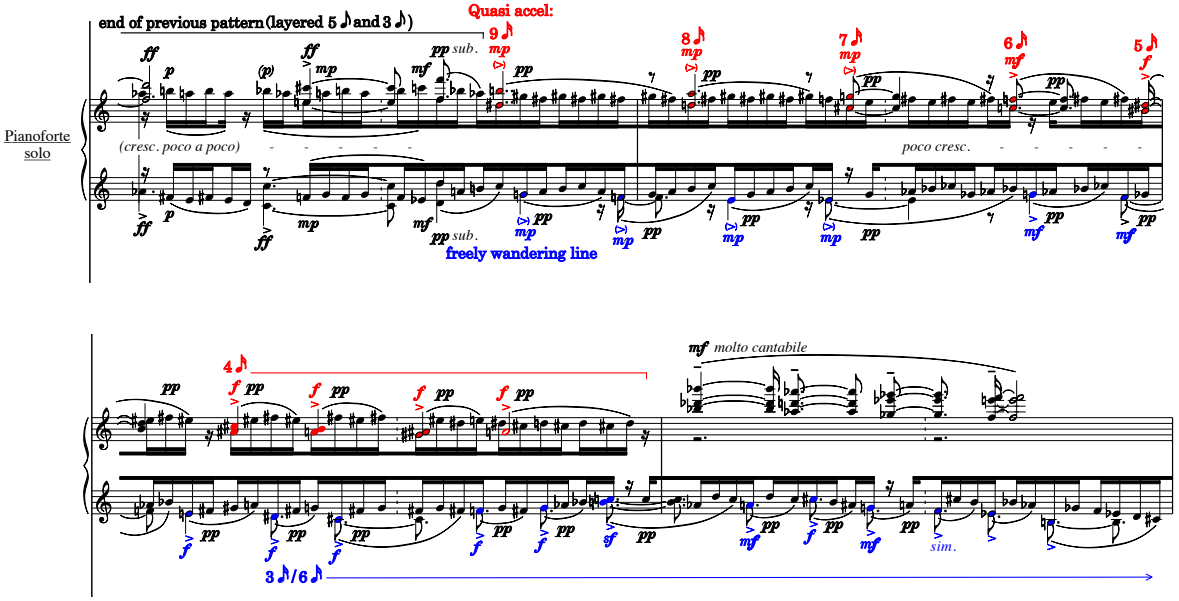


Figure 95: Ligeti, *Concerto for Piano and Orchestra*, same passage as **Figure 76**, solo piano part only, rhythmic layers marked.

While passages like this are undoubtedly very physically taxing, they remain fundamentally isochronous in a musicianship sense, and so they can be learnt in a traditional workflow: set the metronome to 'small unit=slow,' then gradually get faster. The effect of the two-speed rhythmic layers will come out automatically when the small unit gets fast enough, with no 'accelerando thinking' required. For that reason I don't propose the scenario 'risseting,' since this is not something we performers choose to do, but rather 'have done to us,' or even 'at us'! It's a fairly common feature of the sound of new music, and of the look of its scores, but not a core musicianship skill. Anyway, for now let's just note that we performers — NMP instructors and trainees alike — don't usually practice accels and rits without reference to particular musical contexts.

A: In the discussion of gridding, we agreed that we couldn't imagine 'creative performer' NMPT instructors handing out metronomes and stopwatches and encouraging trainees to work on steady pulse 'in the abstract,' particularly given the prevailing anti-abstraction mood you identified in 2.3 and 4.2. It seems even less likely that they'll focus on developing something as abstract-seeming as the capacity to execute a smooth accel or rit to a given tempo point across a given stretch of time or specific number of attacks. (*Execute* meaning to clap/tap/sing/cough/play/sniff/think those attacks, or 'IOIs.')

B: It's not a case of simple neglect, though. The tendency to devote more practice time to 'rhythms' than to 'tempi' obviously has historical roots: as we've already mentioned, rhythms are traditionally the composer's territory while tempi are seen as negotiable. But, despite the complaints of twentieth-century notational positivists like Stockhausen and Carter, this difference is not necessarily a bad thing. In that it has presented musicians with two lines of communication which are associated with different tolerances and working methods, it has increased the nuance and richness of how we make and respond to rhythmic demands. However, we also need to be aware of the existence of compositional demands like the Haas example where we do need to strive for maximal rhythm/tempo equivalence, and where the historical distinction might lead us astray. As in the scenarios of pitch, it seems most helpful to frame this awareness in terms of an expansion of the number of distinct tools in our expressive arsenal: such equivalence is necessary in X context but not in Y, so we need to be able to do both (but not at the same time!), and to make the choice consciously.

A: So you would recommend working on 'abstract' accels and rits with a view to applying them in contexts in the X group. But how?

B: Well, like the 'endurance training' I talked about in our steady pulse conversation, it's quite trivial to invent exercises of this kind. In the exercises that follow I have marked tempo waypoints. Composers often supply things that look similar; while this is always done in a helpful spirit, the results are sometimes the result of guesswork or (as in the Lindberg example above of suppressed metric modulations) inappropriately simplified. At my request Phillippe Kocher very kindly programmed a calculator which I've used here:[704] you input the initial and the final tempi and the number of intervening beats, and it gives a list of results with a time-code rounded to the hundredth of a second and the 'tempo' of each beat to a tenth of a bpm. So you can ask: in a linear accelerando from ♩=30 to ♩=210 over 100 beats, how fast should I be at beat 73, and how much time should have elapsed? (The answers are ♩=178.9 and 41.36 seconds, which I wouldn't have liked to work out with pencil and paper.)

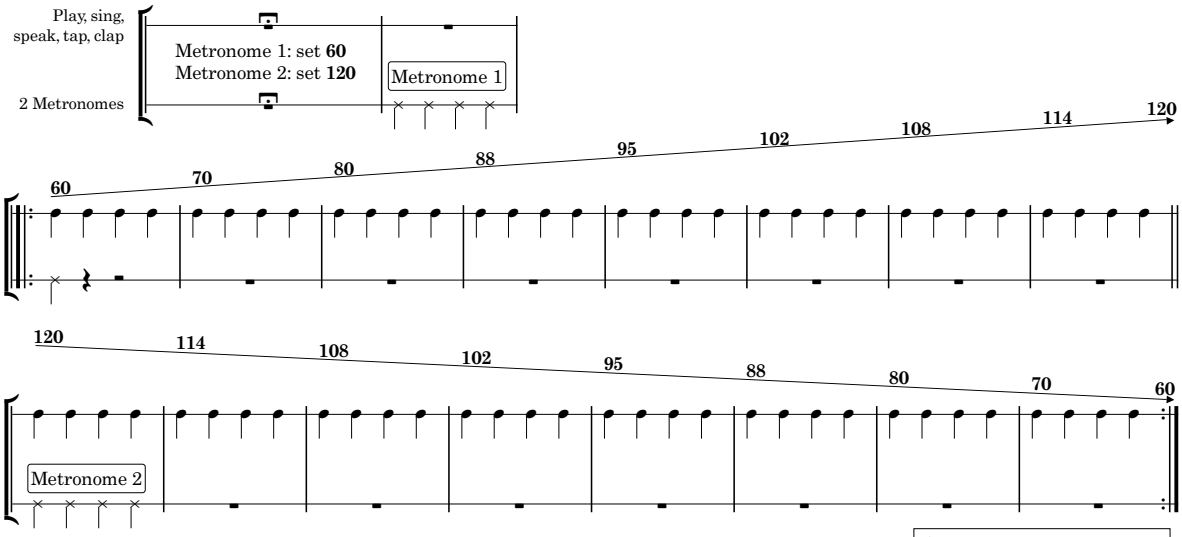
A: That seems a bit mathsy and distant from performer experience.

B: Not at all. In fact, I hadn't asked him to create the calculator for pedagogical reasons, but to help me manage a performing problem of my own. In 2021 I was engaged to to conduct a piece that made comparable demands to the Haas example, in which the inspiration was M. C. Escher's 1960 lithograph

[704] Philippe Kocher, 'Linear Accelerando / Decelerando,' accessed Aug 2, 2022, https://polytempo.zhdk.ch/calculator.html.

Ascending and Descending (an artistic implementation of the 'Penrose stairs' impossible object.) The notated accels had an even shallower gradient than those in the Haas, and I felt the need for guidance. The fact that I couldn't readily find such a simple-seeming tool online (without going deep into the settings of a DAW, for example) is evidence that performers don't usually ask for waypoints during an accel or rit. When we work with gradual changes of pulse in contexts that don't fall into our gestural defaults, we notice a 'Goldilocks' effect. Very steep gradients, particularly those with multiple duck-rabbit transitions, are challenging — that's not surprising. But very shallow ones can be even harder to control. In the example of a very gradual accel, we need to push forward incrementally while simultaneously pulling back on our default *stretto* instincts. That situation is like when you go down a ramp at the airport with a heavy baggage trolley; you and the trolley both want to go in the same direction, but not at the same rate. Medium-gradient changes fall into our musicianship workzones, while steep and shallow ones don't. So, in contrast to fundamentally isochronous preparatory workflows like the Ligeti example above, where we would start slow and gradually get faster, here we should start by working on medium gradients before trying steep or shallow ones. The following exercises are extremely boring. This is intentional, since any addition of interesting musical material would carry specific gestural implications and reduce their general applicability. You will need two metronomes, one of which allows tempo settings up to 240:

Task 1: Medium gradient



⚠ Quality control: The total duration of one accel-rit cycle should last slightly less than 43"

Extension 1: Repeat exercise with tempi swapped (start at Metronome 2, rit to Metronome 1)

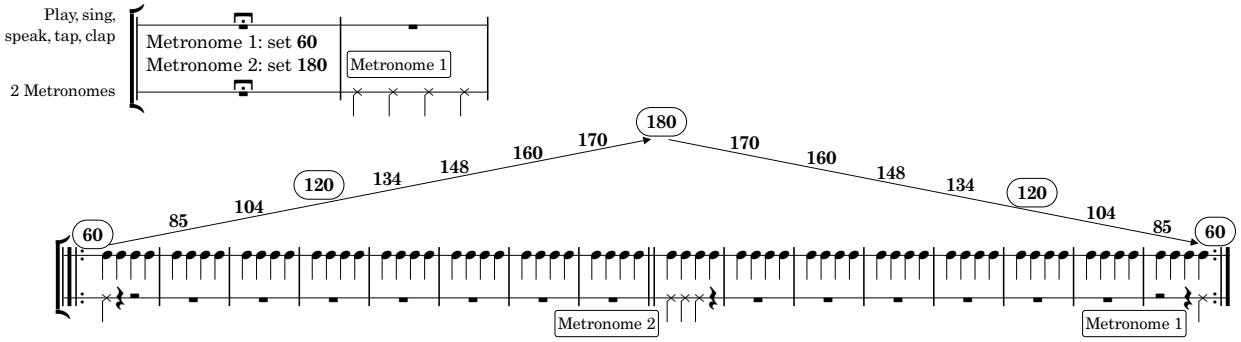
Extension 2: Repeat exercise using pairs from the tempo towers (**Figure 93**) as follows:

Metronome 1=72; Metronome 2=144. Waypoints: 72 — 85 — 95 — 105 — 114 — 122 — 130 — 137 — 144 (and the reverse), duration 35.5";

Metronome 1=80; Metronome 2=160. Waypoints: 80 — 94 — 106 — 117 — 126 — 136 — 144 — 152 — 160 (and the reverse), duration 32".

Extension 3: Replace each ♩ with one of the following pairs:

Task 2: Steeper gradient



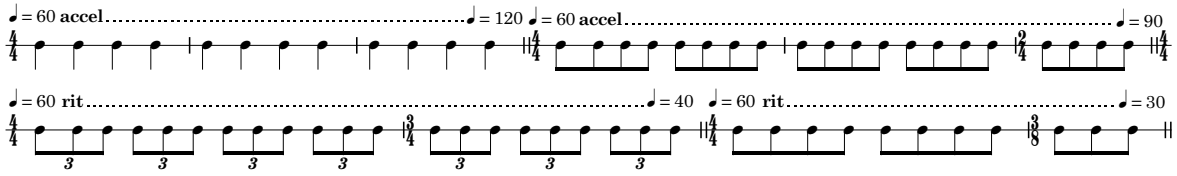
Duration: 32"

And then:

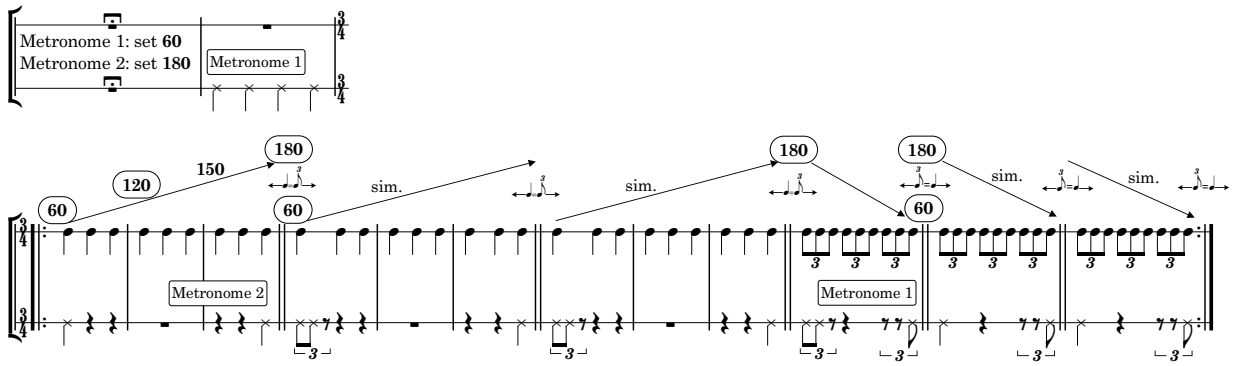
Metronome 1=72; Metronome 2=216. Waypoints: 72 — 102 — 125 — 144 — 160 — 176 — 190 — 204 — 216 (and the reverse), duration 26.66";

Metronome 1=80; Metronome 2=240. Waypoints: 80 — 114 — 138 — 160 — 178 — 196 — 212 — 226 — 240 (and the reverse), duration 24".

Now try the same passage, notated with **duck-rabbit** transitions. How does this affect your performance?



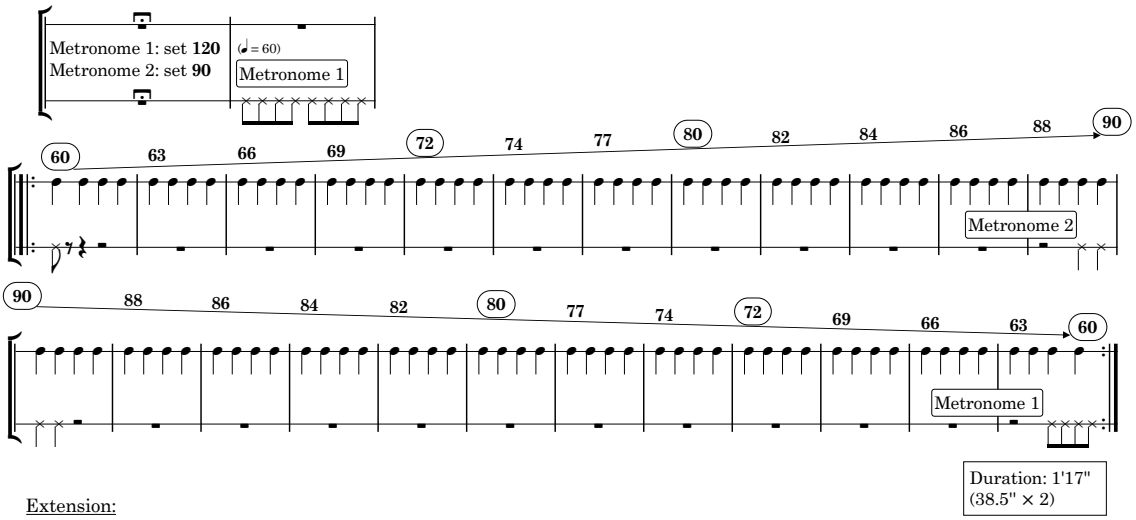
Task 3: Extreme gradient with **duck-rabbits**



Extension:

Metronome 1=72; Metronome 2=216. Waypoints: 72 — 138 — 182 — 216, duration 22.5";
Metronome 1=80; Metronome 2=240. Waypoints: 80 — 154 — 202 — 240, duration 13.5". Difficult!

Task 4: Shallow gradient



Extension:

Metronome 1=144; Metronome 2=108. Waypoints: 72 — 76 — 80 — 83 — 86 — 89 — 92 — 95 — 98 — 100 — 103 — 106 — 108 (and the reverse), duration 1'04" (32" × 2);

Metronome 1=160; Metronome 2=120. Waypoints: 80 — 84 — 88 — 92 — 95 — 99 — 102 — 105 — 108 — 112 — 114 — 117 — 120 (and the reverse), duration 58" (29" × 2).

Figure 96: Exercise: gradual changes of tempo, four varieties of experience. Tempo values for waypoints have been rounded unsystematically for ease of use.

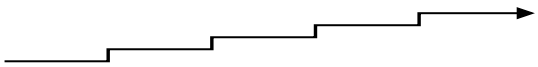
A: In the pitch dialogue you kept on justifying your decision to reduce the flow of information and make strategic simplifications, and here you are adding information! All those waypoints!

B: Yes, and doesn't that confirm Hartenberger's point about the neglect of theoretical and training materials in rhythm versus pitch? I try to take both parameters as seriously as each other.

A: Two more things. You drew continuous simple slopes for the changes of tempo. So how can we use a metronome at all when the tempo is supposed to be changing constantly? And, at the risk of straining our

relationship, I'm going to ask once again — since we still appear to be in the NI section — what this has to do with non-isochronous rhythms.

B: I'll answer your second question first. Although they aren't usually expressed this way, any accel or rit can be understood as a succession of discrete NI transitions, as between my indicated adjacent waypoints, or between the tempi of *Roar* and *We are never…* You might object *no, accels and rits are supposed to be smooth!* and I'd respond that this isn't a calculus class, and I'm not interested in musing on the nature of the asymptote nor whether time is fundamentally discrete or continuous. What matters here is how things feel for us as performers. In the pitch dialogue I suggested that an **ooch** (a unit of experience-derived cognition-in-action, rather a deflection with a fixed value in cents) can usefully stand in for notated twelfth-tones and eighth-tones, to avoid lostness and overshoot. In my preparation of the Escher-inspired piece I found that my use of the usual embodied conception of of an accelerando as a smoothly-increasing tempo led me to overshoot, then to overcorrect and undershoot. Frustratingly, these inconsistent results didn't improve through practice; it seemed to be another **solo intrinsic difficulty**. I eventually realised that I was attempting the equivalent of what aviators call an 'unstabilised approach,' where the energy balance of the aeroplane is out of kilter, and there is a risk of 'pilot-induced oscillations' as the plane attempts to recapture the smooth glidepath. (In these dire cases pilots must recognise quickly that they have made an error, execute a 'go-around,' and make another attempt to establish a stabilised landing gradient, but in musical performances we only have one chance.) When I tried digging steps into the slope at defined levels, like a ziggurat, I was far more consistent. Using Kocher's calculator I wrote on my score the target tempo of every bar, rounded to the nearest bpm. This only took a couple of minutes. Then I learnt the accel as follows: Where a particular bar's tempo coincided with a level on my tempo tower, I locked in with that, using my external earworm references where necessary. I treated the remaining transitions like NI rhythms, representing them to myself as verbalisations where the difference between each level was an ooch, like my gradually-expanding 'customer-to-customer' example in **Figure 91**. Notably, I didn't try to accel within the bars at all, even though I knew that there was nothing significant about the bar divisions and that they existed purely for notational convenience. In fact, during each bar I used local **gridding** — in direct contradiction to the notation — confident that no-one would notice. That's why we can use metronomes (briefly) as references during 'linear' accels and rits, particularly in situations like the shallow and very challenging **Task 4**, and also why your two questions are really the same question. I should really have written each line like this:



A: Seems like a lot of trouble for a simple effect. Haas even writes in his score that the actual tempi don't matter much as long as the audible relationships are maintained. In these cases, why not just do a natural accel and make sure the metric modulations come out right?

B: Ah, helpful composers again! I've argued repeatedly that we should expect that the rhythmic experiences of composers (working in slow time) and performers (working live) will differ significantly, and always take composers' offers of assistance with that expectation in mind. Haas is stating *his* priorities and the breadths

of *his* tolerances, which we should take seriously (in fact we've already done so by evoking the **duck-rabbit** scenario) but not confuse for direct instructions. I didn't go to such preparatory trouble for the sake of getting a high score on a hypothetical *Guitar Hero* league table! Rather, I knew that consistency would lead my colleagues to feel secure, and so we could all devote our attention to other musical considerations: balance, articulation, intonation, and so on. So in the end it was much less trouble, and took less preparation time, than arriving at a solution through wearisome trial and error, which is where relying on naturalness would have left me. If you have the energy, you might revisit the exercises above and see if a similarly 'blocky' approach helps you achieve greater consistency.

A: What about situations where the accel or rit isn't linear?

B: Musicians sometimes call those cases 'exponential' or 'logarithmic,' even though they are rarely truly either. In practice this is shorthand for the common expressive effect where an accel is delayed ('poco a poco,' in truncated Italian), then unleashed explosively to emphasise its climactic impact. In these cases, thinking of the curve of a graph doesn't help me produce replicable results. Instead, if I want that effect in contexts where I need to be very reliable, I'd split the accel into two phases: an initial shallow linear (actually, 'linear-ziggurat') ascent up to a determined point, then a steep ascent to the final target. That will sound plenty logarithmic enough for any situation I've encountered.

A: So far our discussion in this section has only concerned **solo difficulties** and not **ensemble rhythmic difficulties**.

B: A proper treatment of ensemble difficulties in progressive tempo changes is beyond me, and would anyway make this text even more unwieldy than it is. Consider the accelerandos in Stockhausen's *Gruppen*, figs. 118 and 121, which flank the climactic rotating chords at figs. 119, or the very steep accel-then-rit in figs. 74. In these passages the three conductors are (or should be) in unison. The conductors and the orchestras have to deal with multiple **duck-rabbit** transitions, which are often very close together. (Some of these seem to have derailed the performers in the Deutsche Grammophon recording, to which I referred in my definition of **lostness**.) I've performed this piece twice, with different sets of colleagues. An entire PhD, or possibly a psychodrama, could be written about how these exceptionally complicated interactions have played out. Its *dramatis personae* would include the experience of each conductor in this repertoire and their capacity to understand the need for initiative-switching when faced by the kinds of challenges that we identified in the Mayr example, the extent and nature of their prior preparation as a silent trio including how the power dynamics and communication flows play out, how nimble or heavy are the responses of the orchestras to their gestures, the role of the hall's acoustics, the capacity for corrective intervention of the (Stockhausen-mandated) 'fourth conductor' in the hall, or their absence… But this text is intended to intervene in real-world NMPT, and since the management of accels and rits has historically received so little pedagogical attention, we should probably focus on working on our skills in solo contexts before subjecting them to such complex testing in ensemble contexts.

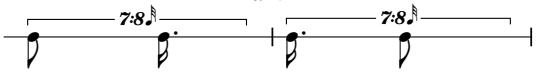
A: Oh, the 'further study needed' excuse!

B: Hey, I'm doing my best here. To punish you I prescribe the following task, which takes me right up to my **clock→cloud transition point**. I'll call it **Task 5**, because it's an extension of the preceding exercise:

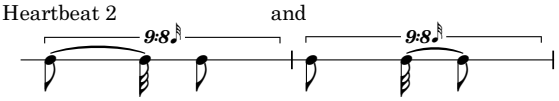
Task 5: Add internally non-isochronous elements

Repeat Task 1 and Task 4 of previous task, but replace every ♩ with one of the following elements. Before attempting, stabilise each element against a metronome at a slow, 'analytical' tempo (e.g. ♩ = 48).

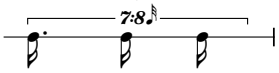
Heartbeat 1 and



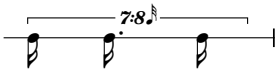
Heartbeat 2 and



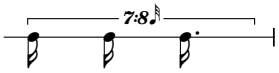
Stumble 1 (dactyl)



Stumble 2 (amphibrach)



Stumble 3 (anapaest)



Exploratory extensions:

Use elements from **Figure 91** ('customer-to-customer'), in the 'minims stay stable' form. First try with a single element. Then attempt the full cycle ('to'→'and'→'sees'→'meets') in each 4/4 bar.

Use even closer pairs than 'Heartbeat 2', such as 'Roar' / 'We are never.'

Figure 97: Exercise: gradual changes of tempo with internally non-isochronous elements.

This is about as far as I can go into the audiation and execution of solo 'polytemporal' progressive changes, and also seems to represent the rough current limits of reasonably-replicable rhythmic work of this type within the new music space as I have observed it. Others will place their limits at different points, and I'm not claiming to reveal the final 'constraints on underlying materials' (as London put it), since music history teaches us that a few years after something has been deemed 'unperformable,' it becomes a regular feature of student concerts.[705] For any more 'nested' task I would resort to the familiar strategy of drawing gridlines and thinking 'I'll place that a bit before / after the line' — a strategy that carries the risk of arbitrariness and entrainment to a false metric that I mentioned back in 2.3.4.3. If you were minded to do so, you could approach **Task 5** with a Keller-type strategy of division of labour and approach it as a duet: one player (the 'conductor') takes responsibility for the placement of the first attack of each element, governing the overall pace of change, while the other dictates the second attack of each group and controls the level of inner 'bounce.' (The players should then swap roles.)

Although these kinds of rhythms are quite commonly heard in free improvisation, I haven't encountered many compositional demands for them, possibly because they are so awkward to express in conventional divisional rhythmic notation. The fearless outlier Benedict Mason has explored rhythms of this type throughout his career, starting with *Hinterstoisser Traverse* for twelve players (1986).[706] Being understandably

[705] E.g. Ligeti's *Études* for piano.
[706] Only a single pitch (G4) is used in this piece.

sceptical of the power of notation alone to communicate these rhythms with the appropriate tolerances, that composer has consistently employed highly detailed clicktracks containing rapid multi-level subdivisions with extremely frequent tempo changes. Through the use of multiple simultaneous clicktrack channels, he has sought (in some pieces, not all) to nail down inter-musician micro-timings, avoiding the need, or opportunity, for the sportive split-initiative rhythmic work of the sort discussed above. While that is probably the only way that these pieces can be rehearsed and performed given real-world constraints on rehearsal time,[707] the use of clicktracks has had the side-effect that the very musicians who would otherwise have savoured these rhythms the most have been prevented from internalising them and bringing them into their sets of portable musicianship skills. This was dramatically the case in that composer's *Ensemble* for three ensembles of identical instrumentation (2013),[708] a project which united the forces of Ensemble Modern, Ensemble Musikfabrik and Klangforum Wien, but which — despite its glorious effect in the hall — handicapped those formidable musicians by gluing them so firmly to their clicktracks that many of them plaintively asked me afterwards 'how did it sound?'

A: You make it sound like these types of rhythm are as rare as giant pandas. Maybe we shouldn't worry too much about practising them.

B: Nevertheless, we hear and feel them every day: think of a dropped ping-pong ball bouncing away, the relationship between the systole and diastole periods of the heart, the not-quite-regular crash of waves on the shore, a dripping tap… It seems likely that NI rhythms — particularly those that I've called enticingly close to isochronous ones — will continue to intrigue composers, since at time of writing I detect a dual fatigue in the artform: a widespread sense that the square rhythms that divisional Western notation yields most readily have been played out, and also that the ultra-black notational practices associated with 'new complexity' are increasingly unappealing. Consequently, I'd cautiously predict that NMP trainees should dwell on these types of rhythm more than their current use might imply, even if I'm unsure how tomorrow's composers will attempt to provoke them.

Let's fall back on our expressive defaults, allow ourselves a gentle *rallentando al fine*, and briefly look at some scenarios of rhythm that have escaped our notice so far.

[707] Some of Mason's rhythmic effects would remain only possible through the use of simultaneous non-aligned clicktracks, even if months of rehearsal were to be available. For example, in *felt* | *ebb* | *thus* | *brink*| *here* | *array* | *telling* (2001), the players, walking while playing kutu-wapas, formed a circle. They then played a series of circular 'sweeps' at various speeds, each player striking their kutu-wapa a few milliseconds after their neighbour. This would have been impossible to achieve through watching and responding; the reaction speed necessary would be superhuman. In this case the use of simultaneous computer-controlled clicktracks was both unavoidable and effective: each player received a simple 𝅘𝅥𝅯 count-in for each strike.
[708] First performed May 3, 2013, Cologne, Staatenhaus am Rheinpark, in the festival ACHT BRÜCKEN | Musik für Köln.

7.3 Using anything other than rhythms to find rhythms

A: You promised that we'd move in the opposite direction to the pitch dialogue, and here we are at the equivalent of 6.3.1 ('using anything other than pitches to find pitches.')

B: You'll be relieved to hear that I don't have nearly as many scenarios as I did there. That's partly because the sub-scenario **speed camera** takes account of gridding situations where the speed limit is given by a physical technique (something other than rhythm), so I won't repeat those examples. A related scenario is **wah-wah**. This is where the speed and nature of a rhythm is determined by dynamics; more specifically, the decisions of ensemble members about what constitutes a dynamic peak. I know that sounds a bit mysterious, so here's an idealised example with two contrasting instrumentations. The players enter when they judge that their neighbour has reached ***mf***:

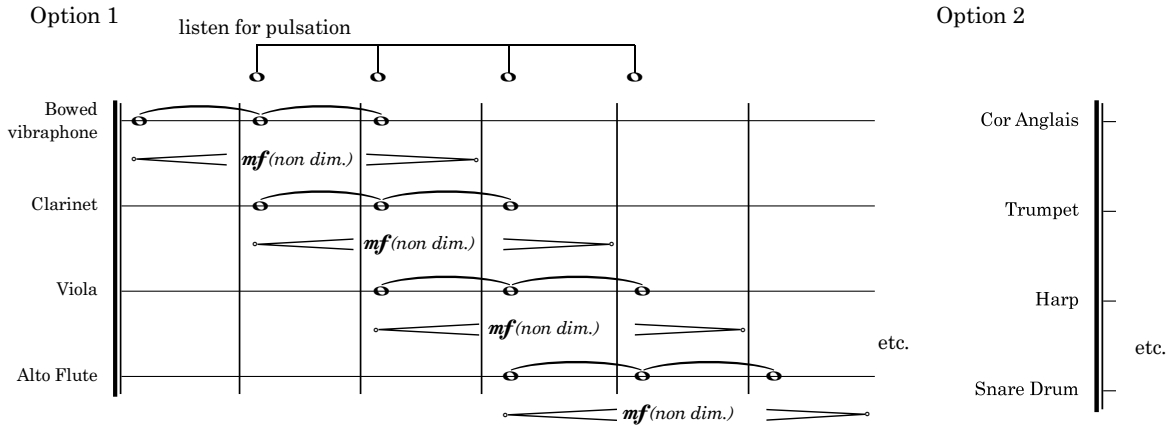


Figure 98: Contrasting varieties of **wah-wah**

A: Isn't that much the same as the *dal / al niente* exercise back in Chapter 3?

B: Yes, and in fact I've used similar suggested instrumentations. When we were concentrating on the transitions themselves, these two instrumentations were seen as '1: easy' versus '2: difficult' options. This time though, instead of focusing on the transitions themselves, we can focus on the nature of pulsation that the exercise yields. So the opposition is more like '1: slow' versus '2: fast,' (or maybe '2: jagged.') Because in both cases the instruments are so different the resulting pulsation will be quite irregular; gridding certainly doesn't apply here. (There might well be situations where a composer has written multiple successive *dal niente* entries that do call for gridding, but in those cases our triage process tells us to prioritise the rhythmic grid and sacrifice, if necessary, the sound: the oboe might speak 'too early' or the bowed marimba 'too late,' but we'd choose not to adjust the rhythm to compensate.) The result of wah-wah will be, by definition, unpredictable — as well as being formed of emerging sounds, it is an emergent phenomenon[709] — but still

[709] *Emergent phenomenon* is a key term in complex systems theory. Although the concept has a long history (see 'Composition of Causes' in John Stuart Mill, *A System of Logic* (1843)), the term 'emergent' was first used by George Henry Lewes in 1875 in distinction from the merely 'resultant': 'Every resultant is either a sum or a difference of the co-operant forces; their sum, when their directions are the same – their difference, when their directions are contrary. Further, every resultant is clearly traceable in its components, because these are homogeneous and commensurable. It is otherwise with emergents, when,

can be managed to an extent. Without intervention such inter-musician attentiveness will lead to slowing and eventually stasis ('After you Claude!—no, after *you*, Cecil!') Consequently a measure of bravery and optimism will help to counteract this tendency: players of 'Option 2'-type instruments should be able to trust their more flexible Option 1-type colleagues to help them integrate (by reaching their dynamic peak earlier to conceal an entry, for example.)

Wah-wah is most obvious where players actually enter *dal niente*, but it also could arise mid-phrase where crescendo peaks convey musical meaning, as in many spectralist-influenced pieces. Even in cases where the notation appears to be highly rhythmically prescriptive, triage might well lead us to employ **wah-wah** instead. I witnessed this when rehearsing Tristan Murail, *Les Courants de l'espace* for ondes Martenot, synthesiser, and small orchestra (1979.) The composer was the soloist, so questions of authorship were (as usual) up in the air: in many passages Murail strongly overrode his own detailed and idiosyncratic rhythmic notation[710] in favour of allowing the sounding peaks of the ondes, synthesiser, and orchestra to determine the time structure rather than the reverse (i.e. attempting to execute them in the allotted time.) The scenario might also be applied to situations where we have a high degree of sensitivity to where we feel the *ends* of notes to be. These are not, of course, identical with the moments that the bow or the breath stops, since each sound leaves a reverberant trace: at first a measurable acoustic one, and then its continuing afterglow in our memory. These considerations were explored by Morton Feldman in *On Time and the Instrumental Factor* for orchestra (1969),[711] but I'd suggest (as ever) that we shouldn't wait for a composer to direct our attention to them, nor assume that they only, or even principally, apply to contexts where a composer has deemed them to be of special interest.

Wah-wah usually plays out in ensemble contexts, although I suppose a solo performer might use the scenario when they are managing a multi-timbral instrument such as a heavily prepared piano (*I'll wait for the sound of the e-bow to emerge, then the rosined glass turning on the strings, then the dragged superball mallet, and see what kind of pulsation results*…) In that it encourages us to abandon small-unit subdivision, it is most relevant to musical practices where gesture and sound are treated phenomenologically: that is, where a local concentration on sound and its interface with silence is foregrounded and considerations of meter are deprioritised. That's my rather crude attempt to group the rhythmic practices of composers such as Jürg Frey, Eva-Maria Houben, Michael Pisaro-Liu (and their Wandelweiser network), but also of Éliane Radigue, and seemingly of any situation where an analogue synthesiser is on stage — in short, the sort of music we'd

instead of adding measurable motion to measurable motion, or things of one kind to other individuals of their kind, there is a co-operation of things of unlike kinds. The emergent is unlike its components insofar as these are incommensurable, and it cannot be reduced to their sum or their difference.' George Henry Lewes, *Problems of Life and Mind. First Series: The Foundations of a Creed*, vol. 2 (Boston: Osgood, 1875), 369.

[710] For Murail, the basic unit is the ♩ instead of the 𝅝 of conventional Western notation, so a 𝅗𝅥 would imply ♪♪. Although confusing on first sight, the approach significantly reduces the notational complexity of rapid (and fundamentally NI) ebbs and flows.

[711] According to Feldman's programme note, 'The sounds were written directly for the instruments rather than being conceived as a grouping of interlocking sounds on the piano and then orchestrated. At first, the sounds were written one by one as a non-metrically measured unit. That is, in a non-time chronological series. I then structured each sound in terms of its acoustical reality (how long it takes to "speak") and found a pulse in which they could then breathe without tension, gravity, or the feeling of a beat. In effect, I was primarily concerned with the natural time duration of each sound in its relation to a corresponding instrumental timbre.'

be more likely to encounter in London's Café Oto than the Wigmore Hall. Because that music is usually performed by musicians who identify as creative in various ways (improvisers, live composers, etc.), and not members of the main cohorts of NMP trainees on the programmes listed in 1.2, they're therefore not the main audience for this text.

I'll briefly point to a related scenario which is at the very limits of this chapter's scope: when there are events in time (so much is unavoidable), but where the performer places them with the intention of evoking no sense of pulsation whatsoever. We've already mentioned Percy Grainger's 'beatless music' (4.1.1); over a century later Jennie Gottschalk comparably described music for which time is 'not a duration to mark, but a space to occupy.'[712] I can't improve on that, so let's borrow the phrase and call this scenario **space-occupying**. I have noticed that expert percussionists who play this repertoire seem to move their arms in slow, buttery-smooth, continuous ellipses; these smooth out the time between attacks and deliberately exclude the possibility of small-unit isochronous thinking. Aside from my brief comments on the sense of suspended time in Cage's *Atlas Eclipticalis*, and my observations of very slow *janggu* playing in 2.3.4.2 above, I'll leave further discussion of strategies in these contexts to better-qualified performers.

A: What about all that discussion of rhythm's interaction with other musical parameters back in 4.1? Surely that's what you mean by 'using anything other than rhythm to find rhythms'?

B: These, too, are usually variants on the **duck-rabbit** scenario. I gave Czernowin's *Sahaf* — the piece with the ratchets — as an example *par excellence* of timbre-rhythm interplay. The rotation of the ratchet may smoothly increase from individual clicks to a whir, speaking perceptually. But from a performer's point of view we can benefit from consciously deciding where (for us) the sorites transition from 'grains of sand' to 'heap' falls, because this can help us reliably time our interventions in the transition — just as in the 'ziggurat' approach to accels and rits I proposed. Comparably, in the scenario **wobble-dosing** (pitch-finding using interference beating) I proposed that it's advantageous to model this as a leader-follower duet, and for one party to stay as static as possible while the other moved. Whether it's a situation where the 'wobble' is accelerating (where the pitches are separating from each other) or slowing (where the pitches are joining), in order to gain expressive control, we can set known points along the transition: *on beat 2 of the bar, I will dose x amount of wobble.*

A: I'm happy to leave it there if you can't think of any more examples…

B: Last one. The last scenario in the pitch dialogue was **look-it-up**, and here it is again.

A: **Look-it-up** this time meaning using a metronome or a clicktrack? We've talked about that a lot already. And how does that come under 'using anything other than rhythms to find rhythms'? It's literally the opposite of that!

[712] Gottschalk, *Experimental Music Since 1970*, 135.

B: Are you sure you're not conflating perception and performer experience when you say that?

A: I see what you mean. A metronome isn't doing rhythmic work, it's just ticking along.

B: Metronomes and clicktracks provide references that are external to our rhythmic armatures, even if we make such heavy use of them in our preparation to the extent that they might become part of our set-up. Even when we actually use a clicktrack in performance, we don't (or shouldn't) simply follow it, any more than players simply follow a conductor's control of time — whatever Lydia Tár says. I find it a useful idea to imagine the clicktrack as an extra percussionist, and to fool myself that I'm actually producing each click with my gestures in the same way that I'd connect with (for example) the cowbell player in the first movement of John Adams' *Chamber Symphony*. So, obviously, I must be anticipating the clicks — including as they change tempo — although I don't feel it in that explicitly-projective way. It may sound odd, but I usually don't make much use of **look-it-up** when I'm obliged to use a clicktrack (for example, when there's a need to synchronise with a very detailed video track, or in the case of the kutu-wapa multi-player swirl effect in the Benedict Mason example in footnote 707 above.)

A: So when do you use rhythmic **look-it-up**, then?

B: In any situation where I have reached the limits of my own capacities to help myself, and so feel the need to outsource the problem. This scenario is a wastebasket category into which I throw all my least tractable problems, such as where gridding is taken to ultra-extreme scales (e.g. the maintenance of steady pulse within very narrow tolerances across very long periods, such as when spending several hours recording a very tempo-sensitive composition, or the need to record dozens of orchestration extracts at identical tempi in the ACTOR collaboration I referred to in footnote 373), or where two NI rhythms are overlaid in such a way that they meet at particular, noticeable, points. As I note in the next and final section, **look-it-up** may also be useful in targeted self-therapy: *I know I tend to drag slow septuplets, and I'm working on it.*

7.4 Dragged back to the calculator, pencil, and metronome

> Would you please please please please please please please stop talking?
> Jig, in Ernest Hemingway, *Hills Like White Elephants* (1927)[713]

B: In this dialogue I've attempted to go beyond, or at least to straddle, the opposition that we identified at the start between the 'ideal kilogram' and the 'prompted by scripts' approaches to rhythm, in the hope of providing a meaningful goal that the rhythm elements of NMPT-focused musicianship might aim towards — *gradus ad?* However, I must admit that in my own practice I have not been entirely successful in maintaining this strategic ambiguity, because I am continually pulled to one side by the weight of my own training — my *déformation professionelle* — and by the immediate practical demands of the situation.

[713] Ernest Hemingway, 'Hills Like White Elephants,' in *Men Without Women* (Cleveland and New York: World, 1944), 76.

A: You mean that you still spend most of your time decoding and replicating in a Boulez/Reina-approved way, even if you know that other approaches are possible.

B: Precisely. I led 2.3.4 with a quote from Mark Delaere about the paradox of the neglect of rhythmic training in a 'quintessentially temporal artform' — what Hartenberger called the '5% Quandary.' In the discourse of performer pedagogy, the difference between the conceptual (over?)sophistication of writings on pitch and the way rhythm has been documented is dramatic. While in pitch I felt the need to clear a path through thickets, in rhythm I needed to place stakes and trellises in poorly-prepared ground. That's my excuse, anyway, for the relative diffuseness of Chapter 7 versus Chapter 6. It's hard not to agree with Hartenberger that the legacy of historical racism is detectable here, alongside classical music's (and NMPT's) history of ignoring insights that other musics can offer. For that reason, although I've stressed the great variety of potential ways of 'doing time' in this dialogue, including an emphasis on cherishing fundamentally NI rhythms, in real-world training contexts I actually recommend quite a rigid approach favouring repetitive practice of what I've called workflow difficulties, and with tight tolerances about what counts as acceptable. I'm particularly careful to check that simple-looking tuplets, such as triplets and quintuplets, are given appropriate attention.

A: I thought you struck quite a dismissive tone about workflow difficulties. You used the words 'only' and 'mere' a few times.

B: If I did, it was in order to make a point, and I apologise. I only meant that they are conceptually simpler than the other ways of doing rhythm we've discussed here, such as the 'duetting' approach I suggested in the Keller and Mayr examples. Rhythmic difficulty is a very difficult concept to grasp, and I think that we are only at the beginning of our understanding of it. At times in this discussion, and often in my performing practice, I have felt my own lack of musicianship-led NMPT acutely. For example: such is the power of my default responses to notation that sometimes I fall into elementary traps, even when I recognise them as such. One score asked for ♪=72 followed by ♩=68. The danger is obvious: this is a near-double-tempo situation, and also a *poco meno mosso*. But my traditional classical training never led me to question my tendency to bundle tempi into categories of 'fast' and 'slow' (e.g. through **duck-rabbit** thinking), so the transition still feels bothersome. In my interactions with performers (both student and professional) I encounter similar situations frequently.

A: But you can override such tendencies through targeted, interventionist, practice, can't you? That's what you called 'un-learning' (4.1).

B: There are situations where this unlearning process still feels terribly awkward. Here is a short passage from Vito Žuraj's monodrama *Ubuquity* for soprano and instrumental groups (2013/2018). The intended effect is of a madcap, vulgar, drunken waltz, but it's best for the performers to stay sober:

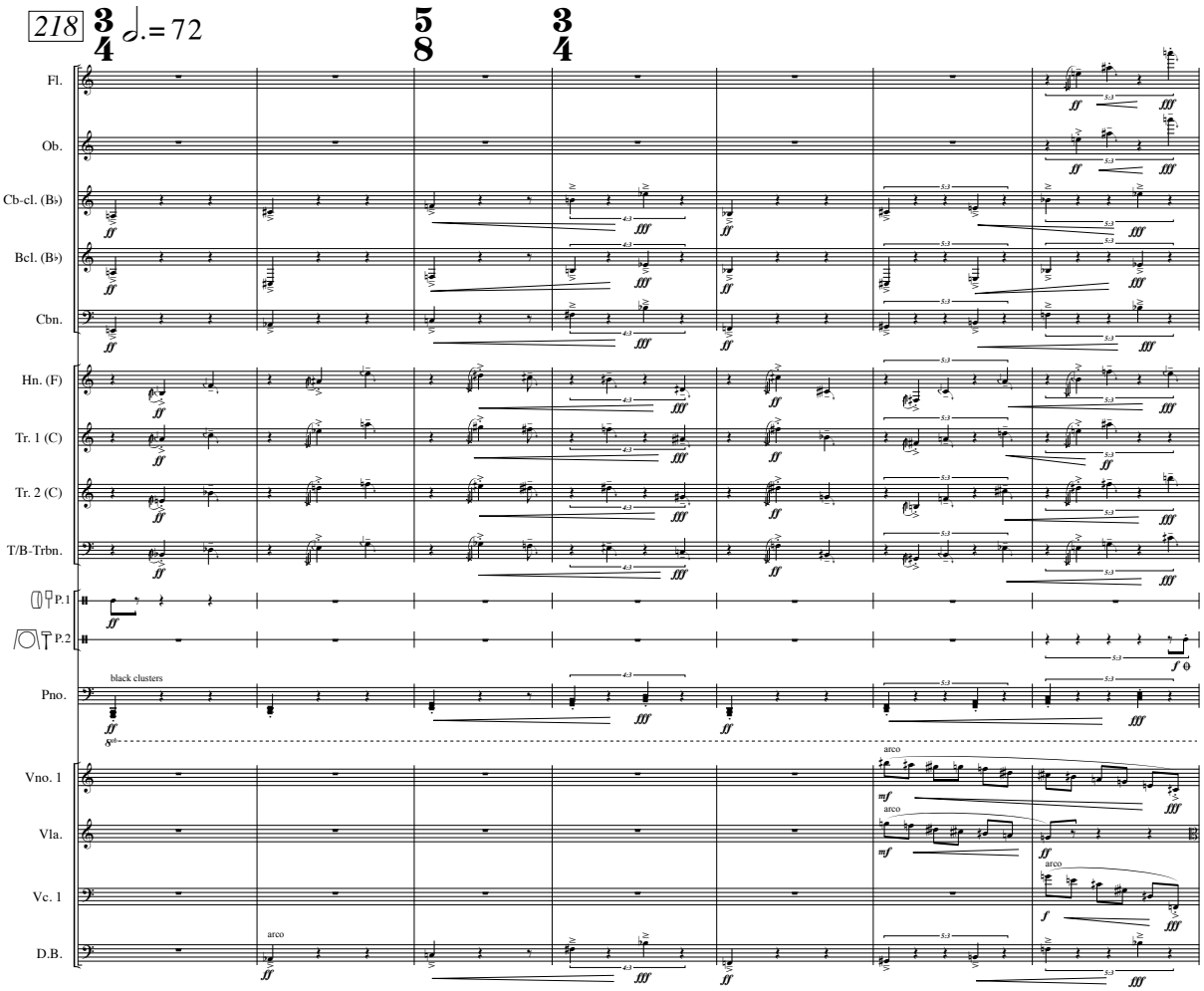


Figure 99: Vito Žuraj, *Ubuquity* for soprano and instrumental groups (2013/2018), bars 218-224.

From the outside, the $\frac{3}{4}$ and the $\frac{5}{8}$ bars look like they are broadly conducted 'in 1,' although a conductor can convey a lot of internal subdivisional information here. This signals a universally-recognised danger-zone: passages that are too fast to beat in 3, but too slow to control well in 1. The real trouble arrives with the ♩s under the 5:3 brackets,[714] which clearly need to sound together, and whose difficulty of execution is severely compounded by the hocketing in-and-out orchestration.

A: Solving such problems should be just another day at the office. Remind everyone to think through the complete tuplet rather than just their attacks…

B: Hey, I gave you that advice earlier! No, what I (and the players) found worrisome was that those 5:3 ♩s go improbably fast. If 𝅗𝅥.=72, normal ♩s are 216 ppm (each lasting 278ms) and ♪s are 432 ppm (each lasting 139ms). The 5:3 ♩s run at 360 ppm so each lasts 167ms — that is, a difference of 82 ms to ♩s but only 28ms to ♪s, meaning that they are almost three times closer in duration to ♪s than ♩s. So, while they are obviously

[714] Readers may feel that the transition between bars 220 and 221 is already sufficiently awkward. This may be alleviated by thinking the $\frac{5}{8}$ as a 2+3 (♩ ♩), then continuing to think ♩. s in bar 221 (with the rhythm conceived as a ♪ ♪ ♩. ♪ rather than a 'floating' quadruplet.)

better thought of as slow ♪s than fast ♩s, as a player who shared my glitchy thinking said to me in frustration — *they still look like bloody ♩s!* The ♩s were in our guts, and the ♪s in our brains. I had actually already done the calculation in my score-preparation process, and was also aware that I could mentally re-notate bars 221-224 as a trivial:

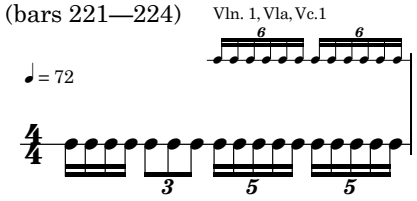


Figure 100: Bars 221-224 of the same passage, re-notated.

So you might say that I have no excuse when I admit that I still felt, and continue to feel, that the 5:3 ♩s are implausibly fast here. While this is definitely my problem, it also confirms the desirability of (simple, didactic, workflow-orientated) dedicated NMPT at the earliest possible stage in a rhythm-training journey. And it's not just me. To speak very frankly, I have encountered professional musicians for whom it's come as a surprise to notice that ♪s are longer (or slower, if you like) than ♩s.[715] I agree with Reina's diagnosis that rhythmic training has been systematically neglected, even if our approaches to addressing this neglect differ.

A: I hadn't realised we were allowed to put the blame on our instructors!

B: Feel free, I'm almost done here. It is probably too late for me to change the faulty defaults that my classical training gave me. The best I can do is to be conscious of them and intervene as necessary to correct them. (In this case I used **look-it-up** and programmed the extended passage, which contains many comparable moments, into João Pais' Click-Tracker for my preparation.) In the process at least I feel that I'm learning something and improving myself, so it's positive if sometimes painful!

A: 'Positive if painful' — we could hardly end on a better summary of these dialogues.

A and B: In which case we can stop pretending we're different people. Let's dissolve back into each other and try to present a unified voice for a brief Afterword.

[715] It is irresistible to compare this with the (often told, hard to verify) story that the restaurant chain A&W's Third-of-a-Pound Burger, launched in the 1980s as a competitor to the McDonald's Quarter Pounder at the same price point, failed because a significant number of North Americans thought that the A&W burger was smaller (because 3<4.)

Chapter 8: Afterword

Even though I have defended the right to generalise and not justify every point with reference to authorities — indeed, I see it as an educator's responsibility to do so — this has been a long and discursive text, requiring much patience on the part of the reader. With this in mind, I now summarise the argument so far without further justifications or qualifications. Following this, I suggest ways that the NMPT model I have proposed might be implemented. I politely ask any reader who has skipped forward to this chapter (as suggested in the Preface) to note that each blunt point has been argued for at length and with many examples given and counterexamples acknowledged, and to take this into account in any future citation of this summary.

8.1 A summary of the argument

The twentieth-century ad hoc model of NMPT is inadequate and widely acknowledged to be so (1.1.) Accordingly, various replacement models have emerged (1.2.) These have not yet received significant scrutiny or evaluation (3.1), nor is it clear that any existing framework would be entirely appropriate for this task (3.2.)

The provision and and quality of resources to support NMPT is highly imbalanced (2.) There exist detailed, wide-ranging, high-quality instrumentally-specific resources to support trainees as they acquire instrumental skills (2.2.) On the other hand, the provision of non-instrumentally-specific (musicianship) resources is sparse in coverage and uneven in quality (2.3.) This is due to two related obstacles: the post-spectralist consensus, relating to new music's characteristic materials (4.1) and the gestural consensus, relating to its characteristic procedures (4.2.) Additionally, behavioural taboos among new music performers have tended to inhibit the production of such materials (2.4.2).

Any attempt to provide materials to support, or to evaluate the performance of, NMPT providers must first identify who or what the instructor actually is. This is a non-trivial task (3.) The ad hoc model casts the composer as the final instructor, with performer-instructors playing the role of technical support. Models of NMPT that approximate orchestral training pathways, both within and outside conservatoires, rely on that pathway's self-organising 'assembly line' to play the instructor role (3.2.) Due to the fundamental differences between orchestral and new music practices — in particular the silo-effects of the traditional division of instrument families — this reliance can leave trainees with significant gaps in knowledge and musicianship skills (3.2.) Instrument-performer actants, institutional structures and ambiences, and peer interactions, rather than charismatic individuals, are the real primary instructors (3.1.) Despite the importance of acknowledging the distribution of the role of the instructor, individuals can play a vital role in ensuring that any gaps in skills and knowledge within this distributed instructor are swiftly identified and addressed. A person who takes such a role is referred to here as a NMPT caretaker (3.3.)

Since there is more common practice in new music than composers are structurally motivated to accept (3.2), a caretaker is not obliged to reconceptualise their role for every project and pedagogical interaction; however, due to the relative absence of NMPT-focused conceptual vocabulary, they may feel it necessary

to do so at present. To meet this need, this text has offered a conceptual vocabulary for the consideration of NMPT caretakers (5), and samples of how these concepts might be brought into pedagogical effect in the training of skills of pitch and rhythm via dialogues and exercises (6, 7.)

The scope of the notion of musicianship developed in Chapters 5, 6, and 7 is much wider than the comparatively-reduced role of the musicianship teacher in most current performer training models, in NMPT and non-specialised courses alike (2.3.1.) Most notably through the use of the scenario concept, musicianship here encompasses many aspects of practice that have traditionally fallen under the heading of interpretation. Common themes in Chapters 6 and 7 include:

- The importance of instructors developing a strong sense of performer agency in their trainees, and the confidence to make decisions without always referring them 'up the chain of command' to the composer.

- A strong sense of the distinctness of two characteristic musicianship skill-sets: slow thinking (associated with composition) and fast thinking (associated with performance). Notwithstanding the ongoing broad move to elide the categories of composer and performer, these ways of thinking remain distinct, even while professional identities shift.

- An emphasis on the value of a performer making conscious interventions in their own practice. Terms such as 'inquiry stance' or 'reflective practitioner' (3.1) seem too mild to describe the intensity of the interventions described here, which are less motivated by the desire to document and understand, and more by the pragmatic demands of preparation for a competitive professional performing career. A more appropriate term is cognition-in-action, in the sense developed by Montero (4.2.) Instructors should try to equip trainees with the tools to perform such interventions. The exercises in these chapters are attempts in this direction and should principally be viewed by instructors as prompts to construct their own tools. The dialogic approach developed in Chapters 6 and 7, although presented as an interaction between two people (an instructor and a trainee) is really the learning journey of a single person who has found it useful to split themselves in this way with the goal of self-improvement. The proposed approaches to many of the musical difficulties described in these chapters involve comparable acts of conscious splitting-and-intervening. A few of these included:

    - the attempt to decouple fine pitch work (tuning) from its associations with slow time (6.2);

    - the suggestion that some ensemble rhythmic difficulties are best resolved by splitting initiative between members of a group, with clear apportionment of responsibility (7.1);

    - the recommendations that gradual changes of pulse (as notated and perceived) are often best approached through conscious quantisation (7.2.2.2), and that a performer may profitably approach pitch alterations that initially seem (and sound) smooth via the use of known units of cognition-in-action (6.3.3.1);

- and above all, the recommendation that, in the face of musical demands that initially seem infinitely varied and only approachable on a case-by-case basis, it is advantageous for a performer to build and maintain a memory palace of distinct and bounded scenarios (5.9, 6.3, 7.2.)

These are all examples of 'against the grain' or anti-'just-do-it' thinking: they involve imposing LEGO-like (4.1.3) artificial structures (often binary and oppositional in nature) on materials and procedures that a sophisticated discourse has deemed to be irretrievably plasmic (4.1.)

While a musicianship skillset focused on new music will be distinct from those relating to other repertoires, this project has indicated that it can be profitable to cast the net very widely in search of NMPT-relevant features and procedures that may be incorporated in such a skillset, either through direct use or as illuminating contrasts. Those used in this text have included: historical temperaments, orchestral practice in Dvořák and Mahler, EDM, non-isochronous traditional musics, Karnatic pedagogy, assorted solfeges, commercial pop music, phonological rhythm, and barbershop. Many more synergies and contrasts remain to be discovered and/or documented.

8.2 Notes to myself: for action

How might a caretaker put this model into practice in a real-world institutional NMPT programme? I phrase the following as a series of notes to myself, attempting to answer the question *Gradus ad?* (Steps to?) of my title.

- If I am intervening in an existing institution, I should first try to understand how NMPT currently unfolds within that institution. Who or what is really teaching at present? Is the provision solely of the *ad hoc* work-by-work type that favours Parnassian thinking? If not, what musicianship training is offered?

- If the institution does not offer appropriate musicianship training, I should attempt to destabilise any prevailing assumption that the preparation and production of a series of concerts is the inevitable primary mechanism of such a course. In particular, I should look for cases where concert repertoire had been chosen with reference to any consideration other than the pedagogical needs of the NMP trainees, and try to resist falling prey to such external pressures in the future.

- The current tendency within conservatoires is to move NMPT into 'institutes of new music,' with the aim of increasing contact, knowledge exchange, and opportunities for collaboration between composers and performers. Since this seems to indicate a seriousness of intent about NMPT within these conservatoires, and since it reflects the overall direction of travel in the artform outside such institutions, I should strongly welcome and indeed push for the continued development of such institutes. At the same time, I should be aware that the formation of repertoire-specific institutes makes an existing risk more acute: among the potential 'external pressures' to avoid when curating programmes, I should be unafraid to include pressures from individual living composers, some of whom may be (newly close) colleagues in such an institute. I should ensure that any composer-initiated projects that my NMP trainees become involved with as part of their training, including those that promise 'collaborative,' 'devised,' and 'process-led' working methods,

contain content with sufficient cross-project applicability to make them pedagogically appropriate for training performers, and do not in reality reinscribe restrictive working practices in which it is the assumed responsibility of the composer to set the rules of engagement and aesthetic priorities of a project, and the performers to follow these rules and embody these priorities. Since no institute could contain among its composers a representative cross-section even of European new music practice, I (in my caretaker role, scanning for gaps in provision) will need to remain highly aware of new music activity outside that institute, bringing in as appropriate external voices with attitudes that may contrast with or even conflict with those of colleagues, in order to ensure that my trainees are adequately prepared for a varied performing future.

- Accordingly, within my NMPT practice — in strong distinction to my professional performing practice — I should deprioritise projects that focus on meeting the demands of individual composers. In their place I should construct a series of workshops open to all NMP trainees (instrumentalists, singers, and conductors, and also identity-fluid composers.) When planning these workshops I should strive to create a coherent musicianship curriculum which is as broad as possible, while at the same time resist making claims about universal applicability of the skills under development.

- I can draw the content of these workshops from Chapters 6 and 7 of this text, and to a lesser extent from the discussion of parametric separation in Chapter 4. (A Chapter 8, dealing with NMPT approaches to timbre and sound, exists in sketch form but was not included here for reasons of space.) The exercises may be used in the form they appear, if presented with proper explanation and contextualisation, or may be extended or simplified as appropriate. The score extracts in this text were selected from a larger database of examples and heavily edited in the interests of narrative flow; for every proposed scenario, I can offer further examples from this database, seeking out those that call for the principal instruments played by participants. **A** and **B**'s dialogues are highly idealised and artificially structured projections of the kinds of interactions that might unfold in these workshops. Due to the constraints of the written format, **B** lectures much more than they should; there was no room to develop a fully Socratic pathway to every epiphany they hoped to spark in **A**. **A** enters the dialogues with far greater awareness of many matters treated here (e.g. tuning theory, and the terms used by theorists of rhythm) than any NMP trainee I have met as yet. Consequently, I should avoid lecturing like **B** does, and ensure that in my initial interactions I do not presuppose that trainees will have **A**'s level of awareness. I should ensure that all participants take an active and roughly equal role in these sessions: the traditional observer/participant distinction (as often found in masterclasses, for example) does not apply in this hierarchically-flattened approach.

- To avoid unwelcome surprises and/or the creation of a sense of mystique around an unfamiliar pedagogic process, I should ensure that all trainees, as well as colleagues in the institution, are made aware in advance of the practical requirements and subject matter of these workshops. A medium-sized rehearsal hall is required, with a circle of music stands and chairs. A large screen will be necessary to show score extracts, as well as facilities for audio playback. All trainees should bring their principal instrument but also be prepared to sing, tap, speak, and think. I should ensure that trainees receive their materials in advance, appropriately marked with warnings that they will not be expected to understand the content fully until the workshop itself.

- Although I will not relish the task, I will need to help the institution develop a structure of assessment that is as fair and well-understood as possible. The assessment criteria currently in use in NMPT programmes in conservatoires have not been yet adequately compared and evaluated, including in this text.[716] Those that I have seen and participated in encode a fundamentally Parnassian evaluative framework (even if individual assessors diverge from it): the trainee is judged to be most successful when they have maximally conveyed the specific demands posed by the selected compositions. In many conservatoires this is referred to as the 'final recital' model (there exist cognates in European languages: e.g. *examen* in French.) It would not be in the best interests of trainees if I were to reject this framework wholesale, since it prepares them for many real-world performing situations. However, I should also ensure that the trainee's learning journey in the course of the workshops forms part of their assessment. Active participation in these workshops, including self-examination and constructive feedback on the contributions of others, should itself count as a outcome with associated credits (e.g. in the ECTS and comparable systems.) In addition to this participatory credit, some skills developed in the workshops have relatively narrowly-definable learning targets. The degree to which a trainee has acquired these skills may be assessed directly. The distinction I have proposed here between solo difficulties and ensemble difficulties can help inform me in determining which skills may be meaningfully assessed individually, and which would need to be assessed in an ensemble context. The former set concern an individual's closeness to a fixed (non-human) reference (e.g. to notation considered in the positivist sense), while the latter set involve two or more human 'moving parts.' In attempting this division, I should not feel inhibited by the current tendency to privilege (putatively) 'transformative' pedagogy above 'transfer,' since some of the most narrowly-defined, rigorously-assessable musicianship skills may be applied in very open and exploratory performing contexts (3.1.)

- Despite the intensity of such teaching-and-assessing work, I should remind myself that musicianship is only one element of an NMPT programme, and — although I have diagnosed it as especially structurally neglected and in need of additional attention and care — the other aspects of such a programme, including those voiced in the Preface by members of my professional network — remain important. With my overview of current institutional NMPT (1.2) in mind, I should recall that the most active and innovative courses seem to be those led by groups of actants with a high level of intra-group awareness, and not by individuals. Consequently, as an individual, I should aim to help create the conditions where such healthy networks can arise. In my personal reflections, I should also try not to lose sight of the wider social context and function of such programmes; despite the granular attention I have devoted to some details of new music performing practice in this text, other, stronger, social forces are also in play.

- Finally, although I cannot ignore the headwinds that currently threaten the existence of institutional NMPT and the flourishing of new music performance itself in some societies (including in my native country, the United Kingdom), I should remember to remain optimistic and to take pleasure in what I do. Our steps may not lead to the summit of Mount Parnassus, but, nevertheless… onward and upward!

§§§§§

[716] I have participated in assessment processes as external advisor / examiner / jury member in only four conservatoires in three European countries. This is insufficient to provide a balanced view; a future wider study would be strongly desirable.

Appendix A Consent form signed by interviewees

Identifying, systematising, executing, and communicating core skills in contemporary music performance

Information sheet and consent form

What is the study about?

The main aim of the research is to create a pedagogic resource ('workbook') to be used by students and teachers of new music performance. The workbook will contain progressive techniques for improving the student's musical *ensemble skills* — i.e. the skills that are not unique to a particular instrument. These include skills of performing: microtones, complex and/or delicate rhythms, and the ability to apply 'spectrogram-style hearing' when negotiating the overlapping territories of harmony, timbre, and noise.

In order to contextualise and focus the workbook's content, leading figures in new music performance and performance pedagogy have been selected for interview. Interviewees will be asked about their own pedagogic practices and priorities, what in their view constitutes good and bad practice, and the adequacy of existing institutional structures to support good practice.

Who is carrying out the research?

The primary researcher is Clement Power, conductor and PhD researcher at the University of York, under the supervision of Dr John Stringer and Professor Bill Brooks. The project is funded by the White Rose College of the Arts & Humanities (WRoCAH).

How will the research be carried out?

Interviews (1—1.5 hours in duration) will take place in person or over Zoom. Audio will be recorded and transcriptions made available to participants. You will receive compensation for your time, paid at your teaching / consultation hourly rate (up to a maximum 70 GBP/ 75 EUR per hour).

How will the research findings be used?

The main use of the data is to inform the researcher in the construction of the workbook. In addition, the content of interviews may be quoted in the accompanying thesis. This thesis will be published via the open-source platform etheses.whiterose.ac.uk.

Will my contribution be confidential and anonymised?

Quoted material from the interviews will be *anonymised* in any public presentations of the research, including published work or data archives, unless the interviewee expresses an explicit preference otherwise. 'Anonymised' means that not only the names of interviewees will be concealed (quoted as 'Interviewee 1' etc.) but also any context that might identify her/him: the names of institutions, dates and locations of performances, etc.

All data gathered will be stored securely, complying with University of York data management policies (available at https://www.york.ac.uk/records-management/dp/). The data collected will only be accessible by the primary researcher. Participants are free to leave the study at any point. Contributions will be removed from the record if requested.

THE UNIVERSITY of York

White Rose College of the Arts & Humanities
Universities of Leeds, Sheffield & York

Whom can I contact if I have any questions?

Should you have any questions about the study or your contribution to it, please contact Clement on clement.power@york.ac.uk or +44[redacted]. [telephone number redacted]

This research project has been approved by the University of York Arts and Humanities Ethics Committee. The Committee Chair is Professor Jonathan Finch, who can be contacted at jonathan.finch@york.ac.uk and the Department of Music Ethics Chair Mimi O'Neill, mimi.oneill@york.ac.uk

Consent Form

I have been provided with information about the study and contact details for the researcher, should I have any further questions.	☐
I understand that my participation in this study is voluntary and I may leave the study at any time without penalty and without giving a reason. Should I choose to do so, my individual contributions will be removed from the records and destroyed.	☐
I understand that all information I give will be stored in the data storage systems of the University of York, or in line with University data management policies.	☐
I consent to the information I provide being used by the primary researcher for the purposes of the study described in the information sheet and for publications or presentations where appropriate.	☐
I understand that, where my data is used, I will not be identifiable.	☐

Name……

Signature……..Date……..

Email address……

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Appendix B Some NMPT providers

Country	Name of organisation(s)	Organisation type	Name of degree programme (if relevant)	Web address	Notes
Austria	Kunstuniversität Graz / Klangforum Wien	Conservatoire, side-by-side scheme	Masters, Performance Practice in Contemporary Music (PPCM)	https://www.kug.ac.at	Tutors are members of Klangforum Wien (as 'Professor Klangforum')
	Impuls Academy	Residential academy		http://www.impuls.cc	Tutors from various professional ensembles, as well as prominent soloists
Belgium	Royal Conservatory and School of Arts Ghent / Ictus Ensemble / Spectra Ensemble	Conservatoire, side-by-side scheme	Advanced Master in Contemporary Music	https://www.ictus.be/projects/academy	Tutors are members of Ictus and Spectra ensembles
Estonia	Estonian Academy of Music and Theatre	Conservatoire joint programme	Masters in Contemporary Performance and Composition (CoPeCo)	https://eamt.ee/en/	Joint programme with RCM Stockholm, CNSMD Lyon, and HfMT Hamburg (1 semester in each institution)
Finland	Viitasaari Summer Academy, Time of Music Festival	Residential academy		https://musiikinaika.org/en/	NMPT provision depends on parallel festival projects
	Sibelius Academy, Helsinki (NYKY ensemble)	Conservatoire with teaching ensemble		https://www.uniarts.fi/en/	
France	Fondation Royaumont: Académie Voix Nouvelles	Residential academy		https://www.royaumont.com/centre-pour-les-artistes/musique-et-danse/	Main focus is on composition tuition but some NMPT is offered, depending on the project
	Haute école des arts du Rhin (Conservatoire Strasbourg) / Ensemble Linea	Conservatoire, side-by-side scheme	Masters, Techniques et interprétation de la musique contemporaine	https://www.hear.fr/	Tutors are members of Ensemble Linea (Strasbourg)
	European Creative Academy — Annecy	Short residential academy, masterclasses		https://europeancreativeacademy.com/	Some tutors are members of Ensemble intercontemporain (Paris)
	Conservatoire National Supérieur Musique et Danse de Lyon	Conservatoire joint programme	Masters in Contemporary Performance and Composition (CoPeCo)	http://www.cnsmd-lyon.fr/en-2/international/copeco-2	Joint programme with RCM Stockholm, Estonian Academy of Music and Theatre, and HfMT Hamburg (1 semester in each institution)
	IRCAM, ManiFeste Academy	Academy, workshops		https://www.ircam.fr/manifeste/academie/	Main focus is on composition tuition but some NMPT is offered, depending on the ManiFeste festival programme
	ARCO – Art, Research and Creation Opus: GMEM-Marseille / Salzburg Mozarteum / Ensembles Multilaterale / Les Métaboles / Tana string quartet	Conservatoire joint initiative, residential academy		http://arco21.org	2022 edition hosted by Salzburg Mozarteum
	Collegium21	Masterclasses for contemporary harp		https://collegium21.com/	
Germany	International Ensemble Modern Academy / Hochschule für Musik und Darstellende Kunst Frankfurt am Main (IEMA)	Residential academies, workshops, side-by-side scheme, conservatoire programme	Masters, "Internationale Ensemble Modern Akademie – Contemporary Music Performance"	https://www.internationale-em-akademie.de	Multiple projects per year. Full-time participants follow the one-year Masters programme at the Frankfurt Hochschule, others join per project. Hans Zender Academy opened 2021.
	Internationales Musikinstitut Darmstadt: Darmstädter Ferienkurse	Residential academy		https://internationales-musikinstitut.de/en/ferienkurse/ueber/info/	Tutors from various professional ensembles, as well as prominent soloists
	Studio Musikfabrik (officially Youth Ensemble for Contemporary Music of Landesmusikrat Nordrhein-Westfalen)	Non-residential (local) academy		https://www.musikfabrik.eu/en/academy/studio-musikfabrik/	Youth ensemble affiliated with / coached by Ensemble Musikfabrik. Admits participants prior to tertiary education.
	Hochschule für Musik und Theater Hamburg	Conservatoire joint programme	Masters in Contemporary Performance and Composition (CoPeCo)	https://www.hfmt-hamburg.de/start/	Joint programme with RCM Stockholm, Estonian Academy of Music and Theatre, and CNSMD Lyon (1 semester in each institution)
	Staatlichen Hochschule für Musik und Darstellende Kunst Stuttgart	Conservatoire	Masters in Experimental Performance Practice & Theory	https://www.hmdk-stuttgart.de/ https://campusgegenwart.de/	NMPT is offered via 'Campus Gegenwart' (encompassing composition, research, bodywork, and experimental practice)
	Hochschule für Musik Carl Maria von Weber Dresden	Conservatoire joint programme	Master Neue Musik	https://www.hfmdd.de/studium/neue-musik	Joint programme with Hochschüle der Künste Bern and Salzburg Mozarteum
	Hochschule für Musik Hanns Eisler Berlin / Universität der Künste Berlin	Conservatoire joint programme	Masters and modules for undergraduate study	https://klangzeitort.de/lehrveranstaltungen-komposition-udk-hfm/	The 'KLANGZEITORT' institute unites the two Berlin Musikhochschulen. Focus is creative projects but NMPT is also offered (e.g. microtonal ear-training)
	Hochschule für Musik und Tanz Köln	Conservatoire	Master of Music — Interpretation Neue Musik	https://www.hfmt-koeln.de/studiengaenge/master-of-music/master-of-music-interpretation-neue-musik/	NMPT offered via Institut für Neue Musik
	Folkwang Universität der Künste Essen	Conservatoire	Master Neue Musik	https://www.folkwang-uni.de/home/musik/fachgruppen/neue-musik/	Offers classes in microtonal ear-training (string focus)
	Hochschule für Künste Bremen	Conservatoire	Master of Music (Neue Musik)	https://anm.hfk-bremen.de/anm/	NMPT offered via Atelier Neue Musik
	Hochschule für Musik Freiburg	Conservatoire	Masters	https://mh-freiburg.de/	NMPT offered via Institut für Neue Musik. Links with Ensemble Aventure (Freiburg).
	Hochschule für Musik Karlsruhe	Conservatoire	Master Zeitgenössische Musik Instrumental	https://www.hfm-karlsruhe.de/studieren/faecher-und-	Links with SWR Experimentalstudio

				instrumente/zeitgenoessische-musik-instrumental	
	Hochschule für Musik und Theater München	Conservatoire	Master of Music (Neue Musik)	https://website.musikhochschule-muenchen.de/de/	NMPT offered via Institut für Neue Musik, Komposition und Dirigieren
	Hochschule für Musik Saar	Conservatoire	Master of Music, Künstlerisches Profil Neue Musik	http://www.hfm.saarland.de/en/studies/study-offer/master-programmes/#contemporary	
Hungary	Peter Eötvös Contemporary Music Foundation	Masterclasses, mentoring programme		http://eotvosmusicfoundation.org	Primarily aimed at conductors and performing composers
Italy	International Divertimento Ensemble Academy (I.D.E.A.)	Residential academy		https://idea.divertimentoensemble.it/idea-academy/?lang=en	Tutored by Divertimento Ensemble (Milan). NMPT offered on a project-by-project basis
	Accademia di Musica di Pinerolo	Residential academy	Scuola di Specializzazione post laurea in Beni Musicali Strumentali	https://accademiadimusica.it/en/homepage_en/	Mostly focusing on individual tuition and chamber groups. Tutors include prominent solists
Netherlands	Conservatorium van Amsterdam, Amsterdam University of the Arts	Conservatoire	Continuing education course (study by contract)	https://www.conservatoriumvanamsterdam.nl/en/study/continuing-education/applications-of-karnatic-rhythm-to-western-music/	Unique 2-year advanced rhythm training course: 'Applications of Karnatic Rhythm to Western Music' / 'Contemporary Music through Non-Western Techniques'
	Royal Conservatoire The Hague / Asko|Schoenberg Ensemble / New European Ensemble	Conservatoire, side-by-side-scheme	Master Specialisation Ensemble Academy	https://www.koncon.nl/en/programmes/masterspecialisations/classicalmusic/masterspecialisation-ensemble-academy	Conservatoire programme with side-by-side performance in projects with Asko|Schoenberg Ensemble and New European Ensemble
	Gaudeamus Muziekweek Academy (Utrecht)	Residential academy		https://gaudeamus.nl/en/	Primarily focused on composer training, but some NMPT offered depending on the festival programme
South Korea	Tongyeong International Music Festival / TIMF Academy	Residential academy		https://timf.org/en/sub/business/edu_timf.asp	Originally affiliated with Ensemble Modern (Frankfurt), currently being restructured under the leadership of Unsuk Chin
Spain	Mixtur Festival de nova creació sonora de Barcelona	Workshops		https://mixturbcn.com/en/workshops/interpretation	Workshops offered by visiting tutors (usually guest artists of Mixtur Festival)
Switzerland	Lucerne Festival Academy	Residential academy		https://www.lucernefestival.ch/en/lucerne-festival-academy/	Until 2018 (*2017?*) tutored by Ensemble intercontemporain, now by a guest faculty drawn from multiple ensembles and soloists. New initiatives include Lucerne Festival Forward and development of alumni networks.
	Fachhochschule Nordwestschweiz FHNW (Musik Akademie Basel)	Conservatoire	Masters, Performance Zeitgenössischer Musik	https://www.fhnw.ch/de https://www.sonicspacebasel.ch/	NMPT with emphasis on performer-led creative projects via the Sonic Space Basel institute.
	Hochschule der Künste Bern	Conservatoire joint programme	Internationaler Masterstudiengang Neue Musik	https://www.hkb-musik.ch/en/kooperationsmaster	Joint programme with Hochschule für Musik Carl Maria von Weber Dresden and Salzburg Mozarteum
	HSLU Hochschule Lucerne	Conservatoire, residential course	Masters, Interpretation in Contemporary Music	https://www.hslu.ch/en/lucerne-school-of-music/degree-programmes/master-of-arts-in-music/ma-music/interpretation-in-contemporary-music/	The Lucerne conservatoire also runs a week-long 'Akademie für zeitgenössische Musik' (ensemble coaching, workshops with guest tutors); links with Collegium Novum (Zurich)
	HEM Geneva (Haute école de musique Genève – Neuchâtel)	Conservatoire	Master of Arts in Music Performance	https://www.hesge.ch/hem/en/studies/master-arts-music-performance/contemporary-music	Masters programme currently being restructured with a view to providing a specialist NMPT pathway. Informal links to Ensemble Contrechamps.
United Kingdom	London Sinfonietta Academy	Residential academy, side-by-side scheme		https://londonsinfonietta.org.uk/opportunities/academy	Tutored by members of London Sinfonietta
	NEXT Musicians Study Programme: Birmingham Contemporary Music Group / Royal Birmingham Conservatoire	Side-by-side scheme / academy	Joint official certificate from Royal Birmingham Conservatoire and BCMG (not accredited)	https://www.bcmg.org.uk/next-study-programme	One-year programme, tutored by members of BCMG and visiting artists
	Britten Pears Young Artist Programme, Snape Maltings	Residential academy		https://brittenpearsarts.org/take-part/artists/britten-pears-young-artist-programme/residential-courses	The 'Composition and Performance' course offers some NMPT
	Dartington Summer School	Residential academy		https://www.dartington.org/whats-on/programme/summer-school/about/	Varied programme of courses for many ability levels and repertoires, including some NMPT. Uncertain future.
	VOICEBOX (Britten Pears Arts / City, University of London / Sound Festival, Aberdeen /Hawkwood College)	Four residency periods per year		https://www.julietfraser.co.uk/voicebox/	For singers specialising in new music. Pilot project, 2023-2024. Programme designed and led by Juliet Fraser.

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