Harnessing Momentum

A practice-based investigation into the implementation of musical momentum as a tool informing intuition and decision-making in composition

PhD

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Abstract

This folio makes a practice–based investigation of musical momentum, from the composer's perspective. Through the creation of ten original works, I have developed novel approaches to composition led by the prioritisation of momentum, explored the integration of momentum–led approaches into my practice as a composer, and evaluated their impact upon my experience making music. The works are not necessarily aligned in terms of subject matter; rather, they are connected by my sustained focus on the implementation of momentum as a guiding tool for both intuitive and rational decision-making. This focus shaped my creative reasoning at every stage of composition.

In the supporting commentary, I outline some of the ways that this prioritisation of momentum as a conceptual tool influenced my practice. I explain the development and implementation of several momentum-based processes, and discuss how secondary factors such as density, entropy, and volatility can impact upon the harnessing of momentum. The pieces in the folio are varied – there are solo, duo, ensemble, and orchestral works, as well as a mix of acoustic, electronic, and hybrid approaches. The works are unified by their concerted focus on directed musical energy.

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Recorder quartet – Approx. duration: 6:00 – March 2021.

Still, Inside

Audiovisual/fixed media – Approx. duration: 8:00 – May 2021.

The Black Path

String quartet – Approx. duration: 12:00 – January 2022.

Wrought

Trumpet and piano – Approx. duration: 10:00 – July 2022.

The Calm Estate of Grief

Guitar and fixed media – Approx. duration: 6:00 – August 2022.

Ex Umbra…

Solo clarinet – Approx. duration: 5:30 – January 2023.

Afterglow I

Clarinet, violincello, piano – Approx. duration: 5:30 – February 2023.

Afterglow II

Flute, clarinet, violin, violoncello, piano, percussion – Approx. duration: 6:30 – June 2023.

Ashening

Orchestra – Approx. duration: 14:00 – January 2024.

Microludes for The Black Path

String quartet – Approx. duration: 6:30 – January 2024.

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List of Accompanying Material

A Lost Chaconne

- Score (pdf). Studio recording (mp3). Studio recording plus ‘unheard’ line (mp3).

Performed by Lizzie Knatt, recorded/mixed/mastered by Alex Mackay, May 2024.

Still, Inside

- Performance Instructions/Documentary score (pdf). Video (mp4).

Material developed with Lizzie Knatt (recorders) and Federico Pendenza (guitar). Audiovisual performance recorded and edited by Cameron McArthur, February 2021.

The Black Path

- Score (pdf). Performance audio (mp3).

Performed by Quatuor Diotima, February 2022.

Wrought

- Score (pdf). Digital audio render (mp3).

Rendered July 2024.

The Calm Estate of Grief

- Score (pdf). Performance audio (mp3).

Performed by Bill White, October 2022.

Ex Umbra…

- Score (pdf). Performance audio (mp3).

Performed by Dov Goldberg, Psappha Ensemble, May 2023.

Afterglow I

- Score (pdf). Performance audio (mp3).

Performed by Terra Invisus, March 2023.

Afterglow II

- Score (pdf). Digital audio render (mp3).

Rendered July 2024.

Ashening

- Score (pdf). Digital audio render (mp3).

Rendered July 2024.

Microludes for The Black Path

- Score (pdf). Performance audio (mp3).

Performed by Quatuor Una Corda at Diotima Academy, Metz, January 2024.

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Acknowledgements and Declaration

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Lastly, special thanks to Jenny, my wife, and to Paul, Philippa, and Phoebe, my parents and sister, for helping me to keep my head above the water. Your love and support were essential to this PhD project.

I declare that this thesis is a presentation of original work, and I am the sole author. This work has not previously been presented for an award at this, or any other University. All sources are acknowledged as references.

1: Introduction

1.1 Starting points

Motion–based approaches permeate musical discourse. According to Hubbard, 'metaphors involving motion have shaped discussion and understanding of music for millennia'.[1] Likewise, Rothfarb claims that 'ever since ancient times authors have identified motion as a fundamental aspect of music', even though 'analogies with force, power, or similar concepts from the domain of physics, are historically limited.'[2] Indeed, some musicologists have expressed concerns about the ubiquity of movement–based understanding: Adlington, for example, contends that 'music frequently prompts a "kaleidoscope" of metaphorical imagery, within which ongoing motion is only one of many candidate conceptualizations', including 'metaphors of heat, light, weight, tension and so on'.[3] As a result, he asserts that 'music's changing sound does not require to be experienced in terms of ongoing, path–like motion'.[4] I certainly agree that these other schemas are valid, and in many cases they may be equally as useful as motion–based descriptions. Nevertheless, my personal approach to composition is most heavily coloured by motion–based metaphors, and ideas relating to momentum are integral to my creative process. This was the case even before commencing my doctoral research although in the past much of my control over musical energy and motion was handled intuitively, or controlled indirectly, shaped by other musical concerns.

That predominantly instinctual approach to musical motion was often successful, but it was not totally reliable. Sometimes I found that my intuitive sense of how quickly or intensely the music should move no longer aligned with the momentum-organising elements I had devised. It often felt as though the material wanted to develop in a different direction, or at a different pace than I had originally intended. I found it difficult to predict when this misalignment would occur, and when it did, I struggled to respond to my intuitive impulses without undermining the systems I had established. Recognising that this approach to harnessing momentum was inadequate, I found myself keen to reinforce my intuition with focused, meaningful inquiry. This was one of the driving factors behind my decision to focus this doctoral project on the prioritisation of momentum within the process of composition.

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[1] Timothy L. Hubbard, 'Momentum in Music: Musical Succession as Physical Motion', *Psychomusicology: Music, Mind, and Brain* 27, no. 1 (2017): 14.
[2] Lee Rothfarb, 'Energetics', in *The Cambridge History of Western Music Theory*, ed. Thomas Christensen (Cambridge: Cambridge University Press, 2002), 927.
[3] Robert Adlington, 'Moving beyond Motion: Metaphors for Changing Sound', *Journal of the Royal Musical Association* 128, no. 2 (2003): 317.
[4] Ibid, 318.

In its most fundamental sense, momentum can be described as 'the force that keeps an object moving' or 'the quality that keeps an event developing or making progress after it has started'.[5] Momentum is intrinsically linked with physical movement, associated with objects gaining speed and carrying their energy in specific directions. However, specific implementations of the term can vary significantly, depending on how it is interpreted. Most discussion of momentum concerns the propulsion of musical ideas through a work (and consequently, through time), but in my experience, the term is just as frequently employed by performers and composers looking to discuss metaphorical experiences of change, effort, tension, direction, or catharsis, as it is used to discuss the physical movement of musicians, or the duration of a passage (in minutes and seconds). In this project, I did not seek to represent physical motion in musical form; rather, I engaged with momentum on a metaphorical level, approaching it as a concept that influenced the generation, organisation, and transformation of musical material. Accordingly, it is only rarely in this folio that momentum is made the subject of my music. Instead, it serves as a guiding tool, organising and informing my choices regarding a wide range of musical parameters, including (but not limited to) melody, structure, texture, timbre, harmony, and rhythm. I predicted that using momentum as a decision-making tool might enhance the synergy between my intuitive judgement and any logical, rational, or system-based processes I developed, making my output more cohesive. I hoped that this approach to composition would be flexible enough to accommodate improvisation and indeterminacy, where desired, and I hoped that it would be applicable across a variety of ensemble combinations and musical contexts. I was also keen to find out how this approach might support and influence my efforts to absorb, adapt, and assimilate musical features from a variety of genres into my personal output.

1.2 Momentum in musicology

Numerous musicologists have developed systems and theories which situate momentum within broader discussion of musical motion. Ideas presented and reviewed by Clarke ('the relationship between music and motion … is a fundamental aspect of music's impact and meaning'),[6] and by Hubbard ('if music exhibits momentum–like effects, then variables shown to influence momentum–like effects in other domains … might similarly influence the representation of music'),[7] validated my position at the outset of this project by confirming

[5] Cambridge University Press, *Momentum, Cambridge Dictionary*, accessed March 4th, 2024, https://dictionary.cambridge.org/dictionary/english/momentum.
[6] Eric Clarke, 'Meaning and the Specification of Motion in Music', *Musicae Scientiae* 5, no. 2 (2001): 213.
[7] Hubbard, 'Momentum in Music', 25.

the ubiquity and significance of momentum within music. Howell notes that 'composers often exploit the idea of temporal ambiguity, writing music that appears to subscribe to one timeframe while in fact suggesting a range of alternatives. This gap between compositional reality and listener perception—between the actual and the apparent—is a notably creative one'.[8] I speculated that Howell's identification of suggested, but ultimately unexplored temporal possibilities might be linked to the management of musical momentum, insofar as the experience of musical time is closely linked with the rate of progression towards points of arrival. Howell recognises that historically, it was tonality that played a significant role in 'generating an ongoing sense of continuity while delineating the various stages that shape an architectural outline'.[9] He continues by pointing out that 'post-tonal repertoire raises new challenges for composers who wish to convey the equivalent interaction of temporal narrative and structural shape within a modernist idiom'. [10] A focus upon momentum during composition could offer a solution for these 'post-tonal' challenges, providing a means to conceptualise, understand, and represent musical continuity and direction, independent of the specific systems or techniques employed within a work.

Further exploration of momentum in musicology led me to the work of Steve Larson. Larson proposes that the entire landscape of tonal music can be considered in terms of three musical forces: gravity, magnetism and inertia. He defines these forces as 'tendencies we hear in, and attribute to music – tendencies to move in certain ways.'[11]

Some of Larson's definitions are as follows:

- melodic gravity – 'the tendency of a note heard as above a reference platform to descend.'
- melodic magnetism – 'the tendency of an unstable note to move to the nearest stable pitch (a tendency that gets stronger the closer we move to the goal).'
- musical inertia – 'the tendency of a pattern of pitches or durations, or both, to continue in the same fashion.'

He also defines two of the forces in relation to rhythm:

- metric magnetism – 'the pull of a note on an unstable attack point to a subsequent and more stable attack point.'

[8] Tim Howell, 'Magnus Lindberg: Narratives of Time and Space', *Contemporary Music Review* 33, no. 4, (2014): 355.
[9] Ibid.
[10] Ibid.
[11] Steve Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, (Bloomington: Indiana University Press, 2012): 22.

- rhythmic gravity – 'the quality we attribute to a rhythm, when we map its flow onto a physical gesture, that reflects the impact physical gravity has on that physical gesture.'[12]

I was attracted to these definitions because they are succinct, specific, and comprehensible. In his analyses, Larson communicated cohesive accounts of musical movement that seemed to align with my intuitive understanding of momentum. I appreciated that his definitions were largely unaffected by style, remaining applicable across a range of tonal musical settings, including baroque, pop, and late 20th and 21st century jazz, as I expected that this kind of transferability would be an important element in my approach. Initially, I was excited by the prospect of attempting to transform Larson's *forces* from analytical apparatuses into compositional tools, and I considered using his definitions to inform my approach to momentum. This idea was partially reinforced by further literature – Hubbard recognises that 'the apparent lack of a stationary condition in music is more consistent with momentum than with inertia',[13] and in 'Musical Forces and Agential Energies', Hatten notes that Larson's definition of 'inertia' invites a practical exploration of momentum:

'The concept of musical momentum implies … that there must be some source of energy capable of overcoming inertial stasis, and that energy clearly cannot be provided by Larson's three forces in many cases… It is only after having achieved momentum that an unimpeded continuation of consistent motion … can reflect an analogue to the physical law of inertia, which is simply the tendency of a given state (whether moving or stationary) to persist. Inertia, as in the physical world, does not contribute any energy of its own. Instead, the energy creating momentum must be inferred as having its source in a presumed agent'.[14]

These are crucial distinctions that separate momentum from the broader discussion of musical motion. The idea that momentum can be actively induced – and directed to some extent substantiates my position: it reinforces the agency of the composer and validates the idea that a creative prioritisation of momentum can be of consequence for the musical output produced. If, as both writers imply, a composer can intentionally and deliberately affect the musical momentum, then they can also make specific, targeted musical decisions, according to their understanding of the ways in which those decisions contribute to the momentum across a larger passage, or even the entire work. This further confirms the importance and

[12] Larson, *Musical Forces*, 22.
[13] Hubbard, 'Momentum in Music', 25.
[14] Robert S. Hatten, 'Musical Forces and Agential Energies: An Expansion of Steve Larson's Model', *Music Theory Online* 18, no. 3 (2012): 3.

utility of this project's efforts to develop approaches that facilitate engagement with musical momentum as a compositional tool.

Disappointingly, more nuanced exploration of Larson's work revealed some limitations arising from his interpretation of 'forces', that prevented me from using his ideas as the basis of my approach to momentum. Han notes that Larson's 'nomenclature is somewhat misleading since magnetism, inertia and gravity are all words with technical definitions taken directly from the field of physics.'[15] To some extent, this challenge reflects a broader issue discussed earlier in this commentary: the inconsistent use of motion-related language in music, combining physical, metaphorical, and semiotic frameworks. In Larson's case, this is a particular problem, as his science-based terms are in partial conflict with the fact that his theory centres on an 'embodied intuitive understanding of physical motion, as opposed to an 'intellectual understanding of physics'.[16] It can be difficult to separate what Larson considers to be physically-derived from what is figurative; sometimes it is unclear whether his definitions are meant to function quasi-scientifically, or as metaphorical, experience-based tools that aid communication and understanding of compositional ideas. Recognising the potential for similar ambiguity in my own project, I endeavoured to avoid similar confusion by making it explicitly clear that my work viewed momentum as a metaphorical construct within my creative process.

Larson is also keen to point out that his definitions are solely focused 'within "common–practice tonal music" (the western–European music of Bach to Brahms and some contemporary jazz and popular music)'.[17] My own output is not consistently tonal; I do not regularly conform to any one harmonic approach. Rather, I amalgamate ideas from many separate systems, drawing from tonality, serialism, and aleatoricism and more, as and when I deem it necessary or valuable. This does not instantly make Larson's ideas incompatible with my work, and it is far from an insurmountable issue. For example, Hatten explains that in atonal music, 'the absence of scale degree information provided by common practice tonality means we do not have built-in environmental forces such as those hypothesized for a tonal hierarchy. Thus, any implications of forces leading to expected pitch outcomes must be earned by the work itself.'[18] Nonetheless, whilst it would be possible to repeatedly reconstruct Larson's ideas in new harmonic contexts, it seemed difficult to suggest that my

[15] Joshua Han, 'A Social Semiotic Account of Music-Movement Correspondences', (PhD Thesis, UNSW Sydney, 2021), 48.
[16] Larson, *Musical Forces*, 22.
[17] Mark L. Johnson and Steve Larson, '"Something in the Way She Moves" – Metaphors of Musical Motion', *Metaphor and Symbol* 18, no. 2 (2003): 64.
[18] Hatten, 'Musical Forces and Agential Energies', 6.

work would meaningfully relate to Larson's forces, if I had to redefine fundamental aspects of those 'expected pitch outcomes' in each new work,[19] continually reinterpreting and recontextualising his definitions' in ways he never intended. So, whilst Larson's work served as useful inspiration, it was ultimately of limited practical use to this project.

Overall, the body of musicological work produced by Larson, Hatten, Howell, and others provided a useful foundation for my project, helping me to define, assess, and contextualise momentum and its role within my music. Whilst several sources establish momentum as a useful reflective and analytical descriptor, and some of those sources partially address the consideration of momentum in the creation of new music, the majority of musicological discussion of momentum is understandably analytical. There is a lack of musicological discussion regarding the practical application of momentum as a tool, and this reinforced the need for a practice-based exploration of the topic.

1.3 Momentum in composition/knowledge gap and research aims

There are several composers who have made momentum, energy, or motion a focus of their output, and it is useful at this stage to further contextualise my research by considering how some of these composers' approaches relate to my own practice. A prime example of a work that makes movement its subject is Mark-Anthony Turnage's *Momentum*.[20] Hazlewood suggests that *Momentum* is 'driven by an ever-present, dynamic energy.'[21] This is true to an extent – Turnage's manipulation of musical material does evoke a sense of motion and vitality. However, despite the piece's title, there is little evidence to suggest that ideas relating to momentum are of more than surface-level importance to this piece. Indeed, in *Momentum*, there is a separation between Turnage's overarching aesthetic tendencies and the specific compositional tools he employs to manage musical progression at a moment-to-moment level. The sense of motion in his piece is mostly conveyed via relatively conventional motivic transformation, which is not meaningfully informed by the stylistic elements drawn from jazz and sport which are central to the work's character.

Turnage's focus on momentum is predominantly communicated via the sustained imitative manipulation of a simple melodic motif. The motif in question is a caricatured version of the 'olé olé olé' chant heard in sporting arenas (and on school playgrounds) across the

[19] Ibid.
[20] Mark-Anthony Turnage, *Momentum* (Mainz: Schott Music, 1991).
[21] Charles Hazlewood, 'Mark-Anthony Turnage's Momentum and Kai', *Discovering Music*, aired May 20, 2007 (London: BBC Radio 3, 2007), radio broadcast.

globe. The original version of *olé* (first recorded as *Anderlecht Champion* by Grand Jojo),[22] is compared with Turnage's first presentation of the motif (bar 15 of *Momentum*) in **Fig. 1**.

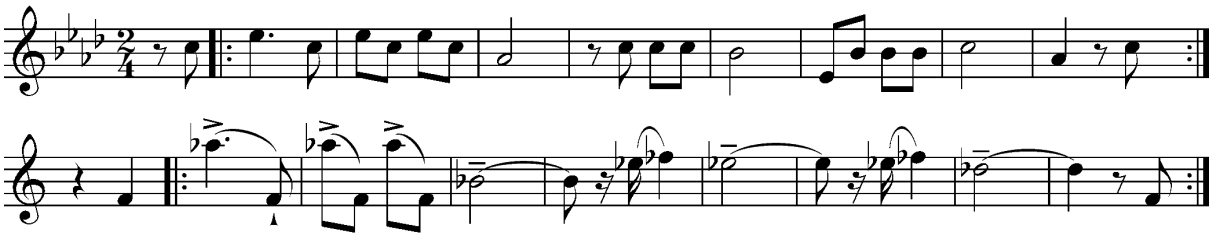

Fig. 1 Upper stave: Grand Jojo, *Anderlecht Champion*, olé olé olé motif (transcribed). Lower stave: Turnage, *Momentum*, trumpet motif, bar 15.

Turnage distorts the *Anderlecht* motif by augmenting its melodic leaps and replacing the regular quaver rhythms with unequal subdivision, implying a dotted feel. This modified version of the motif is just consistent enough with the original figure for its essence to remain identifiable – Hazlewood reckons that 'the contours of "*olé*" are plainly there for all to see, but filtered through Turnage's harmonic world.'[23] Accordingly, there is little harmonic similarity between the two versions of the motif: *Anderlecht Champion* is diatonic, and clearly outlines a tonic-dominant relationship, whereas Turnage's pitch content appears to be derived from a B♭ minor blues scale. *Anderlecht*'s opening major triad is replaced by large melodic leaps, but Turnage's B♭ pitch centre is implied by the placement of tonic and mediant notes in the third and seventh full bars of each motif, corresponding with their placement in the source. Turnage's decision to notate the fourth bar of the motif (bar 19 in the score) using a F♭ rather than an E♮ also hints at his perception of that note as the flattened fifth degree of the scale. Reconstructing a diatonic melody using blues scale material in this way would seem to tie in with Turnage's aesthetic fixation on jazz music, which colours both *Momentum* and his wider output. It is well documented that Turnage's 'absolute love of jazz' is a 'core stylistic truth of his'.[24] Hazlewood goes so far as to state that 'there isn't a piece of [Turnage's] that [Hazlewood] can think of which doesn't have a strong sense of jazz inflection all the way through it.'[25]

Though Turnage's primary version of the *Anderlecht Champion* motif seems to be based in jazz harmony, its development through imitation and layering is rooted in conventionally classical techniques. Turnage subverts expectations as soon as they are

[22] Grand Jojo, *'Anderlecht Champion', Anderlecht Champion,* (Vogue, 1985), vinyl.
[23] Hazlewood, 'Mark-Anthony Turnage's Momentum and Kai', *Discovering Music*.
[24] Ibid.
[25] Ibid.

established by beginning to introduce imitative variations of his motif before the primary figure is fully heard. Canon begins in the horns in bar 18, and distorted echoes of the motif appear in saxophones and trombones in bars 17 and 18, introducing pitches from outside of the hexatonic blues scale. In doing so, they challenge the jazz-derived harmony of the main motif, expanding the harmonic palette and undermining the suggestion that jazz features are influencing the nature of the musical momentum. Instead, the dissonance of the canons contributes to an increasingly volatile atmosphere; this increasing dissonance corresponds with a growing sense of momentum as the music seems to move towards the next point of arrival. Incidentally, Turnage also subverts that expectation: the polyphonic *olé* figures are abruptly cut off by a new contrasting bass figure, without any suggestion of resolution.

As *Momentum* progresses, no emergent sense of a large-scale shape or goal materialises. The work follows an episodic structure, relying heavily on repetition, syncopation, and the juxtaposition of the primary motif against competing figures to maintain continuity. Turnage makes sustained use of canon and layering, continuing to intersperse fragments of his redesigned *olé* theme amongst other animated figures and shapes, reworking both the intervallic construction of motif and the surrounding harmony so that the music is never fully settled. Points of arrival are hinted at by the recurrence of the main motif at several points in the work, but in the absence of a recognisable form or a consistent harmonic approach, the search for stability is ultimately unsuccessful. Instead, the continued withholding of resolution compels the music to keep moving until its close. Comparisons could be made between this kind of motif-focused, developmentally free-flowing form and certain patterns of tension and release found in jazz, where cyclical improvisation based on a core melody is common; however, it would be an overstatement to claim that this vague similarity meaningfully shaped Turnage's treatment of material.

Thus, while the main musical content of *Momentum* has links to sport, and while the colour and character of the piece reflects Turnage's aesthetic preference for jazz-inspired harmonies and rhythms, there is little evidence to suggest that these influences significantly shaped his conceptual approach to momentum at a deeper level. The sense of motion in the piece is generated and managed through relatively traditional imitative and contrapuntal techniques, which do not betray more than a surface-level consideration of momentum as part of the composition process. This treatment of momentum as a byproduct of motivic development is effective, but not especially novel, and offers no more insight for my project than any other work that achieves energy through the manipulation of melodic, harmonic, and rhythmic material. This does not mean that external elements cannot meaningfully inform the creation or management of approaches to momentum – indeed, some of Turnage's other

works, such as *Scorched,*[26] and *Blood on the Floor,*[27] exhibit similar aesthetic tendencies whilst also containing musical concepts that are fundamentally informed by features of jazz, incorporating elements such as improvisation into their fundamental design. Assimilating such features necessitates some consideration of musical momentum (even if it is predominantly passive or instinctual). Integrating improvisational elements requires a structural framework that anticipates and supports spontaneous development, meaning that considerations of momentum must be embedded into the architecture of the piece to ensure continuity. Ultimately then, Turnage' *Momentum* demonstrates that a focus on momentum as the subject of a work does not necessarily imply that momentum has been embedded into the process of composition, or employed as a decision-making tool. Similarly, the integration of stylistic elements from external genres does not guarantee a novel sense of motion, if those features are not used to inform fundamental aspects of the work's construction and continuation.

John Adams' *Short Ride in a Fast Machine*[28] and Louis Andriessen's *De Snelheid*[29] are further examples of works whose subject matter is momentum-adjacent. Both works explore concepts relating to speed, direction, and velocity. However, in contrast to *Momentum*, these topics also inform the fundamental compositional decision-making. Both composers thereby engage with momentum on a metaphorical level, even if this engagement is somewhat indirect. Adams creates the illusion of shifting time by adjusting the placement of his material relative to a fixed pulse. Andriessen subjects his core pulse to repeated metric modulation, which alters its speed and subdivision. This evolving pulse challenges the stability of surrounding material, creating a sense of paradoxical disorientation, before suggesting ultimate reconciliation.

Short Ride is primarily focused on the idea of speed as its subject, but the impact of motion-based thinking on Adams' general composition approach is also apparent. Adams attempts to represent 'the experience of speeding down a highway in a too-fast sports car' through rhythmic and metrical conflicts.[30] He establishes a sense of persistent motion from bar 1, via a regular, incessant woodblock pulse. This pulse remains largely unmoved throughout the piece, even though notated metre changes frequently. Different orchestral sections move according to their own implied metric-subgroups, making the relationship

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[26]Mark-Anthony Turnage, *Scorched: Concerto for Jazz Guitar and Orchestra* (London: Boosey & Hawkes, 2002).
[27]Mark-Anthony Turnage, *Blood on the Floor: Nine Movements for Jazz Ensemble and Orchestra* (London: Boosey & Hawkes, 1996).
[28] John Adams, *Short Ride in a Fast Machine*, (New York: Boosey & Hawkes), 1986.
[29] Louis Andriessen, De Snelheid, rev. ed. (Amsterdam: Donemus, 1984).
[30] Kleppinger, 'Metrical Issues in John Adams's Short Ride in a Fast Machine', 65.

between the woodblock pulse and the prevailing metre uncertain. This layering of metric material impacts upon the fundamental experience of time and progression, as Kleppinger explains: '[*Short Ride*'s] very design pulls its audience into attempting to discover metrical regularities without allowing those regularities to persist.'[31] Each repeated figure that attempts to pull the music in a new direction by disputing the primary pulse creates the kind of temporal ambiguity identified by Howell earlier in the chapter. This has an impact on the direction and velocity of the work's overall momentum. The arising metric conflicts increase the level of tension, and this induces a parallel increase in the intensity of directed energy, propelling the piece towards implosion points. Each time it seems that the music can no longer sustain so many competing interests, the building energy reaches its peak. Adams repeatedly employs suspended cymbal and tam-tam rolls to help guide the listener towards each apex (e.g. bars 51, 79, 122, 133, 180), reinforcing the sense of increasing motion created by the metric density and complexity. These peaks are abruptly halted, (and correspondingly, the cymbals are quickly choked), and the rate of momentum drops dramatically after each crest, before the competing metric groups begin to build towards the next apex once again.

Adams' approach necessitated some consideration of momentum as a malleable musical element. By layering competing material so that it propels the music towards points of arrival, he demonstrates some awareness of momentum as a factor influencing his compositional decision-making. Nonetheless, it is clear that he does not employ momentum as the primary tool for the generation or organisation of material. Instead, his management of motion and energy is fundamentally informed by his efforts to suggest and maintain competing temporal possibilities, as a reflection of physical motion.

Adams' own writing suggests that he was conscious of the impact of energy in his general practice, even in works where motion is not the explicit subject: his introduction to the score of *Shaker Loops* refers to 'a freer movement from one level of energy to another', which he feels makes for a 'more dramatic experience of the form'.[32] Similarly, Powell suggests that in *Harmonielehre*, Adams 'evokes depth by employing varying levels of pulse, each utilising a particular timbre and instrumental register; the result is a collective movement, individual participants contributing to a larger momentum.'[33] So, though momentum does not serve as a the principal conceptual force in Adams' compositional process, his sensitivity to

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[31] Stanley Kleppinger, 'Metrical Issues in John Adams's Short Ride in a Fast Machine', *Indiana Theory Review* 22, no. 1 (2001): 81.
[32] John Adams, Shaker Loops for string orchestra (1982 Revision). 1989). New York, NY: Associated Music.
[33] Richard Powell, 'Accessible Narratives: Continuity in the Music of John Adams', *Contemporary Music Review* 33, no. 4 (2014): 390–407.

energy and its relationship with musical motion betrays its significance as an underlying factor that shapes his decisions regarding musical continuity and form.

In *De Snelheid*, Andriessen set out 'to write a piece dealing with contradictory perceptions of musical velocity … He wished to demonstrate that musical speed is inseparable from the rate of harmonic rhythm, by setting up a dialectic between velocity articulated by pulse rate (whose nature is not intrinsically musical), and that articulated by harmonic changes (which is).'[34] Velocity serves as the explicit subject of the music, and so, 'at first glance, the construction of the tempo and metric structure of *De Snelheid* suggests some kind of an exercise in tempo or metric modulation'.[35] Tay explains that 'at first there are 5 impulses per beat at 45 bpm. At page 14, the number of impulses per beat is increased to 6 and the speed of impulse quickens. At page 20, 1 impulse is removed from the repeating cell and the total length of beat is shortened and is therefore perceived as quickening from 45 bpm to 54 bpm. This process of temporal redivision followed by truncation repeats across the piece until the maximum tremolo at page 109 is reached.'[36]

This focus on creating a velocity-based experience is comparable to Adams' engagement with speed through implied metre. However, Andriessen extends his engagement with momentum further beyond the surface level. Like Adams, Andriessen uses woodblocks to convey pulse. But, unlike Adams, that pulse is constantly challenged, subverted, and destabilised. 'The orchestra is divided into three groups, with the third placed centre stage and the mirrored forces of the two 'pulse' groups on either side. These keepers of the pulse … hocket the material across the dividing stage space.'[37] 'Andriessen 'pits the high, fast pulse sound against the low percussion sound of the third orchestra, which having failed early on to keep up with the pulse of the others, gradually establishes a powerful momentum of its own. This eventually overwhelms the whole texture, and is finally joined by the former 'pulse' groups to end the work in a symbolic accord.'[38] The woodblock pulse seems to speed up with each metric modulation, until 'At bar 1098, [where] the percussionists reach a maximum playing speed that cannot be exceeded, they play a tremelo [sic]. At this point, the initial pulse (45 bpm) is articulated by the rest of the ensemble both rhythmically and harmonically. Essentially, the piece accelerates until it reaches its starting tempo, which is impossible.'[39] So, though the sustained modulation of the woodblock pulse and the

[34] David Wright, 'Louis Andriessen: Polity, Time, Speed, Substance', *Tempo,* no 187 (1993): 11.
[35] Wright, 'Louis Andriessen: Polity, Time, Speed, Substance', 12.
[36] A. W. J. Tay, 'Recomposing Reality: The Composer as Illusionist', (doctoral thesis, Guildhall School of Music and Drama, 2023), 39.
[37] Wright, 'Louis Andriessen: Polity, Time, Speed, Substance', 12.
[38] Ibid.
[39] Tay, 'Recomposing Reality: The Composer as Illusionist', 38.

compression of the hocketed elements convey a surface-level impression of energy that is comparable to that of Adams or Turnage, the embedding of velocity into the conceptual framework of the piece, as a construct symbolising paradox, illusion, and conflict, suggests that Andriessen used velocity as a tool, helping him to communicate deeper metaphorical and philosophical concerns as part of his output.

Andriessen composed several works with related conceptual focuses, exploring time (*De Tijd*), velocity (*De Snelheid*), and matter (*De Materie*). His appreciation of the fact that such topics can be the subject of both surface-level musical exploration and deeper, semiotic and figurative consideration is a source of inspiration and motivation for this folio. It could be argued that momentum (as a product of velocity) is intrinsically linked to Andriessen's compositional process, and it likely had some influence on his creative intentions at a deeper level. Yet, despite exploring these related concepts in some depth, Andriessen made little explicit mention of momentum itself, and this again leaves room for further exploration of my own. I have attempted to employ stratified approaches to momentum in my work, conceiving of simultaneous global and local scales, and this is somewhat similar to Andriessen's separation of global paradox from local pulse rate and harmonic change. The impact of my attempts to separate momentum into separate tiers is explored in detail in later chapters.

Notably, all three of these composers are willing to intuitively adjust the output of the processes they create if they deem it musically necessary. Turnage has said that: 'the system shouldn't dictate to you – you should be able to use the system to generate the notes and then see whether it works... if pieces become systematic, it comes out in the performance … if a piece is too systemised, I will either scrap it or I'll just add more layers.'[40] Adams argues that 'a good artist' should have an 'intuitive sense of form and his innate sense of balance,'[41] implying that exclusively adhering to pre-determined plans for shape and form would be inadequate. In *De Snelheid*, 'several times the bass drum fails to sound the beginning of a cycle; once it re-enters a bar too early and once a bar too late. Given the scrupulousness of many of the details of Andriessen's scores, these contradictions seem engagingly more like an artistic antidote to the relentlessness of impersonal systems.'[42] The work presented in this portfolio is firmly aligned with the idea that every device, idea, and construct that I produce is subject to artistic and aesthetic assessment. I am happy to deviate from any planned pattern or design, if it seems to be beneficial or necessary. Therefore, one of the measures

[40] Mark-Anthony Turnage, quoted in Andrew Clements, *Mark-Anthony Turnage* (London: Faber, 2000), 38.
[41] John Adams, quoted in K Robert Schwarz, 'Process vs. Intuition in the Recent Works of Steve Reich and John Adams', *American Music* 8, no. 3 (1990), 260-261.
[42] Wright, 'Louis Andriessen: Polity, Time, Speed, Substance', 12.

of success for this project is the extent to which the systems and tools I develop can absorb intuitive alteration, without breaking down. I expected that pre-compositional clarity regarding momentum would facilitate easier intuitive deviation – local, small-scale adjustments should not undermine the overall motion, if the fundamental conceptualisation of momentum is clear and well-communicated.

This is one of the ways that this project is aligned with the views of Iannis Xenakis. Though Xenakis pioneered processes of composition built on computation, pre-determination, and stochastic principles, 'after assessing the aesthetic qualities of the computation's results, [Xenakis] would accordingly adjust them in his compositions.'[43] In *Formalized Music*, Xenakis argues that 'to make music means to express human intelligence by sonic means. This is intelligence in its broadest sense, which includes not only the peregrinations of pure logic but also the "logic" of emotions and of intuition.'[44] He later confirms that 'when scientific and mathematical thought serve music, or any human creative activity, it should amalgamate dialectically with intuition',[45] arguing that 'intuition and experience must always play their part in guiding, deciding, and testing.'[46] Xenakis' use of the term dialectic suggests that he conceives of composition as a process in which these opposites interact productively; he imagines a constant negotiation between strict mathematical systems and spontaneous artistic decisions.

Though Xenakis discussed many topics which relate to my project, the extent to which Xenakis focused on momentum is not easy to determine. The term 'momentum' is not explicitly mentioned in *Formalized Music*, but there is evidence to suggest that 'although Xenakis did not develop an explicit theory of musical energy, the subject was present in his thoughts.'[47] In a number of works, he employs extramusical structures and systems in order to better communicate his desires for motion. In *Terretektorh*,[48] for example, 'the design of space calls for a circular arrangement of eighty-eight musicians around the conductor, with the public inserted between them. With this setup, Xenakis was able to build layers of complexity for the listener while keeping the harmonic-melodic environment static, in order

[43] Ramón del Buey Cañas and Oswaldo Emiddio Vasquez Hadjilyra, 'Iannis Xenakis's Materialism: On the Dialectic of Real-time Computation', in *Meta-Xenakis: New Perspectives on Iannis Xenakis's Life, Work, and Legacies*, ed. Sharon Kanach and Peter Nelson, (Cambridge: Open Book Publishers, 2024), 143.
[44] Iannis Xenakis, *Formalized Music: Thought and Mathematics in Composition*, rev. ed. (Stuyvesant, NY: Pendragon Press, 1992), 178.
[45] Ibid, 181.
[46] Ibid, 81.
[47] Mauricio García de la Torre, 'Activating Sound Phenomena in the Music of Iannis Xenakis.' in *Meta-Xenakis: New Perspectives on Iannis Xenakis's Life, Work, and Legacies*, ed. Sharon Kanach and Peter Nelson, (Cambridge: Open Book Publishers, 2024), 208.
[48] Iannis Xenakis, *Terretektorh* (Paris: Éditions Salabert, 1966).

to make way for percussion like wooden blocks, whips, maracas, and whistles. Both directional and stochastic sound movement results through changes in intensity, register, density, timbre, and spatial localization.'[49] This inventive approach suggests a more fundamental embedding of momentum into Xenakis' process than the surface-level focus in Turnage's *Momentum*. Similarly, García de la Torre suggests that: 'the key to [the process in the first section of *Metastasis]* consists of the increase of energy in several features: density, intensity, harmonic tension, and activity of the continuous trajectories. The aim is to move from the simple texture of the opening to the harmonic complexity of the climax (mm. 55), which is emphasized by violent tremolos. Through careful design of dynamic processes, Xenakis achieved the transition from unity to mass, from immobility to change.'[50] This would imply that Xenakis engaged with momentum as a metaphorical compositional concern.

References to energy, motion, and momentum in the music of Xenakis are not limited to García de la Torre's paper – they can be found in much of the discussion of Xenakis' music. According to Kermit-Canfield, Xenakis, 'manipulates… musical parameters in order to write music that seems to move'.[51] Wannamaker asserts that in *Herma*, 'it seems clear that no sense of forward motion or cathartic resolution is communicated by the pitch content of the piece. Rather, the momentum of the music is entirely a product of its rhythmic and dynamic intensity and the tremendous overt technical virtuosity which must be displayed by its performer.'[52] These statements suggest Xenakis' management of musical elements is guided by some consideration of momentum, even if it is indirect. This is reflected in Xenakis' own writing: he confirms that 'densities, durations, registers, speeds, etc., can all be subjected to the law of large numbers with the necessary approximations. [The composer] can therefore with the aid of means and deviations shape these sets and make them evolve in different directions. The best known is that which goes from order to disorder, or vice versa, and which introduces the concept of entropy.'[53] Some of those musical elements – density, intensity, entropy, harmonic tension – are principal concepts that I engage with in order to translate my intended momentum into specific musical output. Indeed, the idea that secondary factors such as those listed above can function as valuable interfaces for engaging with momentum is repeatedly confirmed in the subsequent chapters of this doctoral project. The fact that Xenakis used these facets of momentum to control the direction and intensity of energy in

[49] García de la Torre, 'Activating Sound Phenomena in the Music of Iannis Xenakis.', 209-210.
[50] Ibid, 208-9.
[51] Elliot Kermit-Canfield, 'Spatialization in Selected Works of Iannis Xenakis,' (master's dissertation, Pennsylvania State University, 2013), iii.
[52] Robert A. Wannamaker, 'Structure and Perception in *Herma* by Iannis Xenakis', *Music Theory Online* 7, no. 3 (2001): 8.
[53] Xenakis, *Formalized Music*, 16.

works like *Herma* and *Metastasis* certainly suggests that he was conscious of the role momentum played in his approach to making music. So while Xenakis did not explicitly state that momentum was one of his priority concerns, his detailed discussion of factors influencing momentum like density and entropy, and his willingness to follow intuition, even when it does not correspond with rational or pre-determined choices, mean that his output often exhibits momentum-adjacent thinking that is similar to the approaches explored in my work.

Despite this similarity, the relationship between my output and Xenakis' is complex. Though there are conceptual parallels between our approaches, there is a definite aural disparity between our music. This is a product of our differing preferences regarding the intersection point between logic and intuition. Xenakis seeks a higher level of philosophical and mathematical justification for his choices, and though he recognises the value of intuition, he favours precise system-derived justification for decision-making where appropriate. In contrast, I favour intuition, approximation, and improvisation. For example, Xenakis refutes aleatoric or graphical notation, arguing that 'the composer commits an act of resignation when he admits several possible and equivalent circuits … the problem of choice is betrayed, and it is the interpreter who is promoted to the rank of composer by the composer himself.'[54] Xenakis implies that this is a negative outcome, but I am more than happy for the interpreter to be 'promoted' in this way, if this leads to the fulfilment of my musical aims. In fact, I believe that the performers perception of their influence over the musical outcomes can affect the overall nature of momentum in a work.

As already explained, I am willing to combine elements of tonality, serialism, aleatoricism, or any other approach to composition that I find useful. I see my practice as a process of sculpting, whereby musical ideas are manoeuvred, shaped and refined in an effort to produce semiotically consistent musical output that communicates the energy I imagined. I usually begin composing with an awareness of the overall direction that I would like a piece to move in, and a largely intuitive understanding of how I would like to develop the intensity and nature of that motion. My process then consists of attempts to construct and balance musical gestures, shapes, and figures, such that they conform to that imagined path for the directed energy, and I am happy to employ any system, tool, or method, if I believe that it will enhance the communication of my ideas, or the overall cohesion. This requires me to interpret my intuitive desires, so that they can be directed into actionable decisions that usefully inform the next steps for my music. It does not require me to map the physical characteristics of

[54] Wannamaker, 'Structure and Perception in *Herma* by Iannis Xenakis', 38.

musical momentum directly onto specific gestures or elements within a piece, or to explain my choices through mathematical or scientific models.

In my experience, controlled improvisation creates possibilities for the management of the rate and experience of momentum that cannot be achieved through total pre-determination. As such, incorporating improvisation into the design of my works can be beneficial and constructive. I believe that Xenakis was more aligned with this view than his assertions about aleatoricism would suggest. Peter Hill suggests that 'it would be wrong to imagine that the performance of Xenakis's music does not involve the process of decision-making by the player.'[55] '"Accuracy" takes on a new meaning in this music, partly as Xenakis, by laying out certain chords so that they lie well beyond normal stretch, has built into his notation the element of genuine impossibility. In this way he has ensured that each performance will become an attempt at an ideal but unrealizable perfection.'[56] Hill exemplifies such impossibilities in works such as *Herma and Evryali*, where 'in any given passage one must make decisions according to a scale of accuracy priorities: a scale that distinguishes between what can and cannot be clearly heard, what is of primary importance to the sense of the music and what is subordinate … playing the right notes is only one of a number of aims to be reconciled in conveying as accurate a picture as possible of the intended sound.'[57]

Effectively then, in his 'impossible' scores, Xenakis lays out his 'ideal' version of the music, and challenges performers to produce a realisation of the score that is as close to perfection as possible. It is up to the performer to determine how best to achieve this, and to determine the scale on which they should measure their success. It could therefore be argued that whilst Xenakis makes absolutely clear what he would like to hear, his unattainable precision equates to him requesting a form of improvisation from the performers of his music, in the sense that they must make spontaneous decisions, reacting to the sound as it is produced, in order to select and communicate the most important aspects of Xenakis' music. In my practice, by explicitly prioritising momentum, I am making it clear that the overall experience of directed motion is the musical feature that I want the performer to focus on. I am more interested in the experience of motion than anything else, including, at times, the precision of pitch, rhythm, or articulation. Any two given performances may differ in a number of ways, but if they both realise the intended sense of motion, then I will be satisfied. Thus, in some cases, incorporating a controlled amount of improvisation into a wider conceptual framework can be the most effective way to communicate a particular focus on some types

[55] Peter Hill, 'Xenakis and the Performer,' *Tempo*, no. 112 (1975), 18.
[56] Ibid., 19.
[57] Ibid., 19.

of momentum. As such, this project also explores the role of improvisation as a part of momentum and considers the balance of power between the composer and the performers as another factor influencing momentum.

So, like Xenakis, I engage with a variety of concepts and processes that act as catalysts for musical decision-making, and these processes are focused on ideas of energy and motion. In my case, these structures, strategies, and processes serve my fundamental understanding of the musical momentum. Like Xenakis, I am willing to intuitively adjust the output of those processes, where I deem it to be necessary. However, I am more willing to relinquish control, and I am happy to allow improvisation and performer interpretation to become integrated parts of the musical design. Both of our approaches explore ways in which external tools and systems can contribute to the creation and communication of momentum in music, but they serve different priorities, and in this sense our output is sonically and conceptually dissimilar.

Of course, it would be overzealous to suggest that composers *must* determine specific intentions for their musical momentum, given that almost any element of music can be used to affect momentum to some degree: harmony, structure, rhythm, timbre, dynamics, and countless other musical features can all play a role in altering the overall direction and rate of motion. In the present era, composers regularly develop entirely novel approaches to energy as part of their musical vocabularies. As Mark Hutchinson states: 'elements which would have functioned as "rules" in earlier styles – including the rules of the earlier avant–garde, such as the emancipation of dissonance or the avoidance of periodic rhythm – are reduced to available "strategies" for the composer within a field where there are few or no overriding rules *per se*'.[58] Thus, it is possible for momentum to be organised, but indirectly managed, carried along as a by–product of composers' management of other concerns. This could go some way towards explaining why practical approaches to musical momentum have been left somewhat under–examined. It is highly likely that secondary, indirect, or passive approaches to momentum were employed by several of the composers whose music inspired me throughout the project (such as Thomas Adès, Anna Thorvaldsdottir, Magnus Lindberg, Brad Mehldau, and Luciano Berio). These composers rarely make explicit mention of momentum when talking or writing about their music, but their handling of features such as rhythm, timbre, repetition, and structure implies an intrinsic awareness and thoughtful handling of the direction and intensity of their music's energy. The clarity and coherence of these composers' music also suggests an exceptional synergy between their intuitive

[58] Mark Hutchinson, Coherence in New Music: Experience, Aesthetics, Analysis, (Oxford: Routledge, 2016), 5.

management of momentum and the rational decision-making processes that they establish as part of their work.

Therefore, despite the wealth of musicological approaches to momentum outlined earlier in the chapter, the examples of composers making momentum the subject of their work, and the fact that many composers manage momentum as a product of other temporal, harmonical, or structural concerns, the process of developing a consistent compositional approach that prioritises momentum seems to be of great value. In particular, I want to define an approach which goes beyond the surface-level, ensuring that momentum informs the fundamental design of the music and its consequent coherence, and treating intuition as a valuable part of my momentum-based decision-making process. This kind of approach remains relatively underexplored. Whilst musicologists have employed momentum as an analytical tool, and several composers have investigated ideas which are related to motion and progression, there remains a gap in the knowledge regarding the explicit, deliberate, and intentional harnessing of momentum as the primary guiding tool within the process of creating music. Whilst I recognised that an active attempt to harness momentum might not be *essential*, I anticipated that it could be immensely useful, if it enhanced clarity of thought during the design of works, as well as more effective communication about those works with performers.

1.4 Towards musical material

So far in this commentary, I have established the research gap that my practice-based exploration of momentum targets, and I have situated my research within both musicological and compositional contexts. I have demonstrated that the concept of momentum is varied enough to warrant investigation from multiple different perspectives, identified a gap in the knowledge, and explained why my focus is therefore directed towards the harnessing of momentum as a conceptual tool during composition. Whilst momentum's multidimensionality makes this project relevant to a wide range of composers, performers, and musicologists, I recognised that it might also be a threat to this project's success. Experience has taught me that as a composer, I am susceptible to becoming overwhelmed by possibility. Attempting to produce musical material before establishing clear conceptual bounds has previously caused me to lose control over the music's direction, due to uncertainty about how best to shape or manage the material as it develops. This in turn resulted in a composition process that relied almost wholly on listening and reflective assessment to try and hone the rate and direction of musical motion, nearer to trial and error than deliberate construction. This kind of process can produce satisfying output, but it is an approach to composition that I find inefficient,

unpredictable, and ultimately demoralising. As such, any vague or unfocused attempts to simply 'compose with momentum' were very unlikely to produce convincing works that made specific inquiry into the ways that momentum can be harnessed. Such oversimplification (or maybe, under-complication) would likely result in compositional intentions that are unclear, or underdeveloped, leading to confusion, indecision, and uncertainty for me as a composer. This would undoubtedly be reflected in my output.

To ensure that I avoided such unfocused inquiry, I framed my research with the following questions:

- How does the prioritisation of momentum influence my practice as a composer?
- What are some strategies, techniques, and processes that facilitate the implementation of momentum as a compositional tool, and how can they be incorporated into my compositional approach, so that they inform both rational and intuitive decision-making?
- How can processes and features that influence the momentum in external sources, from diverse disciplines (such as jazz, folk, poetry, or prose) be translated into my compositional method?

In attempting to answer these questions, I identified several aspects of momentum that connected my metaphorical designs for directed energy with my musical content. The way that I employed these features to create music that exhibited the tendencies I desired is discussed in depth in the subsequent chapters of this commentary, but some of the most vital concepts are summarised below, to facilitate easier understanding later.

1.4.1 Global and local

Most works in the folio approach momentum on two simultaneous scales. The first is 'global' momentum – the broad sense of directed motion, and its rate of change over the course of an entire passage, section, or work. Discussion of global momentum is not meant to be overly precise – it can be planned and organised, but it is a holistic and 'zoomed–out' perspective. This large–scale type of momentum might refer to a general trends over periods of time, such as the impression of energy fading away slowly, or the feeling that the cumulative musical energy is building towards a peak. 'Local' momentum, by contrast, refers to small–scale progress from one moment to the next – the specific placement of successive figures and gestures such that they feel cohesive and purposeful. There is a reciprocal relationship between these tiers – to an extent, the global directed energy dictates the placement, and arrangement of individual musical figures, but at the same time, the nature of those shapes

and figures can impact upon the way that global motion progresses. Sometimes the impact of specific figures, gestures, or shapes is best understood when viewed from a broader perspective. Equally, sometimes the wider musical context can be assessed through examination of the energy that is conveyed by a single gesture or phrase. Insofar as composition is concerned, both global-first and local-first approaches have uses at different times, and it is worthwhile to be able to approach my work from both perspectives.

1.4.2 Component factors

Over the course of the portfolio, I identified three secondary variables which I found had the most consistent influence upon musical momentum: density, entropy, and volatility. Consideration of these factors during composition can help with the identification of musical features that most strongly impact the momentum in a given passage, section, or entire work. By mapping out these variables and their rates of change over time, it is possible to create an approximate plan for the overall momentum in a work. Attempting to realise this plan can help with the coherent combination of disparate musical elements, and the effective communication of a sense of progression. These component factors also served as important tools for communicating about momentum with performers.

Density refers to the concentration of musical events within a given span of time. It can encompass the number of notes, gestures, layers, or textures occurring simultaneously or in rapid succession. High density implies saturation, intensity, or crowding of material; low density suggests openness, spaciousness, or restraint. Density is perceptually linked to activity and energy, but it does not necessarily correlate with entropy or volatility. A dense passage may be highly regular (low entropy) or unstable (high volatility), depending on how its elements behave. As a compositional parameter, density plays a crucial role in shaping texture, pacing, and dynamic contour.

Entropy refers to the degree of unpredictability or disorder within a work. It describes how difficult it is to anticipate what will happen next, based on pitch, rhythm, texture, timbre, or other parameters. Low entropy suggests high predictability and structural clarity, often resulting from repetition, pre-determination of musical processes, or stable implementation of familiar frameworks. High entropy can be communicated via irregularity, ambiguity, or a breakdown of expected patterns. Crucially, entropy is not equivalent to complexity. A passage can be highly complex but low in entropy if its behaviour is internally consistent and predictable. Conversely, simple material can yield high entropy if it unfolds in erratic or unexpected ways. In my compositional approach, entropy is both a structural tool and an

expressive force: it influences perceived momentum and informs decisions about how tightly or loosely musical materials are organised.

Volatility refers to the quality or state of being likely to change suddenly. Again, this could be approached via one or more musical parameters, such as pitch, rhythm, dynamics, texture, or timbre. High volatility may be expressed through rapid, unstable fluctuations, or through moments of apparent stasis that carry an implicit tension, where the sustained absence of change intensifies the expectation that change is imminent. Low volatility is marked by smooth, gradual development or clearly communicated structural stability. A passage may remain texturally static, and display low density and entropy, yet feel volatile if it builds anticipation of disruption. In my compositional thinking, volatility plays a crucial role in shaping dramatic contour, supporting shifts in momentum by implying progression through structures, and by creating tension, even in silence or stillness.

When working with performers, it is often both easier and more efficient to discuss approaches to composition using terms related to momentum such as density, volatility, and entropy, as those terms are not as heavily loaded with connotations or expectations as recognised musical features such as pitch, rhythm, or harmony. Being able to discuss my aims in terms which don't carry so much technical or historical baggage helped me to offer performers immediate insight into the inner workings of a piece, and the process by which it was created, reducing confusion, and reducing the potential for miscommunication to interfere with the successful realisation of my intentions for musical motion. These terms helped frame and contextualise my intentions, avoiding the confusion of physical and metaphorical meaning that affected Larson's work.

The graphical representations of momentum were also immensely useful when sharing ideas with performers, as they afforded the musicians more insight into my pre-compositional aims, revealing details about the creation of figures and ideas that would be harder to discern through the final score alone. This improved communication from both parties, and by consequence, improved the quality of my final output. In the later stages of the portfolio, I explore the use of graphical designs for momentum based on these three secondary facets in some depth, testing the impact of these visual representations of momentum in a variety of ensemble contexts.

1.4.3 Improvisation, decision-making, and expectations of the musical score

The relationship between composer and performer(s) is built upon a necessary set of expectations. These expectations ensure that all parties understand the roles they need to fulfil in order to produce the best version of the music that they can. This is especially relevant

to time–limited contexts (such as workshops and development opportunities), where rehearsal needs to be highly efficient. Whilst there is debate about the extent to which the score can be seen as absolute within classical music, there is a general expectation from performers that the score should contain a sufficient level of detail that ensures that any given performance is repeatable, measurably accurate, and consistent with the composer's intentions. Performers understand that it is their responsibility to attempt to faithfully reproduce these details, and whilst there might be some allowance for (or encouragement of) interpretation, on the whole composers can expect any two given performances of a fully notated classical score to be very similar, Factors such as ensemble type and performance context also influence the level of interpretive variance (e.g., a solo pianist reciting Romantic works might be expected to take more interpretive liberty than a chamber orchestra playing music for a ballet), but overall, this relationship is relatively secure across many classical performance contexts. In other areas of music (e.g. jazz), the opposite is often true – the composer's notated work is made with the understanding that it is open to interpretation, and that the performers will adapt and develop the material, incorporating their own ideas along the way. In improvisation–focused contexts, two performances can vary significantly, with only fundamental musical elements remaining consistent from one version to the next. These implicit expectations and standards have a direct impact on the way that musical momentum and directed energy can be built and manipulated. Much of my music actively blurs lines, embedding devices that encourage improvisation, spontaneous decision-making, randomness and unpredictability into otherwise fully notated scores. This incorporation of improvised elements can be used to induce shifts in the balance of power between composer and performer(s), and these shifts are recurring points of note that impact the momentum in several of the works in this folio.

1.4.4. Scope

As a practice–based project, the works included in the folio are the 'basis of the contribution to knowledge'.[59] Fundamentally original, they provide insightful responses to the research questions, which could not be better expressed through language or other non–musical means. This commentary's purpose is to explain some of the key choices and considerations that shaped each work, documenting my intentions, some challenges faced, and the main outcomes arising from the momentum–focused approaches I employed. It should be noted that the commentary is not exhaustive – I address the most relevant and valuable points

[59] Linda Candy, 'Practice Based Research: A Guide', *Creativity and Cognition Studios* (Report, University of Technology, Sydney, 2006): 1.

arising from each work, but cannot usefully deconstruct every process, technique, and idea explored in the music. Similarly, I will not attempt to analyse the impact of any of my decisions upon the audience. Whilst I do try to imagine how different listeners might interpret my music, any attempt to report on or quantify their real–world experience would quickly go beyond the focus of this project.

The works in the folio are presented in chronological order, by date of completion. This reflects the folio's naturally iterative design, and the fact that my practical application of momentum–related approaches was continually refined as the research progressed.

2: Exploration and Experimentation

In this first stage of the project, I identified and tested some preliminary strategies for engaging with momentum. Prior to commencing my PhD, I found some success incorporating features from late 20th and 21st century jazz into my musical output, and I recognised that much of this music displayed interesting approaches to musical motion. In many jazz works, melody plays a foundational role in the management of global momentum. Even when all members of an ensemble are simultaneously improvising, and the melody is not explicitly heard, it remains an implicit point of reference, guiding ensemble interaction and ensuring that improvised decisions regarding the overall direction and intensity of momentum remain coherent and consistent. This overarching clarity allows for flexibility in the handling of local momentum, which is shaped through distinct processes of suggestion and implication. Techniques such as parsimonious voice leading, modal interchange, and syncopation are employed to suggest (or subvert) moments of harmonic arrival, which remain governed by the principal melody. I was particularly inspired by contemporary applications of this melody-driven, harmonically flexible approach, as exemplified in compositions by John Taylor, Kenny Wheeler, Brad Mehldau, and Kit Downes. These musicians design and construct their melodies so that in performance, they are able seek out unexpected sonorities, taking calculated risks to shape their musical content in ways that foster a persistent sense of instability. Whilst improvising, they use this localised unpredictability to construct complex, tension-filled phrases and gestures capable of deviating impulsively from expectation – but always in a way that ultimately conforms to the essential directed energy communicated by the melody. Thus, the inclination toward complexity does not compromise the coherence of the overall sense of momentum; in fact, it contributes to the character and nature of the motion.

In *A Lost Chaconne,* I attempted to expand on one example of this approach to momentum, using 'The Garden',[60] the first track on Brad Mehldau's album *Finding Gabriel* as a point of reference. In *Still, Inside*, I experimented with improvisation, live coding, and randomisation, reflecting on and attempting to classify some of the most significant facets of momentum by isolating them in a context that does not engage with pulse, metre, or conventional notation. Then in *The Black Path*, I refined my handling of momentum further still, separating my designs for momentum into explicit global and local tiers, and experimenting with the balance of power between composer and performer(s) for the first

[60] Brad Mehldau, 'The Garden', *Finding Gabriel*, Nonesuch, 2019, CD.

time. Whilst some of the approaches I tested were immediately impactful, others required refinement and redesign in later stages, as unanticipated issues limited their efficacy. The knowledge gained from these early pieces provided a platform upon which I could build; the learning that took place during their creation was crucial to the subsequent development of my practice.

2.1 *A Lost Chaconne*, for recorder quartet

In numerous reviews and interviews, writers label Brad Mehldau as 'a jazz pianist with a Brahmsian bent'[61], or 'a jazzman in a classical mood',[62] who holds 'affinities with 19th–century German Romantics like Schubert and Brahms'.[63] John Lewis suggests that 'even when he's gently mutilating pieces by Radiohead, Nick Drake or the Beatles, [Mehldau] sounds like Glenn Gould ripping into the Goldberg Variations.'[64] Mehldau has expressed respect for Brahms, Bach, and other composers from the Western classical tradition; his particular admiration of Brahms stems from the fact that 'Brahms was a master of counterpoint, with its strict rules, yet his music expresses ardent, immediate emotion that we associate with the free flights of romanticism.'[65] Despite the many classical comparisons, in terms of harmony, timbre, phrase shape, and many other significant musical elements, Mehldau's jazz music does not typically sound much like Brahms. Instead, Mehldau's implementation of the aforementioned approach to momentum produces an experience of motion more reminiscent of a Brahms' intermezzo than of archetypal 20th jazz standards such as Bobby Timmons' *Moanin',*[66] or Errol Garner's *Misty.*[67] In particular, it is the 'use of imitation and dialogue between left and right hands in both his compositions and improvisations' that results in melody-led motion that is more reminiscent of classical repertoire.[68] These 'contrapuntal idiosyncrasies … have come to define Mehldau as a composer and performer',[69] and Mehldau has acknowledged the prioritisation of line and melody in his music, stating: 'I am no longer relying on the structure of the song for my improvisation, in the classic jazz manner

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[61] Adam Shatz, 'A Jazz Pianist with a Brahmsian Bent', *New York Times*, Jul 25, 1999, AR 31.
[62] Allan Kozinn, 'Brad Mehldau is a Jazzman in a Classical Mood', *New York Times*, Nov 10, 2010, C3
[63] Shatz, 'A Jazz Pianist with a Brahmsian Bent', AR 31.
[64] John Lewis, 'Contemporary Album of the Month – Brad Mehldau: After Bach', *The Guardian*, March 1, 2018.
[65] Brad Mehldau, 'House on Hill,' *Brad Mehldau Music*, March 2006, accessed March 23, 2025, https://www.bradmehldaumusic.com/essay-house-on-hill.
[66] Bobby Timmons, 'Moanin',' *Moanin'*, performed by Art Blakey and the Jazz Messengers (New York: Blue Note Records, 1999), CD. Originally released 1958.
[67] Erroll Garner, 'Misty,' *Contrasts* (London: Columbia Records, 2000), CD. Originally released 1955.
[68] Daniel J. Arthurs, *'Reconstructing Tonal Principles in the Music of Brad Mehldau,'* (PhD thesis, Indiana University, 2011), 2.
[69] Ibid, v.

of theme and variations… but instead am using pieces of the melody as motivic jumping–off points, and then allowing the harmony to follow in a freer manner'.[70] Chinen reckons that this approach allows Mehldau to '[preserve] the intervallic heart of the melody while shifting textures and tonal centres almost constantly'.[71]

In *A Lost Chaconne*, I planned to build on the layered approach Mehldau employs in 'The Garden' by composing a primary melodic line of my own, but then entirely excluding this fundamental melody from the performance score, so that only its influence remains. I hoped that extending Mehldau's use of implication and expectation by entirely separating the governing melody from the final score might enable me to indicate that my music had the potential to move towards harmonically distant points of arrival, without destabilising the momentum on the broadest scale, or undermining any key moments of structural importance in the music. I speculated that attempting to replicate the jazz-based model of localised deviation within melody-directed motion might be an effective way to capture the sophisticated interplay of tension and resolution that characterised that style of jazz, without needing to mimic jazz rhythms or harmonies. I recognise now that this approach could be explained as local momentum being produced by imitation, governed according to intuition, whilst global momentum is managed by the shape of the melody. At the time of writing this piece, I had not yet established that stratified understanding of global and local tiers. As a result, sometimes my approach to momentum in this work lacked precision and consistency, and this made it harder to retain an overall sense of coherence in the piece I produced.

The prime melodic content in 'The Garden' is built on top of a gentle, but incessant piano loop. At first the loop establishes a modal feel, but as layers are added, and the melodic figure progresses, the harmony is destabilised and the movement of individual voices becomes the principal factor controlling the experience of local motion. With each added layer, the intensity increases, and a corresponding increase in density makes it apparent that the music is accelerating towards a climax. This process continues towards an inevitable explosion point, around four and a half minutes into the piece, where wild and frenetic improvised solos disrupt the layering process. In the buildup to this apex moment, the prime melody is totally removed. It is entirely replaced by jagged, improvised figures and shapes, which are sonically dissimilar to the core melody, but which are clearly arranged around the implied, unheard line. After this climax, the rate of momentum decreases significantly. The solo section fades to surprising silence – it does not receive neat harmonic resolution, and there is little in the way of closure, as the melody does not return. Instead, after the silence,

[70] Brad Mehldau, quoted in Nate Chinen, *Playing Changes* (New York: Vintage Books, 2019), 47.
[71] Chinen, Playing Changes, 48.

a short bridging soli passage brings the music back to a variation of the initial loop. The musical content continues to imply an association with the original melody, but the melody itself is withheld until the final few seconds of the work; its return signifies the end of the process, and thereby the work's close. In this way, the momentum is still influenced by the melodic line, even when it is not present in the music.

My work is also constructed on top of a fundamental musical core. But, as mentioned above, rather than embedding that core within the music, I separated it from the ensemble and include it in the score as an extra part, which is intended to be left unheard in performance. This is the titular *Lost Chaconne* – a steady recurring melodic sequence, which provides the framework upon which increasingly complex and intricate lines and shapes can be constructed. The quartet can refer to this part in rehearsal, to better understand how their own lines were derived and assembled, and how they relate to the global sense of momentum that I envisaged during the music's design. This increase in understanding should lead to performances that more closely align with my intentions.

There are two halves to the underlying part. At first, it contains a descending scalic motif which is slowly distorted via small changes to the placement of the motif against the metre. The heard quartet drift further and further from the core line, until the process ultimately breaks down at the mid–point of the piece. Following this climax, the 'lost' melody becomes a simple two–part pattern which is propelled through a chain of consecutive metric modulations, in which each repeat of the pattern enters at a slower proportional speed.

Fig. 2 shows the second core figure, at three different proportional speeds. This shifting loop underpins the falling microtonal gestures in the heard quartet. The pitches and rhythms from the core line are preserved in the performance score, and align neatly with the heard staves, ensuring that the unheard melody's voice-leading retains a controlling influence on the intricate microtonal gestures. This is best observed in bars 34 and 35. Both voices in the unheard melody descend by semitone, from D and B♭ to A and C♯. The soprano recorders make the same journey in the equivalent number of beats, (meaning their direction and rate of travel aligns with the core melody) but they do so with the addition of microtonal triplets and quintuplets. These additions increase the localised complexity and suggest a desire to move away from the fundamental melody. As the piece continues, the recorders begin to follow this implied escape, deviating further away from the unheard core, realigning with it less frequently, and moving with less predictability. Eventually (around bar 42), the heard staves bear almost no audible resemblance to the unheard 'lost chaconne', but, even when the core line is almost totally removed, they continue to align with its implied shape. As the music draws closer to the work's conclusion, the momentum seems to decelerate, but the

tempo of the heard staves does not change, (except for a small rallentando that helps to signify the arrival of the closing section at bar 54). Instead, it is the modulation of the melody that slows them down. The unheard melody pulls back on the microtonal figures, resulting in the momentum losing pace. Eventually, as the parts stabilise around a pedal tone, a closing melodic figure emerges. It is built out of the final iteration of the core line, and continues to follow the voice leading of that unheard part. The core line's influence is so distant now that this figure seems to have 'grown' of its own accord.

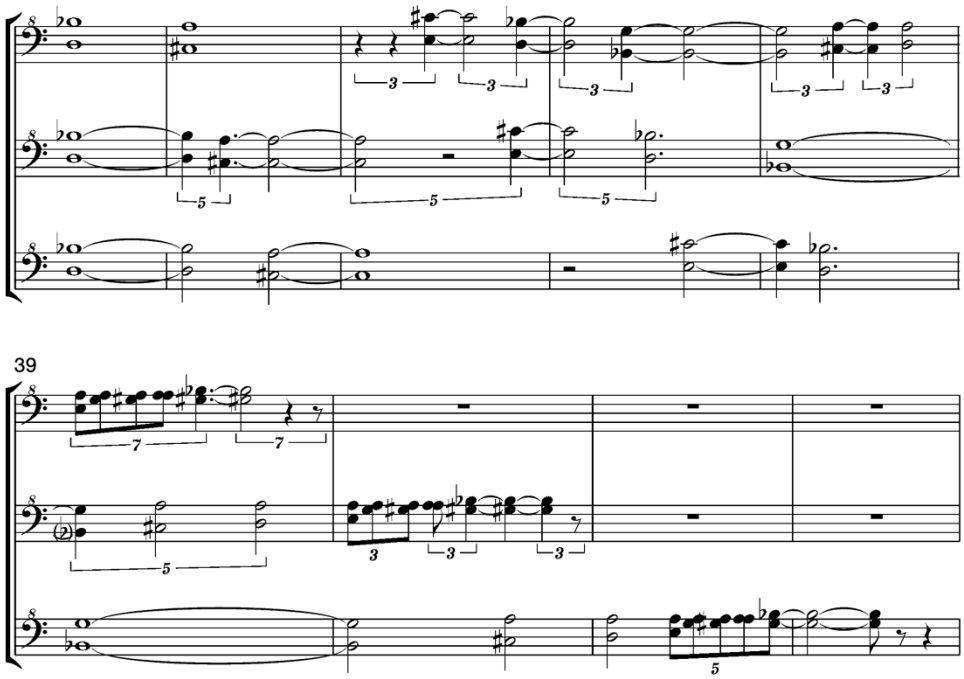


Fig. 2 Proportional variations of unheard pattern in *A Lost Chaconne* (in ratio 4:5:6)

With the benefit of hindsight, it is apparent that Mehldau's approach to momentum could be explained by some of the factors influencing momentum discussed in chapter one of this commentary. He creates an initial melodic impulse, and then, through a steady increase in density, volatility, and entropy, builds towards a climax, and this intensification determines the global sense of inevitable motion. Mehldau manages to create a sensation of travel through a musical plane even though his harmony has not gone anywhere at all. At this early stage in the project, I had not yet identified those crucial factors influencing momentum, nor had I sufficiently understood the difference between global motion and local movement. As such, my ability to truly harness the directed motion was limited. I hoped that the precise–but–obscured mathematical transformation in this piece would indicate a sense of movement, and that the stretching and twisting of patterns would suggest that the music is being pushed towards some kind of ultimate collapse governed by an external agent. At

times, this was a success. The microtonal passages were well governed by the unheard line, and this helped me to manage both the overall motion, and the extended temperament. However, at other times, I struggled to harness momentum, as I was not sufficiently in control of the processes I developed. In the first half of the piece in particular, the music I created whilst sketching ideas would quickly drift from the unheard line, to the extent that the primary direction and intensity of motion became unclear, and the melodic features outlining my control over the musical momentum were undermined. When attempting to address this issue, I found that the processes I created introduced too many layers of tight logic and I struggled to manage them all at once. I recognise now that I was not yet equipped to handle these layers, as I had not developed separate global and local approaches, and consequently they suffocated my ideas, rather than supporting them. With perspective, it is clear that for this process to succeed, the primary melodic material cannot rely too heavily on any one scale, mode, or harmonic field. Aspects of the melody need to remain perceptible, even when harmony, rhythm, and pitch have been transformed. The melody that I designed did not afford me sufficient flexibility in this regard, and this again explains the conflict between intuition, local motion, and the global sense of forward energy that I encountered in this work.

Another limitation that I hadn't fully accounted for was the recorder's lack of dynamic range. I knew that the instrument's gradation of tone takes places over a smaller span than other instruments, but I had not appreciated that this significantly affects the musical momentum. *A Lost Chaconne* taught me that dynamics are one of the most significant tools for quickly adjusting the direction or rate of musical motion – they have increased impact in momentum–focused contexts that do not prioritise harmonic function. With the various compositional restrictions already imposed on harmony and phrasing, the ensemble's limited dynamics exacerbated the lack of flexibility in my approach. Overall, whilst I did manage to make some useful exploration of the jazz-derived idea of melody-dominant momentum, the fact that I had not yet developed sufficient strategies for managing momentum at this early stage meant that my ultimate aims for momentum were only somewhat successfully realised.

2.2 *Still, Inside*, for live coder/audiovisual

Still, Inside was created in the early months of 2021. It is a reflection on my experience of the first Covid–19 lockdowns, and the impact that isolation had upon my relationship with the everyday objects around me. Lockdowns, social distancing, and the move to home–working rapidly and significantly altered the landscape of music–making in general. The innocuous and unobtrusive buildings outside my window suddenly seemed more intriguing, as I spent more time at home. As I observed them from new angles, my perception of time felt strangely

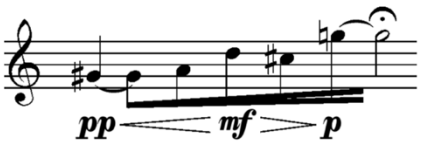
warped, as though the familiar surroundings had taken on new layers of meaning. When restrictions eventually eased and life began to return to normal, I found myself noticing new details in the buildings, objects, people, and places around me that I had previously taken for granted. In *Still, Inside*, I tried to capture some of that experience, sampling, transforming, and reconstructing familiar instrumental sounds to reveal new qualities and overlooked features through temporal and conceptual engagement with momentum.

At the time of this work's creation, conventional opportunities to collaborate with performers were limited, and new attitudes were therefore required. To make the most of the situation, I began to explore live coding, using the 'code–based music creation and performance tool' *Sonic Pi*, devised by Sam Aaron.[72] At first, I had no intention of including this music in my PhD research – it was something to explore whilst trapped indoors, and I thought it might become a separate strand of my compositional output. However, it quickly became clear that this type of code–based music making invites many opportunities for novel thinking about momentum.

The work was created in collaboration with Federico Pendenza (classical guitar) and Lizzie Knatt (recorders). It was a fully remote process: we followed an epistolary method, whereby I notated small, fragmented ideas and text–based instructions, and then sent these fragments to the performers, asking them to make recordings, and return them with to me with feedback. The sample prompts varied significantly: some were very precisely notated, whilst others left much to the performers' discretion, encouraging them to make use of their instrumental knowledge. An example of one such prompt is shown in **Fig. 3**, and the complete 'sample prompts' document is included as **Appendix A**. After a few iterations of this collaborative process, we created a bank of audio samples, which I could manipulate in Sonic Pi to construct the final piece. This was a unique collaborative process – it was very fruitful, and the performers reported that they felt meaningfully connected with the content of the work, because of their agency over the creation of sample material, despite being somewhat removed from its final form. However, I don't think any of us would like to replicate this work's circumstance.

[72] Sam Aaron, 'Sonic Pi', *Sonic Pi*, n.d., accessed July 30, 2024, https://sonic–pi.net/

- Play this motif. Make three recordings.



  - Guitar: play it in three different positions (to create timbral variation)
  - Recorder: incorporate some different fingerings/use different instruments each time (slight microtonal discrepancies are welcome!)

Fig. 3 Prompt for sample–making, as shared with performers for *Still, Inside*.

There is no strict performance score for *Still, Inside* – just a general plan for the momentum. Performers are instructed to use the samples, within the coded structures in *Sonic Pi*, to create improvise an experience of motion that aligns with movement across the four axes shown below in **Fig. 4**. The score included in this folio is documentary evidence and reflects the submitted audiovisual performance – it follows the general sounds as they were manipulated, but it is not prescriptive. In place of instructions regarding metre, form, and harmonic function, the live coder manipulates the library of samples and their sound, instigating momentum processes, based on oppositional continuums, and reacting to randomised events, to shape the musical motion in real time.

The plan for (what I now recognise as macro) momentum was conceived on a set of axes (**Fig. 4**). These descriptive axes were my first attempt at identifying the key factors influencing momentum. I recognised that the idea of moving from one end of a spectrum to the other (e.g. from order towards chaos) creates an impactful sense of direction in the music – it creates an objective for the live–coder to aim towards, and this facilitates thoughtful, spontaneous decision-making. For the version of the piece included in the folio, the broad outline was to move across the axes from left to right, towards a climax, then back leftwards after this peak, until the work's close.

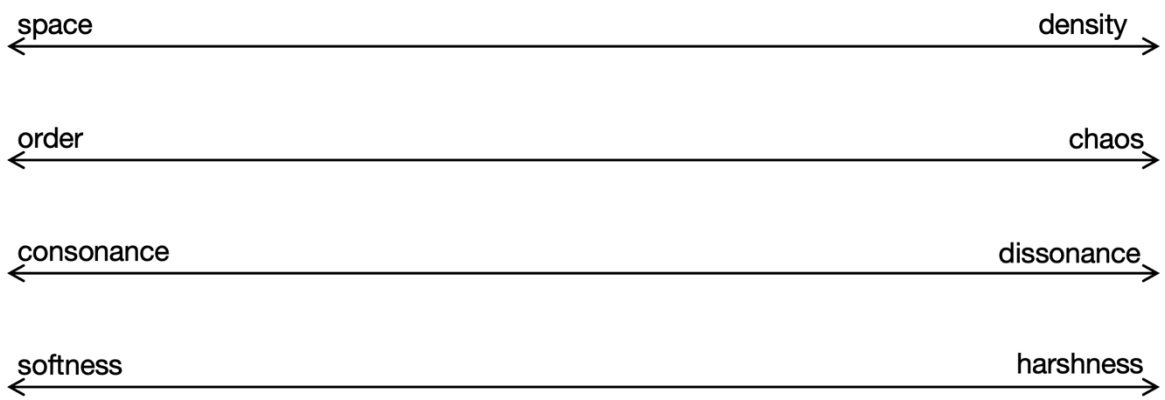


Fig. 4 Axes organising momentum in *Still, Inside*

In Sonic Pi, I organised the samples into modifiable blocks of code. These blocks are designed to facilitate various kinds of randomisation, and multiple ways of controlling the sounds. One block of code might command Sonic Pi to choose a particular pitch (for instance, one of the 5 pitches in the motif in **Fig. 3**), and to play this pitch for a certain duration, or to pass it through FX such as reverb, delay, ring modulation, to alter the sonority. Another might involve only unpitched samples and randomise their playback rate (speed). These values can all be adjusted at will, during performance, allowing the live coder to closely shape the sense of motion as it develops. Their management of specific gestures is therefore improvised and reactionary – the coder will always know what the approximate outcome of a command will be, but they cannot make specific decisions regarding pitch content or be overly temporally precise. I recognise now that this equates to control over the overall (global) flow of energy, which is governed by the movement across axes, leaving the local features to follow their own indeterminate paths.

The submitted version of the piece was recorded in a single take, to capture the live, improvised nature of the piece. It also has an added visual element – a series of fixed shots of various views from within my home, looking outside. These snippets of footage play at varied speeds – some slow, some up to 20 times faster than captured, mimicking some of the processes applied in the code, and hopefully drawing the audience's attention to issues of progression and perceived flow. Whilst attending and presenting at some of the online performances of the lockdown era, I learned that watching coded loops run on a screen at home is not as comprehensively stimulating as a regular concert. In–person performances offer plenty for the audience to look at, be surrounded by, and engage with. Observing the performer's relationship with their instrument, their sound, and the performance space can be just as important to the experience of energy as listening to the work. This does not mean that online performance is inferior; rather, that other considerations need to be made. So, for the showings of this work which took place entirely online, the additional visual element was provided in the hope that it might satiate the visual appetite of a virtual audience watching and listening from afar.

Representing the factors influencing momentum upon a set of continuums was highly effective. The four axes in **Fig. 4** were useful as both compositional guides and instructional performance tools, and my simple plan to move along the axes was clear enough to help me make decisions about the development of the sound over the course of the work. I was able to engage with momentum in a reactive manner – not just planning the energy of an entire piece in advance, but shaping and adjusting it in real time to ensure that the rate of travel is just right. In general, the global–centric approach in *Still, Inside* resulted in largely steady

change. It encouraged a glacial sense of movement, and didn't respond so well to sudden interjections, or unexpected alterations to the direction of travel. This was something I intended to develop in subsequent pieces, as I recognised for the first time here that global considerations might be beneficially separated from local designs – even in conventionally notated works. Refining this idea, and refining the axes, became a key goal for the next stage of the project.

2.3 *The Black Path*, for string quartet

The Black Path was composed in summer 2021. The most substantial work of this exploratory phase, it continues to engage with improvisation and indeterminacy – this time in a conventionally notated score. It was during the development of this piece that I first trialled the global and local descriptors. I predicted that separating my conceptualisation of momentum into discrete strands would allow me to make localised adjustments according to intuition, altering harmonic, rhythmic, and melodic aspects of specific figures and gestures as needed, without then needing to reconstruct the overall musical shape, to accommodate the changes made. I hoped that this would circumvent some of the challenges encountered in *A Lost Chaconne*, resulting in a creative process that was more productive, efficient, and sustainable, which avoided the experience of being constricted by pre-determined harmonic or structural concerns. In this work, the global momentum is defined by repeated movement from order to chaos and back again. It is also heavily influenced by shifts in the balance of power between the composer and the performers. I approached local momentum via simple thematic juxtaposition, organised by a Ligeti–inspired structure.

The Black Path is split into two movements. The first establishes a traditional score–as–absolute approach, in which the performers adhere to precise, largely conventional notation. The music repeatedly tends towards chaos, resulting in wild indeterminate gestures which break through the texture (bars 46 and 95, for example). The nature of the indeterminate techniques means that performers make some localised decisions about pitch and gesture at these entropic moments, but these moments are fleeting, as I retained fundamental control over structure and the arrangement of material. I recognise now that the implied movement towards these peaks was just as influenced by density and volatility as entropy. I was not actively tracking these factors in *The Black Path*, having decided to focus predominantly on the order/chaos continuum. A more complete representation of those factors influencing momentum would have made the generation of material even easier here.

At the start of the second movement, the performers are given greater control over several parameters, including pitch, duration, and density of texture. Consistent metre

disappears, and instead, performers must communicate with one another to decide upon the rate of progression and synchronisation. I employed dashed barlines as points of non-metred reference – performers can use these lines to validate their position relative to one another, but they should not infer (or convey) strong and weak beats from these bars' placement. Through the use of these barlines, as well as boxed notation (determining the gestural material a performer should use, but not specifying specific rhythms or synchronisations), I was able to retain control over the fundamental shape, whilst ceding final choices regarding pitch and rhythm to the performers. The performers do not gain total control of the musical momentum, given that I pre-selected the array of pitches available to them, and prevented them from diverging too heavily through the grouping of material within the dashed barlines. Rather, they are given just enough power to influence the particular means by which the music arrives at certain key moments. This is a fundamental shift, and there is a consequent change in the nature of momentum. The global rate of motion seems to slow and reduce in intensity as a consequence of this change. The music is less obviously goal-oriented, and greater focus is placed on the local level choices that the performers make.

From bar 129, I began to gradually transfer power over decision-making back away from the performers, by reintroducing elements of conventional notation. Indeterminate elements (such as boxed notation) persist until bar 213, near the works close, but these devices are increasingly used to support or accompany the primary melodic or gestural material, which is precisely notated. My intention was to create the impression that the way that the music moved had been irrevocably changed; that the effects of the transformation process lingered even once the notation was fully conventional. In other words, affording the performers a greater degree of agency at the start of the second movement invited them to continue to expressively interact with the standard notation in the rest of that movement, in a way they might not otherwise have done. I hoped that this change in the nature of momentum would have a notable impact upon the way that the performers communicated the experience of closure (and the cessation of momentum) at the end of the work. I feel that this was achieved – in the recording included in this folio, the Diotima quartet are completely synchronised, right through to the final bar. The final notes feel fragile, but conclusive, and the final bar of silence feels heavy, as though time is momentarily suspended.

Although I had not yet begun to chart my pre-compositional designs for momentum in the form of line graphs, it is useful to approximate my abstract perception of the movement between order and chaos in graphical form here. **Fig. 5** is a retrospective attempt to visualise my intentions. It maps the order-chaos continuum onto the y axis, and bar numbers on the x axis, showing how I might have represented the development of global motion in *The Black*

Path on a line graph, as a process of gradual movement from one extreme to the other. There are two entropic peaks in the first movement, around bars 46 and 96. The changing responsibilities in the second movement contribute to one slower build to a climax in bar 186.

When working on *The Black Path,* I conceived of general changes in the amount of order/disorder, and had not yet thought about expressly specifying the amount of entropy at particular moments. Thus, the graph in **Fig. 5** is approximate, and should be interpreted as such. It effectively represents my general design, but it normalises the local fluctuation to a substantial degree.

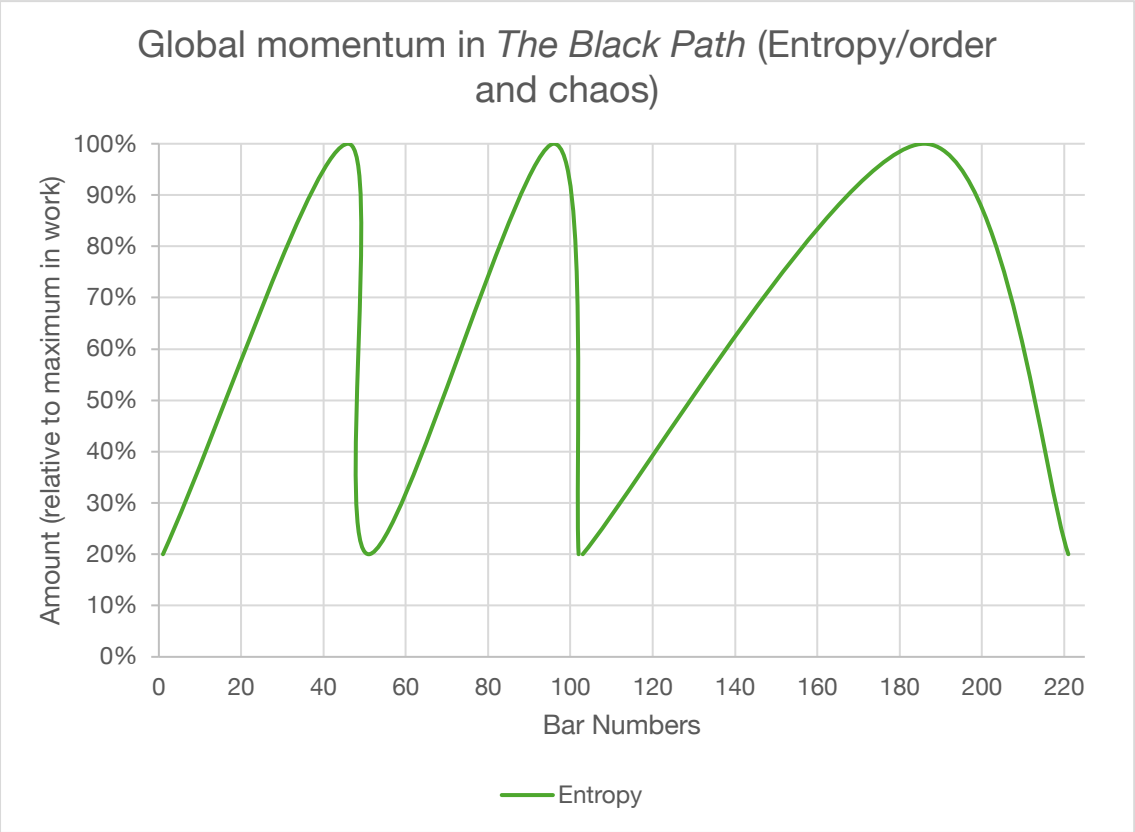


Fig. 5 Graphical representation of movement between order and chaos, the principle governing factor for global momentum in *The Black Path*.

The moment-to-moment progression (i.e., the local momentum) in *The Black Path* is governed by a separate structure, unrelated to the movement between order and chaos. I initially hinted at a serial design, steadily moving from dissonant clusters to consonant intervals. Two themes governing the local motion emerge: the first, built from the initial part of the row, is formed of sustained chromatic clusters, that glisten and rub against one another. The second theme is represented by short, spiky, fast flowing melodic shapes and gestures. The juxtaposition and contrast of these simple concepts determines the moment–to–moment progression of the first movement. The second movement is similarly governed

– this time theme 'A' is equally tempered material, and theme 'B' constitutes any material from outside this temperament. The themes appear in a precise order, as shown in **Fig. 6**. In line with my intention to reinterpret ideas and material from various external sources, this tabular structure is adapted from a thesis found whilst researching the musicological definitions explored in chapter one. In his analysis of transformation procedures in Ligeti's second string quartet, Power acknowledges that 'the brevity of [the table's] descriptions might seem striking in view of the richness of activity that [Ligeti's work contains]. They are intended to be concise enough to be applied in a wide variety of circumstances, yet specific enough so as not to be meaningless.'[73] I was struck by the potential to transform this analytical tool into a compositional aid, useful for organising local momentum. In my experience, much of Ligeti's music incorporated local complexity whilst communicating coherent large-scale motion, and so it made especial sense to explore ways of assimilating elements of his approach into my own work.

I found the structure usefully pliable: it allows for clear flow of the two related concepts: restricting thematic content to this binary pattern makes moment–to–moment decision making much easier. I was somewhat surprised to find that working within this prescriptive local structure gave me a sense of liberty. The pressure to adhere to my own self-imposed bounds (that caused issues in *A* Lost Chaconne) was lifted by this structure – its specificity gave a sense of purpose to my problem solving, but its flexibility meant that I was able to transfer this into directed musical progression. My deliberate selection of broad and imprecise conceptual themes (such as temperament) also helped here. My separated approach to global and local momentum meant that adhering to this structure did not impact my plans for the fundamental motion, and this also lifted some of the burden, as I was able to manipulate my material without worrying about the impact on the global concept.

In particular, developing material for stage XIII caused me to reflect on my practice, as it contradicted my intuition – the idea that I should still be introducing ideas in new forms, right until the end of the work, was a little alien to me – but it resulted in some of my most effective writing. In the first movement, this section was achieved through the introduction of pizzicato. In the second movement, I employed harmonics, and outlined fragments of a local folk melody, 'Sea Coal', [74] to tie together the precisely–notated–but–improvised feel. The introduction of the new textures showed that the processes determining the local momentum

[73] Richard Power, 'Analysis of Transformation procedures in Gyorgy Ligeti's String Quartet No. 2', (Doctoral Thesis, University of Illinois Urbana–Champaign, 1995), 110.
[74] Jon Boden, 'Sea Coal', *A Folk Song a Day: October*, Navigator Records, 2010, https://open.spotify.com/track/7rUkZ3yW6o99hdA8NHkHRA?si=80da8d8a26c84e29.

were about to reach their conclusions. The fact that the new material was aurally distinct from the previous music helped me to signify that no further manipulation of the established themes was going to occur. This subtle signal that the local momentum processes were nearing completion corresponded with the global decreasing momentum at the end of each movement, as the music generally tended towards order once more. In this way, the introduction of new material helped to create the experience of closure. The extent to which the decreasing momentum suggested impending closure would be reduced, if these sections were omitted.

The fact that this arbitrary limitation had an overall positive impact is of note: as just mentioned, in *A Lost Chaconne*, similar limitations were largely unhelpful. The difference lies in the nature of the restriction – 'new texture' was a broad directive, that could be interpreted in countless ways. As such, though it did not initially feel intuitive, I was able to generate and test different musical material, until I was satisfied with a solution. In *A Lost Chaconne*, the global and local momentum were effectively bound together (because I had not yet conceived of their separation), tied to specific transformations of harmonies and rhythms that were repeatedly outlined in the organising melodic structure. This made it difficult to edit one part of the work without then needing to make significant adjustments to the overall shape and form. So, though the tabular local structure did sometimes present challenges, these issues did not suppress my creativity, but rather invited me to find solutions, and this was partly thanks to the fact that my designs for local momentum were not set apart from my global approach.

As I had hoped, changes to the balance of power are indeed particularly effective in the context of a string quartet. Chamber ensembles are some of the closest, most knowing group a composer can engage with, and Quatuor Diotima, who workshopped this piece, are some of the best communicators within the string quartet world. String quartet players in particular are required to develop an implicit understanding of their co–performers that is not seen in many other ensembles, 'because all musicians contribute similar elements to the musical performance and they use comparable instrumental techniques. Thus, cohesion and performance quality are more explicitly dependent on social dynamics in the group, rather than on technical aspects of playing music.'[75] As such, transferring power to performers in this context yields particularly interesting opportunities for combined improvisation, communication, and engagement, as the performers can communicate nuanced details and decisions via musical, non–verbal gestures, as well as anticipate the choices other members

[75] Gualtiero Volpe et al., 'Measuring Social Interaction in Music Ensembles', *Philosophical Transactions of the Royal Society B: Biological Sciences*, 371, (2016): 3.

of the group will make. Gilboa et al confirm this position when they acknowledge that 'on the one hand, each [string quartet] player preserves his or her identity while playing but, on the other hand, members of [a string quartet] work as a team to create a cohesive and compelling musical performance. This duality is stimulating not only from the musical perspective but also from organizational and social aspects.'[76]

Stage	Description	Mvmt I Bar No.	Mvmt II Bar No.
I	Introduction of theme A (long clusters) (equal temperament)	1	104
II	Introduction of theme B (short 'spiky' figures) (extended pitch)	28	121
III	Superimposition of themes	32	129
IV	Pinnacle, theme B	45	137
V	Superimposition of themes	51	141
VI	Stasis, based on theme A	64	144
VII	Exaggerated gestures, instability, based on theme A	68	148
VIII	Variation of theme A, influenced by stage VII	70	158
IX	Variation of theme B, strong contrast with stage VIII	91	171
X	Superimposition of themes	94	175
XI	Combination of themes, convergence or divergence of register, climax	95	181
XII	Residue of XI, continued convergence or divergence	97	190
XIII	New texture with strong links to previous events	99	195
XIV	Convergence or divergence, evaporation	102	218

Fig. 6 Table demonstrating the structure of 'themes' organising local momentum in *The Black Path*, adapted from Power's 'Analysis of Transformation procedures in Gyorgy Ligeti's String Quartet No. 2'.

[76] Avi Gilboa and Malka Tal-Shmotkin, 'String Quartets as Self-Managed Teams: An Interdisciplinary Perspective', *Psychology of Music* 40, no. 1 (2012): 19.

The dual approach to local and global momentum worked very well. At times it was difficult to keep track of the multiple threads running simultaneously through the piece; had I developed the graph in **Fig. 5** at the time of creating *The Black Path*, I might have found it easier to compare the alignment of my global concept with the local governing structure from **Fig. 6**. Nonetheless, even without a graph to refer to, and, unlike *A Lost Chaconne,* the process was always manageable. It allowed for precision, close control of individual instruments, and effective idiomatic writing, whilst also facilitating the kind of overarching structure necessary for continuity in long–form works. I anticipated that the larger the ensemble, and the larger the work, the more useful this kind of stratification of momentum might become. On a larger scale (e.g. in a work for orchestra) I expected this kind of separation of momentum could be very successful indeed.

3: Developing and Refining

Having tested several preliminary strategies for harnessing momentum, this second phase of the project focused on refining my application of those strategies. Consolidating my understanding of the strategies' strengths and limitations increased the efficiency of my practice, maximising my ability to impact the musical energy. In this phase I produced two works: *Wrought*, in which I refined the 'factors influencing', and translated their axes–based representation into graphical form, and *The Calm Estate of Grief,* in which I iterated on the process of integrating energy from external (and non–musical) source material.

3.1 *Wrought*, for trumpet and piano

During the creation of *The Black Path* and *Still, Inside*, it became apparent that, whilst certainly useful, the axes could be improved. Some of the factors were more consistently impactful than others, and the axis design cannot easily represent more complex designs for the change in momentum over time, especially approaches which involve multiple increases and decreases in the rate of change. So, as I began to compose *Wrought*, I refined my terminology, selecting precise, but malleable terms, and then enhanced the terms' visual representation by plotting the factors on line graphs.

Of the original terms, 'density' was the most effective. Its musical meaning is better established than the other terms: many composers have explored aspects of density in a variety of ways. Querfurth assembled a number of approaches to density into the following informative definition: 'the number of events within a specific frame of musical time and a specific musical parameter (e.g. pitch, rhythm, timbre, etc.).'[77] This understanding of density is useful for my composition: it is precise, but sufficiently flexible, accommodating both horizontal and vertical interpretations. This also helps to makes the term relevant to momentum on both global and local scales. Decisions about density can usually be made alongside other musical considerations, and this makes it easier to factor density into a work's design.

The terms 'order and chaos' were also useful. They are easy to understand and can be measured over time. Much like density, they are widely applicable, and sufficiently separate from structural, harmonic, and rhythmic concerns. Consequently, I made no conceptual revisions – but I did refine my language. To more effectively discuss order and

[77] Kasper Querfurth, 'Density as an aesthetic principle and creative practice in composition', (doctoral thesis, Guildhall School of Music and Drama, 2020), 22

chaos, from this point on I began to refer 'entropy' – 'the amount of order or lack of order in a system.[78] In my understanding, entropy reflects the extent to which musical events deviate from expectation, whether through pitch, rhythm, texture, or timbre. Low entropy implies high predictability and structural stability, often resulting from deterministic processes or recurring patterns. High entropy suggests greater variability and uncertainty, often arising from intuitive, aleatoric, or less systematised decisions.

'Consonance/dissonance' and 'softness/harshness' were of more limited use. Their relevance to momentum was more inconsistent than I expected, sometimes strongly impacting the musical motion, but other times, having limited agency. For example, consonance played a key role in the outlining of thematic content and structure the opening of *The Black Path.* The pitch content of this opening is fully chromatic, but the way that the pitches are organised and introduced results in a gradual reduction of dissonance, moving from a discordant semitone cluster (bar 11) towards a consonant sonority suggestive of a $C^{(add2)}$ chord (bar 24). This reduction in dissonance contributes to a sense of steady progression that functions independently of the global momentum (which is predominantly organised by entropy). The heightened consonance in bars 24-27 helps to establish a momentary sense of rest, which coincides with the end of the first Ligeti-inspired structural stage. This is then disrupted by the unstable violin gesture introduced in bar 28, which marks the start of the next section. To enhance this contrast, I reintroduce clusters in bar 28 and 29, and the corresponding increase in dissonance reinforces the structural progression.

I treated softness as a means of tempering the initial dissonance, marking the strings *sul tasto* in bars 10 and 11, in an effort to control the timbral intensity of the cluster. The gradual transition to *sul ponticello* then corresponds with the increasing consonance, adding brightness to reinforce the suggestion of motion towards the major chord in bar 24. In this passage, consonance/dissonance and softness/harshness share a symbiotic relationship, working together, but maintaining independence from one another. Consonance/dissonance is a fundamentally associated with pitch relationships, and softness/harshness is concerned with the timbre and the quality of the sound. Though they do not act as primary drivers of momentum in this context, they are essential in articulating form and contrast, subtly guiding the listener's perception of motion through their interaction.

At other times, the boundary between the concepts of consonance/dissonance and softness/harshness became less distinct, making it harder to discern their individual influence upon musical momentum. For instance, in *Still, Inside,* the absence of traditional harmonic

[78] Cambridge University Press, *Entropy, Cambridge Dictionary*, accessed March 4th, 2024, https://dictionary.cambridge.org/dictionary/english/entropy.

function effectively reduced consonance to a matter of spectral timbre. Over the first six minutes of *Still, Inside*, I gradually transitioned gentle underblown tones into increasingly harsh, aggressive, bitcrushed multiphonics. This growing distortion could logically be interpreted as increasing dissonance or intensifying harshness – the distinction between the two concepts has become unclear. This did not undermine the sense of momentum in this particular section; the escalation in distortion aligned with an accelerating motion toward the climax. However, at the end of the piece, where momentum clearly decreases (signalled by reductions on density and entropy), a significant degree of distortion persists. The continued presence of this dissonant harshness, despite the implication of slowing motion, suggested that consonance and/or softness were no longer contributing to the direction or intensity of momentum as they were in the first part of the work. Their coalescence made it challenging to assess why their impact was not felt.

The inconsistent impact of the factors suggested that while consonance/dissonance and softness/harshness may sometimes correlate with musical momentum, they do not consistently determine its nature, intensity, or direction. In some contexts (especially contexts with some amount of harmonic function), their influence is appreciable, and distinct, but at other times, it is harder to tell these factors apart, and it is harder to confirm that their impact on the musical motion is causal, and not just correlative. Whilst at certain times the consideration of these factors helped me to make momentum-adjacent decisions about material, often, their impact was limited, and other influential elements (such as density and entropy) were of greater significance.

In *Wrought*, these two terms were replaced by one new emergent factor – volatility. If entropy quantifies the amount of disorder, then volatility represents the *potential* for disorder to occur – it is 'the quality or state of being likely to change suddenly'.[79] This seemed to be a powerful tool in terms of momentum: much of the energy in *Still, Inside* and *The Black Path* is tied to the sense that the music is *about* to change – even if it is not obvious when or how this change will occur. It is musically apparent that the opening cluster in *The Black Path* is going to change; it is equally apparent that the accidentals in the closing bars of the movement are not of the same consequence. I hoped that this new factor would be more consistent, imposing fewer negative restrictions on the creation of musical material than the outgoing terms.

Having refined the factors influencing momentum, I next improved the visual and temporal representation of the terms. To address the limits of the linear axes, in *Wrought* I

[79] Cambridge University Press, *Volatility, Cambridge Dictionary*, accessed March 4th, 2024, https://dictionary.cambridge.org/dictionary/english/volatility.

began to represent density, volatility, and entropy as functions on line graphs. By plotting time on the x axis and the amount of density, entropy, and volatility on the y axis, I was able to generate a visual representation of the rate at which the factors increase and decrease, charting their intended impact upon the momentum over the course of the work. In this way, the graphed factors acted as pre-compositional tools, delineating my general intentions, and thereby guiding the design of specific musical content. A graph depicting the intended density, volatility, and entropy over the course of *Wrought* can be seen in **Fig. 7a**. This version of the graph served as the fundamental guide for the creation of *Wrought*'s musical material. In the creation stage, I did not label the x-axis with specific units. The graph provided a general understanding of where and how the music should move, but it did not enforce any precise harmonic, melodic, or structural demands. I did not seek to pre-plan the exact placement of gestures and shapes; rather I used the graphs to guide my general creation and management of material, to help me ensure that the material I developed would conform to the general musical motion I desired. Similarly, the 'amount' of each factor is relative to the individual work – I did not attempt to develop an arbitrary scale that could compare these features across my entire output, as I thought that it would be an oversimplification to measure these factors in a purely proportional way. The approximate graph's visual immediacy proved to be of great value, allowing me to directly compare these overlaid factors at speed. This increased the efficiency of my practice, boosting my productivity, whilst also helping me to ensure that my output was coherent.

Fig. 7b replaces the approximate x-axis values in **Fig. 7a** with the bar numbers from the finished work, allowing for comparison between my intentions and the outcomes. On the whole, the lines on these two graphs are similar. The rate of change in the latter third of the work was slower than initially intended, but the general pre-compositional shape of the curves was realised. Discrepancies between the post-compositional chart and my pre-compositional plan do not necessarily indicate a failure to harness the momentum – the graph in **7a** was intended to serve as a decision-making tool, meaning that it fulfilled its purpose if it aided with my overall management of the direction and intensity of progression. As explained previously, if I felt that intuitive deviation from the curves was necessary, I wanted to be able to follow that intuition with confidence. I felt that the material between bars 105 and 154 needed more time to decelerate: more abrupt halting of motion felt rushed. I was comfortable making this decision, as I could visualise the approximate extent to which that choice caused me to deviate from my intentions, and I did not need this deviation to be too great or too fundamentally problematic.

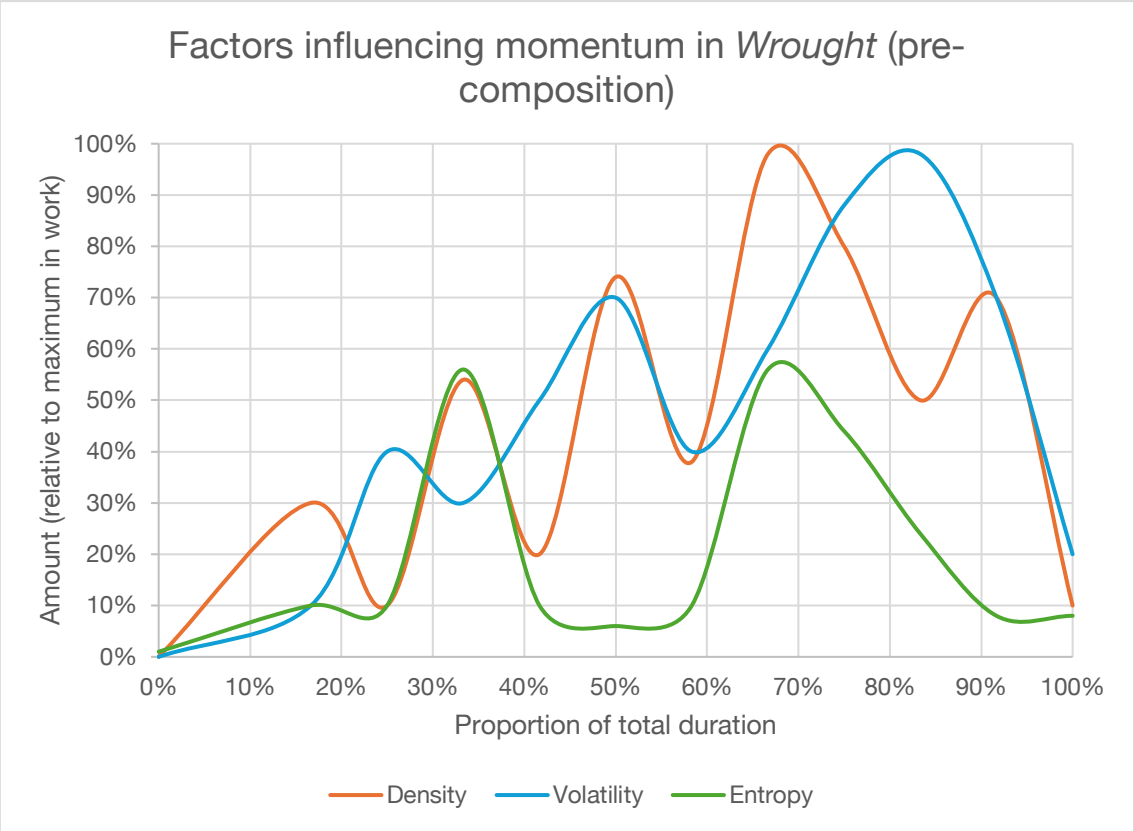


Fig. 7a Line graph showing intended density, volatility, and entropy in *Wrought.*

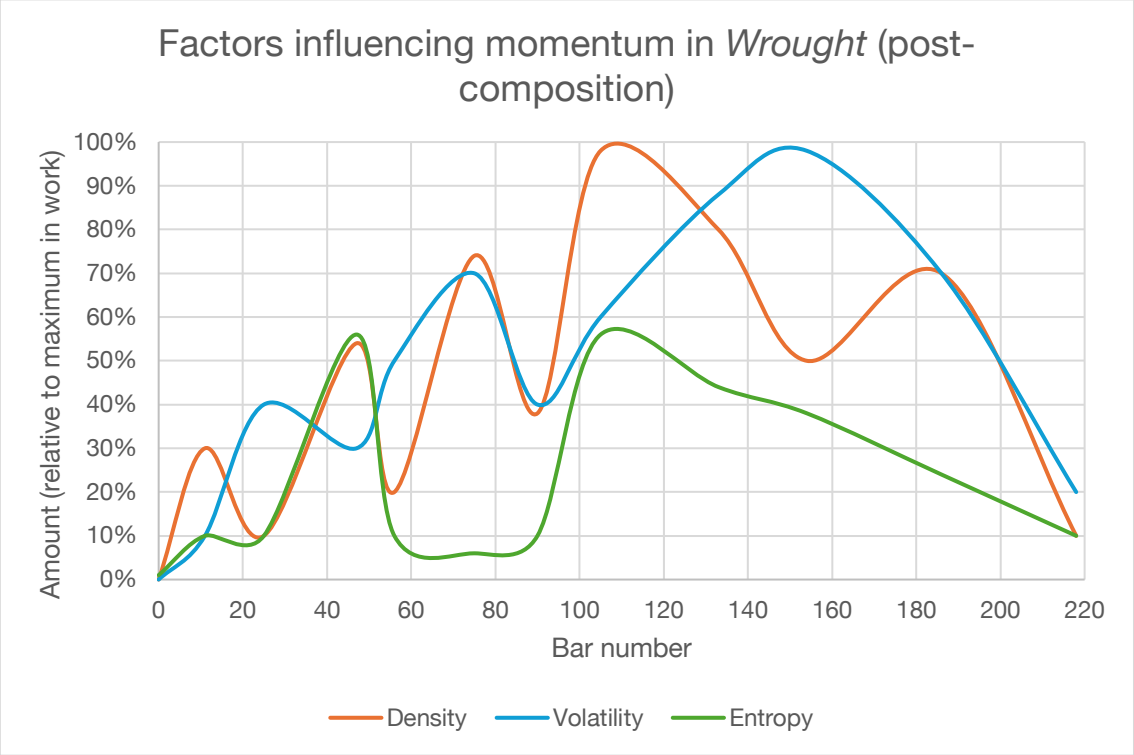


Fig. 7b Line graph showing resultant density, volatility, and entropy in *Wrought.*

The music beginning at bar 56 is a good example of the different factors working independently: the pre-compositional graph suggested that density and volatility should reach their first peak in this section, but the entropy should remain very low. To reflect this, both the rhythm and pitch were entirely built using pre–determined, algorithmic systems. Rhythm in the algorithmic section is based on morse code: in my translation of morse code to music, a 'dot' is one semiquaver length, and a 'dash' one quaver. Each letter is separated by a semiquaver rest, and each word by a quaver rest. This pattern is reinforced by constant staccato and tenuto articulation. The repeating rhythmic cell here spells out the first official telegraph transmission via morse code, a quote from the biblical Book of Numbers – 'What hath God wrought'[80]. Pitch in the passage is serially managed, outlining a 12–tone row that grows from the gestures at the start of the piece. All subsequent presentations of the morse code figure are transpositions, inversions, or retrograded versions of the prime row. The countermelody that enters at bar 73 is similarly pre–determined. Its pitch content is derived from the retrograded prime row, and its rhythmic content is determined by a cipher, where each letter of the alphabet is assigned a recurring numeric value: a=1, b=2, c=3, d=4, e=1, f=2… and so on. I once again used the phrase 'What hath God wrought'[81] as the input material, with the output value determining the duration of the note (this time with quavers as the base value). The products of the two controlling systems are shown in **Fig 8** – morse code in the lower stave, and cipher rhythm in the upper**.**

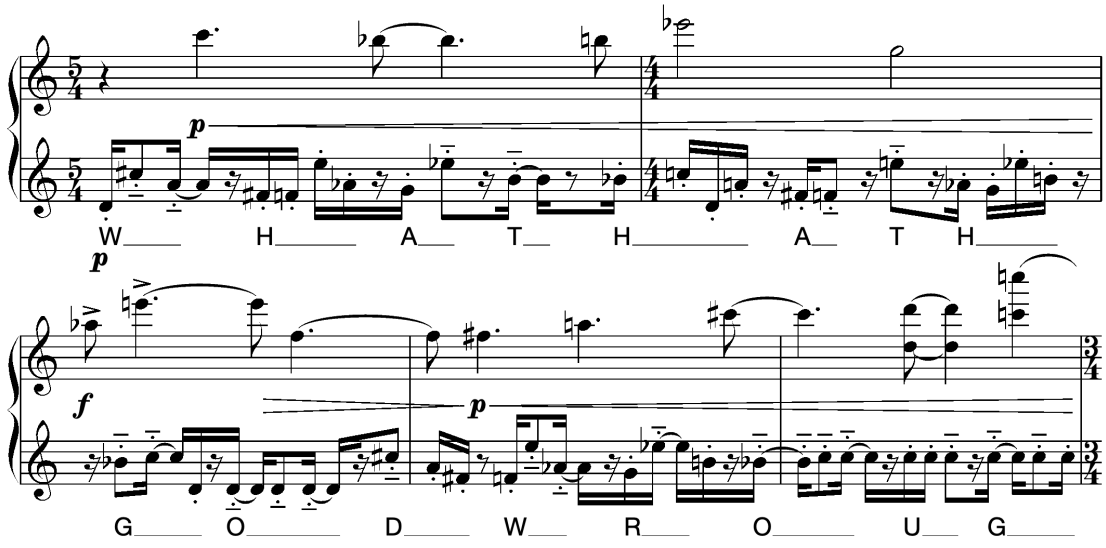


Fig. 8 Simultaneous morse code and cipher patterns employed in *Wrought*, producing high density and volatility, but low entropy.

[80] Numbers 23:23 (*King James Bible*).
[81] Ibid.

This passage is neither calm nor simple, but it is mechanical, precisely constructed, and once its underlying process is established, largely predictable. For these reasons, I consider it to be of low entropy. It could be argued that deterministic writing like this does not necessarily produce low-entropy outcomes for the listener, particularly if the systems shaping the music are too complex to be perceived. This was Xenakis' position – he argued that 'the intelligence of the observer would assimilate a deterministic complexity up to a certain limit. Beyond that, in his eyes, the complexity would swing over into unforeseeability and would become chance or disorder.'[82] I acknowledge the logic of this view and agree that while complexity and entropy are related, they are not simply proportional or interchangeable.

Nonetheless, as explained in chapter one, my compositional focus is not limited to the listener's ability to perceive my actions. Rather, I am interested in how my efforts to manage musical motion inform my creative process, and how I can use the idea of momentum as a tool for the generation of convincing and coherent material. From my compositional perspective, the entropy in this section is comparatively low, because the tools and techniques I used result in output with a high degree of predictability, and, for a sustained period, this output does not tend towards collapse or decay. While I cannot guarantee that listeners will interpret the low entropy of this section as a direct result of its algorithmic basis, I anticipate they may perceive a shift in the rate and intensity of momentum as the driving forces behind the musical progress have changed.

Subsequent material (such as bars 95-118) is more heavily informed by intuition and listening, exhibiting much greater fluctuation. The reintroduction of the trumpet after a twelve-bar break helps to signify that the factors' trajectories change from this moment. At first, the piano continues with the morse code patterns, but I destabilised the mechanical character of this material through the increased use of dynamic swells and the overlaying of quintuplets above the piano semiquavers. All three factors influencing momentum build from this point, and there is a parallel sense of acceleration towards an apex at bar 105, where the three factors peak. The music at 105 is harmonically unstable and ambiguous, ceasing to be serially organised, but not yet establishing a new pitch centre or harmonic field. The rhythmic character is equally volatile, as the even semiquaver subdivisions also cease. Flutter tongue adds an additional layer of timbral volatility. Density does not decrease until bar 112, and so, for a few bars, all three factors' trajectories are climbing. After this apex, the momentum begins to slow. The busy and chaotic gestures begin to find points of temporary rest, pausing each time the piano and trumpet play in unison (e.g. bars 112, 115, 119, and 124). By

[82] Xenakis, *Formalized Music*, 62.

introducing these momentary pauses, I temporarily reduced the intensity of motion, which corresponded with the waning density. These pauses did not provide any meaningful sense of arrival, meaning that the entropy decreased only slightly, and the volatility increases as the search for stability continues.

Again, the final section of *Wrought* takes places over a larger period of time than I initially anticipated. Attempting to enforce a sharper halt to the motivic and gestural material felt abrupt and unsatisfying, and so, during the process of constructing this section, I followed intuition by allowing momentum to decrease more gradually than first planned. I introduced a focus on G as a pitch centre at bar 133, and I expected that this would reduce the overall level of uncertainty. But, it seemed to me that volatility only begins to subside once the suggested pitch centre is more definitely confirmed at bar 154. Though the overall duration of the work was longer than expected, I was pleased with the overall shape and felt that the work was well-balanced. I saw this as a direct consequence of my willingness to deviate from intentions.

Reflecting on the strategies employed in *Wrought* highlights two key points: firstly, the revision of the factors influencing momentum was effective, and the three terms selected do improve my ability manipulate the musical motion. Second, the process of problem solving when these factors present challenges is positive and rewarding. Unlike in *A Lost Chaconne*, I felt more equipped to conquer the challenges I set myself in *Wrought* (such as the isolation of entropy from the other facets at the midpoint of the piece), because the distinction between specific musical material and conceptual goals for motion was clear. I could avoid the frustrations that stunted my progress in some early works in the folio, because I was more confident that I could adjust my self-determined limits, if I deemed necessary (as was the case around bar 127-154), and I could do this without fundamentally destabilising my planned trajectory. This confidence came from my ability to refer to the momentum graph, whenever needed. Thus, even if my understanding of the factors diverges from the listener's likely perception, this method was still instrumental in helping me to clarify and execute my compositional aims regarding momentum.

3.2 *The Calm Estate of Grief*, for guitar and fixed media

This work was created as part of the Twisted Spruce Guitar Symposium, in collaboration with Arizona–based guitarist Bill White. The momentum in this piece was not approached via the graphical method employed in *Wrought*; instead, I combined and extended elements of the externally derived approach from *A Lost Chaconne* with computer-coded randomisation

techniques developed for *Still, Inside*. I also continued to stratify my perception of momentum into global and local tiers.

I wanted to see if my metaphorical understanding of musical momentum could reasonably be extended to non-musical, but music-adjacent mediums, such as poetry. I hypothesised that attempting to create musical parallels of elements affecting the direction and intensity of motion in poetry (such as pacing, flow, structure, and emotional trajectory) might facilitate novel integration of momentum-focused features from an external source. So, in *The Calm Estate*, I attempted to harness the shape and flow of Gladys Cromwell's 1918 poem *Folded Power*. [83] *Folded Power* conveys a sense of directed motion comparable to musical momentum through structure, form, prosody, and phrase shape, all of which contribute to the changing rate and intensity of the poem's progress over time. My understanding of musical momentum in *The Calm Estate* arises from an attempt to reimagine this poetic structure within a musical framework. To achieve this, I first created a vocal setting of the text. This setting, included in **Appendix B**, served as a translation layer between language and instrumental sound: I hoped that creation of this intermediate stage would help me to distil comparable features contributing to the poem's momentum into musical form (e.g. its rhythm, phrasing, and tone), before reimagining them as non-lyrical musical elements in the final score for guitar and fixed media. I hoped that this would ensure a strong connection between my musical momentum and that of the source. Additionally, I believed this process would clarify my intentions around movement and expression for the performer, guiding our co-development of samples for the media part, and informing his interpretation of the score by giving him insight into the origins of the material.

The poem has a regular shape, consisting of five regular quatrains, each with an AABB rhyme scheme. Within this order, there is unpredictability. The number of stresses per line is roughly consistent (mostly 2–4–4–2), but the arrangement of the metric feet is uneven, meaning that the metre continually fluctuates between a duple and triple feel. Cromwell mostly echoes natural speech rhythms, which makes the tone feel more human and contemplative rather than rigidly lyrical. As a result, whilst the global motion is predictable and structured, internal rhythmic variation suggests fluctuation and some amount of instability. This instability is not disruptive enough to undermine the overall momentum: it is always contained within the rigid bounds established by the form. This helps to suggest a clear direction for momentum, whilst also implying that the rate of travel is varied.

[83] Gladys Cromwell, 'Folded Power', *Poetry: A Magazine of Verse* 11, no. 6 (March 1918): 306.

I initially set the text for an unaccompanied tenor voice. My setting mirrored the poem's approach by establishing internal rhythmic and melodic variation within a series of verses. I paid close attention to prosody, trying to capture the energy of the text by retaining spoken phrase shape and syllabic stress in my musical setting. Sometimes I broke words down into morphemes, but I avoided melisma and the repetition of words or sounds almost entirely, so that the vocal setting was as speech-like as possible. To ensure that this solo setting would be idiomatic for voice, each phrase needed to be rhythmically strong, largely conjunct, and gesturally powerful; I also wanted to retain some amount of harmonic ambiguity, to mirror the poem's willingness to deviate. Outside of these self-imposed constraints, decisions regarding rhythm, pitch, and articulation in the vocal setting were fundamentally led by intuition. Although based broadly in diminished and third–mode–of–limited–transposition harmonic territory, I ensured that there was always room for exploration of other harmonic spaces. I achieved this by disrupting relatively tonal or modal sounding shapes with small internal tensions, in a manner that could be explained through Larson's *Forces,* such as unexpected falling tritone leaps at points of rest (e.g. bar 5 to bar 6 in the vocal setting, or bars 40 to 41 in the final score), pulling against the forces of gravity and magnetism. Of course, writing for voice also requires careful consideration of vocal range, tessitura, and the need for space to breathe, and managing these elements also contributed to the nature of the momentum. This was something I hoped to transfer into the final work – writing as though I could create a guitar part that moves like a human voice.

Having crafted a complete vocal version of the poem, I set about transferring that music to the guitar and electronic parts of *The Calm Estate…* The guitar is the primary conveyer of melody in this piece, and after the introduction, it plays the first two verses unaccompanied. The fixed media injects the gentle disruption that the atypically placed stressed beats gave *Folded Power,* entering only to provide room for deviation and hint at exploration of more distant harmonic spaces. For instance, at bar 41, immediately after the first stanza in the guitar, the media part introduces a new timbre (a synthesised kalimba, one of the few sounds in the electronic part not sampled directly from Bill's guitar). This new timbre outlines a hexatonic augmented figure that shares pitches with the treatment of the poem, but which introduces them in an intervallically distinct manner. Because it shares pitch material with the preceding guitar melody, and because of its non-scalic presentation, This first interruption does not significantly disrupt the guitar melody. At bar 51, I used the kalimba to introduce stability again, and this time, it has more of a significant impact. The kalimba outlines a descending scalic transposition of the mode employed by the guitar in the previous

bars. From bar 53, the melody continues, but now using this transposed version of the mode, with constant descending scalic figures interpolated into it.

As mentioned above, these fixed media intrusions fulfil a similar role to the uneven metric feet in the poem: they introduce a limited amount of unpredictability that breaks up the regular shape, without entirely undermining the form. In line with this implied sense of instability (which is ultimately regulated by the overall structure), the apparently random elements of the material in boxed notation parts are in fact deterministic. I controlled their selection by building blocks of code in Sonic Pi, much like those used in *Still, Inside*. These blocks are built using the 'rrand' function, which 'returns a [seemingly] random number between two values exclusively.'[84] This number 'is not truly random, it's pseudo-random. Sonic Pi will give you random-like numbers in a repeatable manner.'[85] By setting a fixed seed for Sonic Pi's pseudo-random number generator, I could develop musical elements in a manner that sounded random, then test out variations of the seemingly random output, before selecting the version that I thought best served the music. This type of pseudo-randomness allowed room for intuition, whilst also echoing the metric variation in Cromwell's poem.

As in *Still, Inside*, the fixed media part is built from samples recorded by the performer. I sent Bill a list of instructions early on in our collaboration, asking him to record various harmonics, dyads, and percussive sounds, and then used Sonic Pi to set up pseudo-randomised, malleable blocks of code. These unpitched sounds and pedal tones, combined with scordatura guitar (to access natural harmonics), establish the opening sound world of the piece. Using Bill's instrument as the source for the samples ensured an excellent timbral blend between the acoustic and electronic parts. This blend was of great importance to the successful communication of momentum in this piece: the fact that the guitar and fixed media parts served largely distinct roles meant that it was especially important to create a sense of aural cohesion and unity in other areas. Employing Bill's instrument as part of the fixed media samples created a perceptible link between the parts, through their shared sonic character.

To improve the clarity for the performer during the dense scalic passage between bars 53-72, the prime melody is shown on an extra stave above the guitar part. This makes the melody's influence on the shape and motion within the passage more apparent: Bill confirmed that he was able to follow the melodic contour of this dense passage with ease, and reported that this notation was very enjoyable to work with. He found it helpful for relating his part to my setting (and by extension, to the poem), and it allowed him to make decisions

[84] https://sonic-pi.net/tutorial.html#section-4
[85] Ibid.

about how best to realise the music, so that his performance captured qualities of the poem that impacted on musical momentum. **Fig. 9** compares bars 16-20 of the vocal setting with bars 53-54 in *The Calm Estate*, showing the ossia notation.

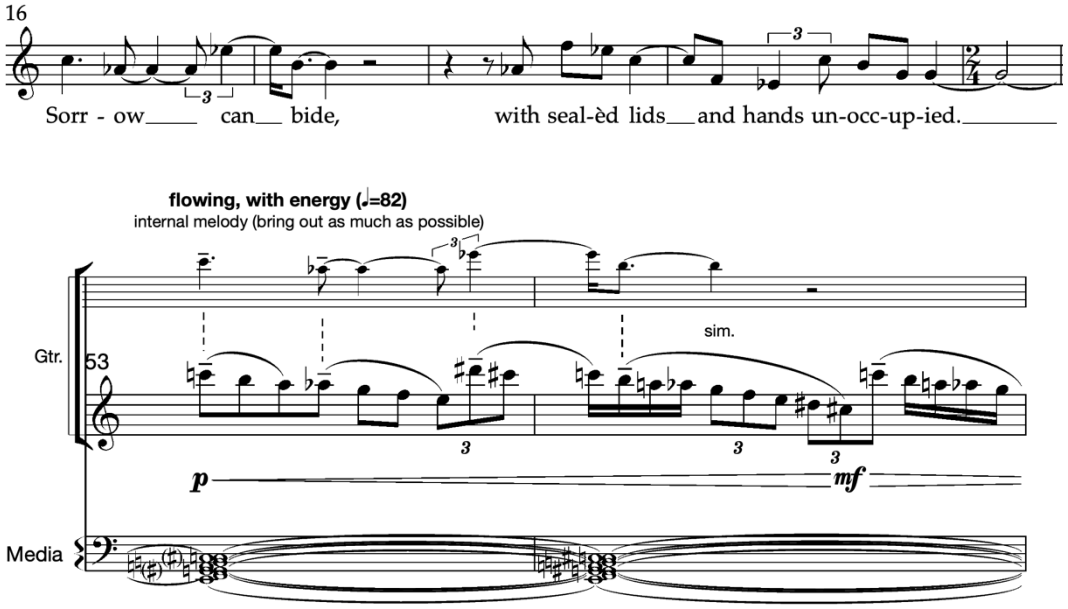


Fig. 9 Vocal setting of *Folded Power*, and its interpolation into *The Calm Estate of Grief*

Though it might have facilitated even closer engagement with the source poem, I chose not to include the text on the ossia stave in the score. This is because I wanted Bill to primarily engage with my musical interpretation of the poem, as this would ensure that he communicated my placement of stressed syllables on strong beats, my efforts to ensure that important words receive melodic emphasis, and my attempts to align the phrasing in the music with syntactic breaks in the text. Allowing Bill to read the poem itself during performance might have meant that he bypassed some of my influence, making his own interpretation of the language. The relationship between composer and performer is not intended to change in this piece (like it did in *The Black Path*), and I did not want to encourage Bill to improvise or take the lead in the process of translating suggested momentum. However, an attempt to precisely demarcate held note durations across the scalic figures in this passage would most likely have stifled the performer's ability to decide how best to interpret the passage. The ossia solution helped to provide Bill with the appropriate amount of guidance, such that he could offer his best interpretation of the music, according to the momentum implied by the melody, without gaining too much influence over decision-making, and without requiring him to analyse the poem for its rhythmic and metric qualities. Bill was able to allow the melodic line to ring out over the scalic patterns wherever he saw fit, producing an expressive and motion–filled section, which is gesturally strong, despite the

barrage of notes within. A different performer might make different decisions, based on their interpretation and their technique, leading to small differences in the resultant sound (for instance, there is a timbral discrepancy between notes fretted near the nut on the lower gauge strings, than closer to the body, on thicker strings, and sometimes, notes can be played in three or four different positions, according to the guitarist's preference). The ossia solution is ideal, as it ensures that the sense of motion is always prioritised, without preventing the performer from achieving their best version of the music by attempting to over-notate technical issues like positions and hand placement. This is a very positive outcome of this approach, and I was pleased with its application.

The final stanza of the poem begins at bar 80 in *The Calm Estate.* This stanza is subtly distinct from the others: it does not explicitly address 'sorrow' (personifying 'her' instead), and adds an extra stress in the first line. These signals are just disruptive enough to unsettle the established rhythmic and syntactic momentum, and this change helps to indicate to the reader that the work is about to reach its close. In my piece, the corresponding passage functions as something of a coda. In terms of musical features, it mostly contains familiar content (reflecting the similarity between the final stanza and the earlier quatrains) – a D pedal, third–mode and half–whole related harmony, and unpitched percussive samples. However, through careful pitch selection, I was able to imply movement towards more conventional tonality (in jazz terms, I would understand this sonority as Barry Harris' major diminished sixth scale). This harmonic shift mirrors the poem's own modulation in tone and rhythm, contributing to a comparable deceleration of musical motion, and guiding the piece towards a reflective and coherent conclusion.

Finding the right way to end a work was something that I struggled with, at various points in my compositional career. I often intuitively favoured a definitive and complete close, but found that cadential-style resolution could feel incongruous when it followed fundamentally non-functional music. Reconciling these concerns was often a major sticking point in my process. Through my exploration of momentum, I have become better equipped to conceive of a gradual slowing toward stasis, and better able express that process through the use of musical devices and tools that are not necessarily informed by harmony. I can imply resolution that has the equivalent power to a traditional cadence, through the implication of slowing momentum or cessation, without relying on traditional harmonic means. This is one notable benefit arising from my approach.

The two–stage method of setting and then translating the source poem was useful, insofar as it made it easier for me to imagine how best to musically represent features I observed in the poem. The vocal setting captured much of the poetic energy, and the direct relationship

with the text ensured that gestures and phrases that were translated into the final score retained aspects of shape and sound from the poem. By considering these elements, *The Calm Estate*… does capture something of the momentum in *Folded Power*.

I do question the extent to which this process encouraged innovative exploration of momentum. The energy I identified in the poem was mostly derived from structural features. Of course, structure has an impact on momentum and energy in music, but this is hardly a novel conclusion, and I had hoped that this kind of two-tiered translation approach would lead to the identification of other prominent factors influencing motion that could be transferred to music. My decision to try and retain the phrase shape of the text in my musical setting meant specific tonal and phonemic qualities of the poem's language were sometimes left unexplored. Perhaps this meant that my approach wasn't always sufficiently equipped to factor in non-structural elements that impacted the sound and intended delivery of the text. Indeed, this limitation points towards another benefit of the graphical approach – its capacity to abstract the management of large-scale structure from specific musical concepts, including formal and structural devices, allows for the consideration of a wider variety of momentum-affecting features as part of the global directive.

Encouragingly, the translational setting was a useful point of reference for the performer, particularly in its inclusion on an *ossia* stave in the dense scalic passages, confirming that this concept is useful in scenarios where my music is related to external sources and momentum processes. Furthermore, the separation of the fixed media part into blocks made it easy to instigate specific changes at key moments in the score Global and local stratification meant I was able to imply that random events were occurring, but constrict this pseudo-randomness to specific sections of the piece, meaning that it could be employed as a feature that created internal instability without losing control of the large–scale continuity. By designing this work so that melody played a fundamental role in determining shape, structure, and global direction, and then by separating the roles of the instruments, so that the guitar was the prime conveyor of melody, I was able to concentrate the fixed media part on specific harmonies and gestures, so that it could impact local momentum to a greater extent than in *Still, Inside*.

Having gained a more nuanced understanding of the ways in which a prioritisation of momentum was impacting my practice, and having established that further exploration of the graphical approach to momentum was warranted, I decided to prioritise the exploration of those visual representations in greater depth in the next phase of the project.

4: Graphical Representations of Momentum: Case Study

In the author's notes for each of his *Chemins*, Berio argues that:

'The best way to analyse and comment on a musical work is to write another one using materials from the original work: a creative exploration of a composition is at the same time an analysis, a commentary and an extension of the original. The most profitable commentary on a symphony or an opera has always been another symphony or another opera. This is why my Chemins, where I quote, translate, expand and transcribe my Sequenzas for solo instrument, are also the Sequenzas' best analyses. The instrumental ensemble brings to the surface and develops musical processes that are hidden and compressed in the solo part, amplifying every aspect, including the temporal one: at times the roles are inverted so that the solo part appears to be generated by its own commentary.' [86]

Like Berio's *Chemins*, the works in this chapter are closely interconnected. These pieces make three treatments of the same material: *Ex Umbra…* establishes the core melodic line that connects these works, before subjecting it to variation, in accordance with the graphed changes in the factors influencing momentum. *Afterglow I* stretches features of *Ex Umbra…* in the y–axis, amplifying the extremes of density, volatility, and entropy. *Afterglow II* stretches the x–axis, as though slowing time, zooming in to reveal new features that were not evident in the preceding works. Each expansion of the material introduces more instruments, growing from a solo piece to a trio, and then a *Pierrot* ensemble with added percussion. This sustained engagement with the same fundamental content allowed me to focus on my graphical handling of momentum in the three works and compare the outcomes.

4.1 *Ex Umbra…,* for clarinet

In the previous chapter, I demonstrated that the pre-compositional development of line graphs representing density, volatility, and entropy served a useful purpose regarding the design and management of the musical momentum in a work. Pre-determining these factors' trajectories and mapping out their intended relationships helped me to ensure that decisions made regarding specific elements of pitch, rhythm, or gesture (whether deterministic or intuitive) usefully contributed to the broad sense of directed progression. It informed the design of structure, and the construction of specific gestural and motivic content, without

[86] Luciano Berio, 'Chemins IV (author's note)'. *Centro Studi Luciano Berio*, n.d., accessed April 11, 2024. http://www.lucianoberio.org/chemins–iv–authors–note?346997434=1.

enforcing strict boundaries. Given that I planned for the graphical representation of momentum in *Ex Umbra…* to serve as the foundation for two further pieces, it was particularly important to clearly diagrammatise my designs for momentum in this work. I hoped that this would ensure that the subsequent exploitation of the material in the *Afterglow* pieces would be meaningful, cohesive, and easier to achieve.

My designs for the flow of density, volatility, and entropy in *Ex Umbra…* are shown in **Fig 10a**. Generally, the amount of entropy rises smoothly and steadily until its peak. Density fluctuates a little more on its way to a similar peak, and continues to fluctuate towards the close of the work. The volatility increases sharply towards its own early climax, before fading away, developing a symbiotic relationship with entropy. As in the previous chapter, I have included both the pre-compositional graph that I sought to translate into music, and a post-compositional graph of momentum relative to the bar numbers in the piece (**Fig. 10b**). Again, a certain level of subjectivity regarding the interpretation of these factors was both inherent and anticipated. The graphical approach was never intended to serve as a precise analytical instrument, but rather, as a helpful visual tool that made decision-making easier and facilitated better communication with performers. In *Ex Umbra…* I believe that the factors influencing momentum were very successfully handled, and their influence was effectively incorporated into the design of this piece. The broad momentum that I intended to communicate was well-conveyed. This is reflected by the extent to which the curves in **Fig 10b** match the intended curves in **10a**.

The melodic content presented at the start of *Ex umbra…* served as the basis for subsequent transformations. Sometimes it acted as a conceptual jumping off point, informing the nature of material, but not necessarily its precise construction. However, the majority of the score is built from intervallic and rhythmic content that is clearly derived from the prime melody. My aim was to give this melody a folk–like quality, make it gesturally strong, and ensure that it was flexible enough to be subjected to various adaptations and alterations. For this reason, the fundamental melody was not governed by any particular harmonic or rhythmic structure. It largely avoids triads and movement by thirds, to avoid any implication of tonality or cadential motion. This ensured that the melody was more readily adaptable to different contexts (avoiding issues that arose in *A Lost Chaconne*, where the unheard line was sometimes too strongly associated with particular intervallic elements of its modal design). The line unfolds itself gradually, expanding to include new pitches and making increasingly dynamic movements as the music moves towards the first peak in density at bar 25.

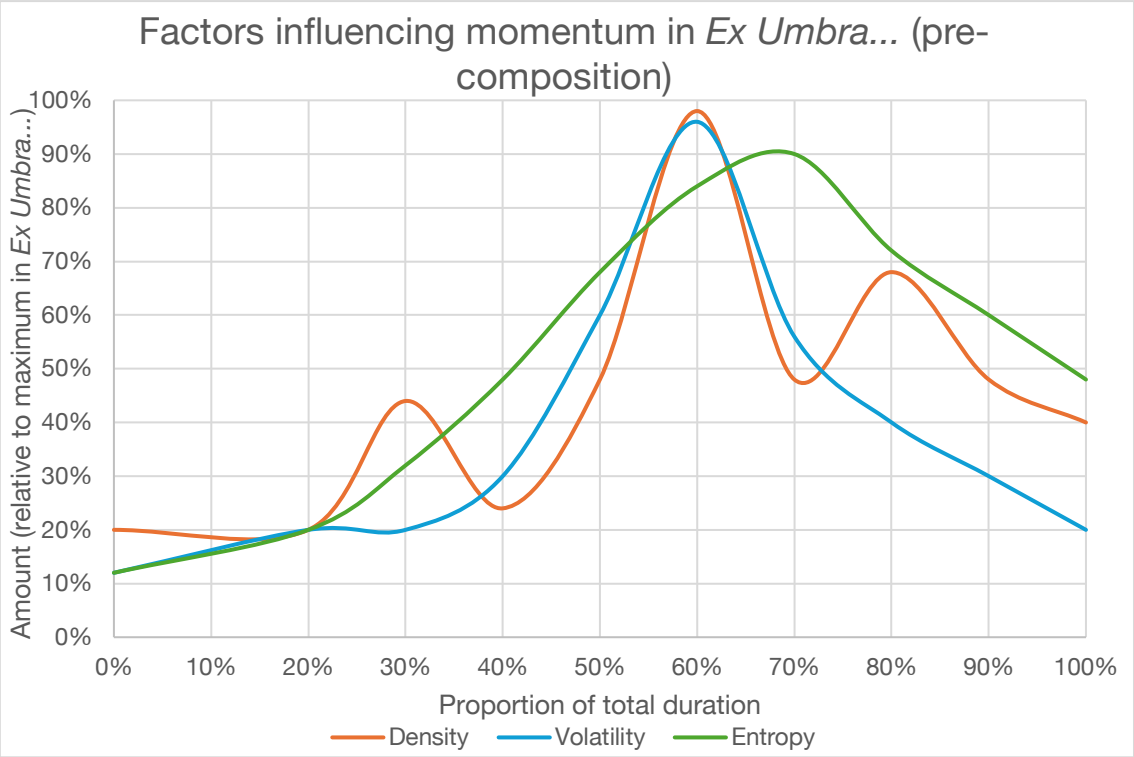


Fig. 10a Line graph showing intended, density, volatility, and entropy in *Ex Umbra...*

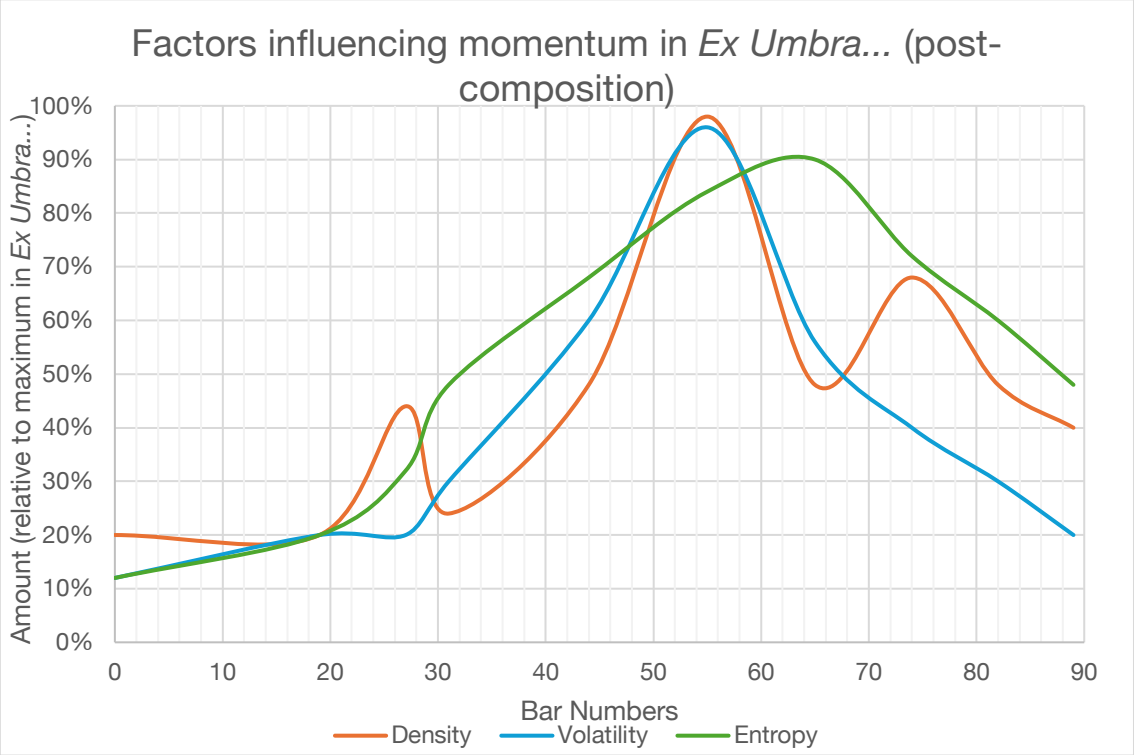


Fig. 10b Line graph showing resultant, density, volatility, and entropy in *Ex Umbra...*

Following on from this first dense peak, and in accordance with the graph, there is a clear change in momentum. The work continues via a series of increasingly volatile microtonal double–trills. Density momentarily decreases due to the sudden impression of temporal suspension, communicated by the removal of regular pulse, and the replacement of scalic melodic gestures with the timbre-focused trills. There is little direct quotation of melody, harmony or rhythm linking this section to the previous – instead, this section emulates the folk-like micro motion of the breath-led phrase structure, giving the performer even more control over the shapes' duration through 'frozen time' boxed notation. Each boxed trill figure oscillates towards a loaded silence. The oscillation results in inherently volatile gestures – the performer is not in full control of the resultant pitches, as they attempt to play three different fingerings at speed, and the sound produced is unstable. The decreasing duration of the silences between each trill suggests that the process is tending towards disorder, as it seems inevitable that this process will collapse.

The second transformation of the core melody is much more immediately energetic, and notably dense. All three factors peak around the point at which this passage commences (bar 55). Accordingly, the material here is constructed from dense disjunct sextuplets, and is almost totally focused on intervallic relationships and pattern–based movement, rather than any settled harmonic field. It is still built from the opening notes of the original line – B♭, B, E♭, F – but it explodes away from these pitches, using a pattern inspired by Nicolas Slonimsky's *Thesaurus of scales and melodic patterns*. My pattern adds pitches a major 7th and perfect 4th away from the pitch in the core line, in a manner similar to figure 1026 in the *Thesaurus*, which interpolates one note into the 'sesquiquinquetone' progression (built from stacked consecutive major 7ths, shown in **Fig. 11**). [87]

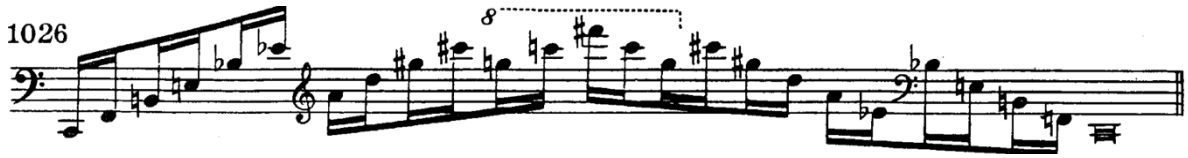
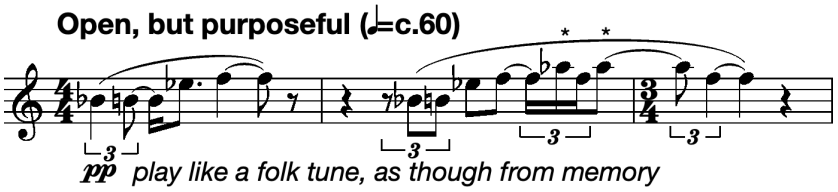


Fig. 11 Interpolation of one note into sesquiquinquetone progression, from Slonimsky's *Thesaurus*

Fig. 12 shows how the pitches from the core line are combined with the Slonimsky pattern, comparing bars 1-3 with bars 55-58. Pitches from core melody that recur in the later passage are highlighted in blue. The other pitches in these bars are derived from the major seventh-based Slonimsky pattern. Their rapid presentation and the generally disjunct shape ensure that this is where density peaks in *Ex Umbra…*

[87] Nicolas Slonimsky, *Thesaurus of Scales and Melodic Patterns* (New York: Schirmer, 1995). 136.

Bars 1-3:



Bars 55-58:

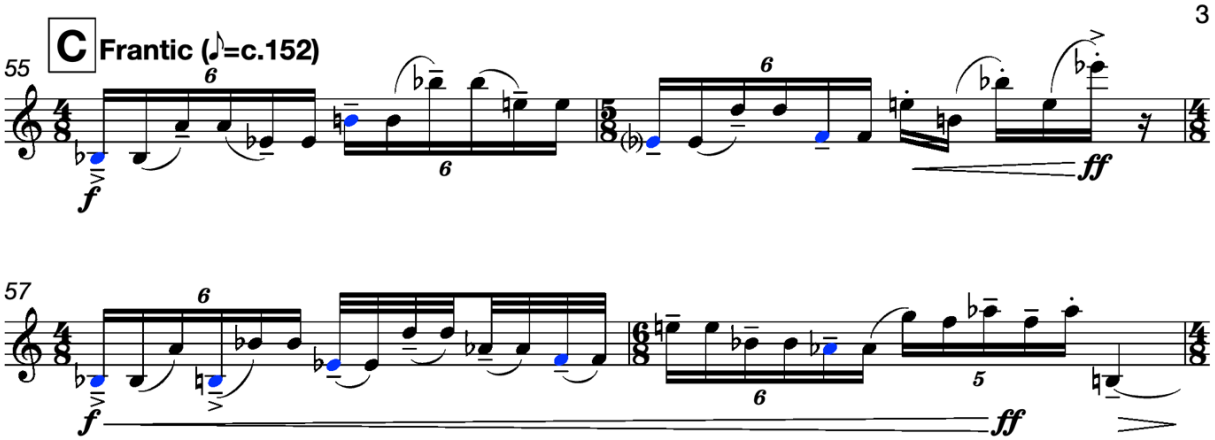


Fig. 12 Core melody from bars 1-3 of *Ex Umbra,* and corresponding pitch fragments of that melody in bars 55-58 (highlighted in blue).

The final transformation in the piece settles into a more consistent harmonic zone. The core melody's pitch and rhythmic content is preserved, harmonised by arpeggiated minor triads, in a manner similar to the interpolated scalic figures in *The Calm Estate.* **Fig. 13** compares the opening bar of the piece with the arpeggiated version in bar 74, once again showing the original melody in blue The interpolated pitches that obscure the melody ensure that the level of density peaks once more, but this peak is less intense than the previous climax. The rapid leaping gestures are dense, but these triadic shapes are steadier than the Slonimsky figures, and seem less unpredictable, thanks to their consonance and smooth voice leading. Accordingly, the levels of entropy and volatility also subside. It becomes apparent that inside of the triad figures, the melody here reoccurs in its original rhythmic and harmonic construction. The return of the melody stabilises the music within a more organised framework than the preceding section, even though that melody is partially concealed by the surrounding pitches that form minor triads, which are drawn from Messiaen's third mode of limited transposition. Though the mode can be employed in a way that suggests tonal harmony, its inherent triadic flexibility means that movement can be achieved in ways that avoid perfect or plagal cadential motion. This was important, as it prevented the arpeggiated passages from implying any unintended tonal resolution, which might have implied too sharp

of a decrease in volatility and entropy. Instead, I was able to suggest a more gradual decrease in these factors that corresponded with my pre-compositional graph.

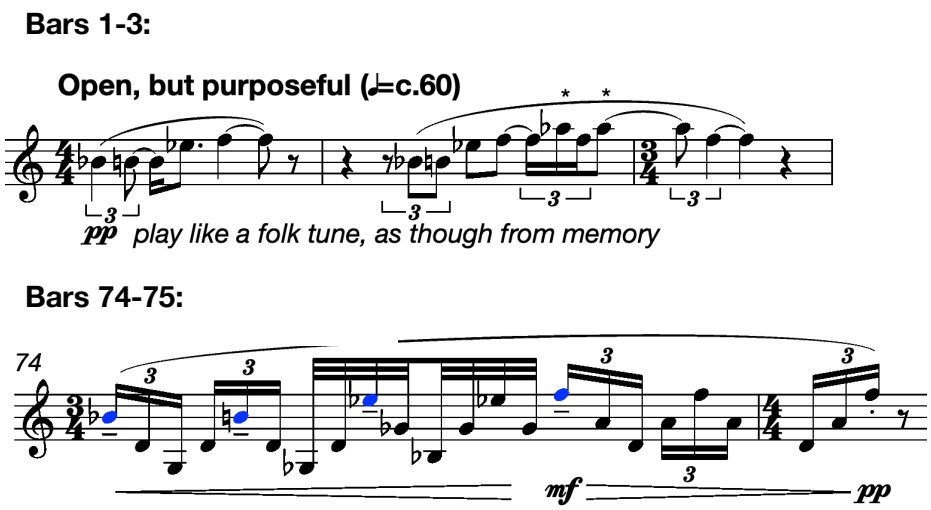


Fig. 13 Core melody from bars 1-3 of *Ex Umbra,* and modally derived triadic harmonisation of the same melody in bar 74. The pitch content and rhythmic placement of the melody is unchanged (highlighted in blue); additional pitches are embedded in between.

Overall, the process of transforming melodic elements in response to the designed fluctuations in density, volatility, and entropy was successfully realised. I was able to generate material that was flexible enough to sustain the various modifications that this graphical approach entailed, and my efforts to adhere to the pre-compositional plan for factors influencing motion ensured that I retained a consistent level of control over the way that momentum influenced the material in this piece.

There were further benefits arising from the clarity that this approach brought to my process: *Ex Umbra…* was developed as part of the Psappha *Composing For…* composer development scheme, and it was the subject of significant exploration and discussion during several group workshops. I found it relatively easy to communicate my compositional aims with my compositional peers, Dov Goldberg, the performer, and with the workshop leaders (themselves members of Psappha). This was largely due to the fact that we could easily discuss my graphed intentions – even a cursory examination of the graph was enough for the workshop attendees to begin to develop informed perspectives on particular musical and conceptual aspects within the work, and more significant comparison between the proposed curves and my draft score allowed my peers to make useful suggestions and bring up queries, without requiring comprehensive knowledge of the work's construction. Of course, I benefitted from this discourse, but crucially, so did Dov – he was able to understand the

origins of the piece in depth, with minimal insight into the specific tools I used to create and organise the material. This was particularly valuable for the 'frozen time' section, as he could comprehend my desired overall flow towards the climax in the next passage, even though conventional notation and metre were temporarily suspended.

4.2 *Afterglow I*, for trio

The plan for this work was straightforward: take the pre-compositional graph from *Ex Umbra…* and stretch it in the y axis. This meant that the overall duration of the work should not change, but the peaks and troughs on the momentum graphs should be exaggerated. I expected that this widening of the extremes would help me to heighten the sense of musical motion. **Fig. 14a** compares the intended momentum in *Ex Umbra…* with that of *Afterglow I*. **Fig. 14b** compares the two pieces' actual outcomes.

Afterglow I begins in exactly the same manner as *Ex Umbra…,* with the core line presented in the clarinet. The two additional instruments (cello and piano) enter delicately, growing out of the core line, and sharing it with the clarinet in a small moment of Ligeti–style micropolyphony (bars 16–23). These instruments are not playing an accompanying role – all three parts work equitably to influence the music's progress. The micropolyphony grows into an increasingly volatile harmonisation of the original line that hints at the Messiaen–derived modal language that defines the sound world of the later parts of the piece. This section makes use of the ensemble's wider dynamic range (compared to the solo clarinet), to pull the music towards a more substantial peak than that of the solo work. Following this is the first significant addition to the solo version of the piece. At bar 34, six spread piano chords are introduced underneath the double–trill movement. These chords are derived from the overtones of the clarinet's low E. The clarinet's acoustic behaviour is similar to a closed cylindrical pipe, meaning that it produces only odd-numbered partials (see **Fig 15**). I built the chords in this section from these upper partials, straightening out microtones by shifting them to the nearest equally tempered pitches.

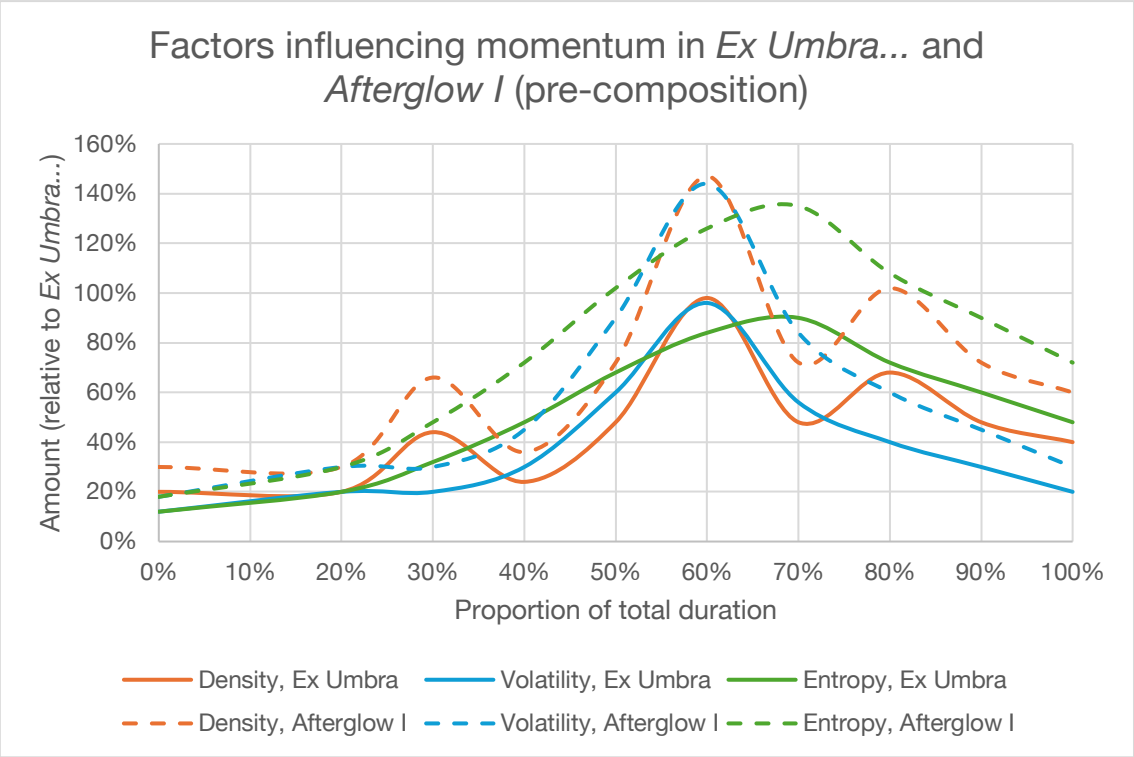


Fig. 14a Line graph showing intended, density, volatility, and entropy in *Ex Umbra...* and *Afterglow I*

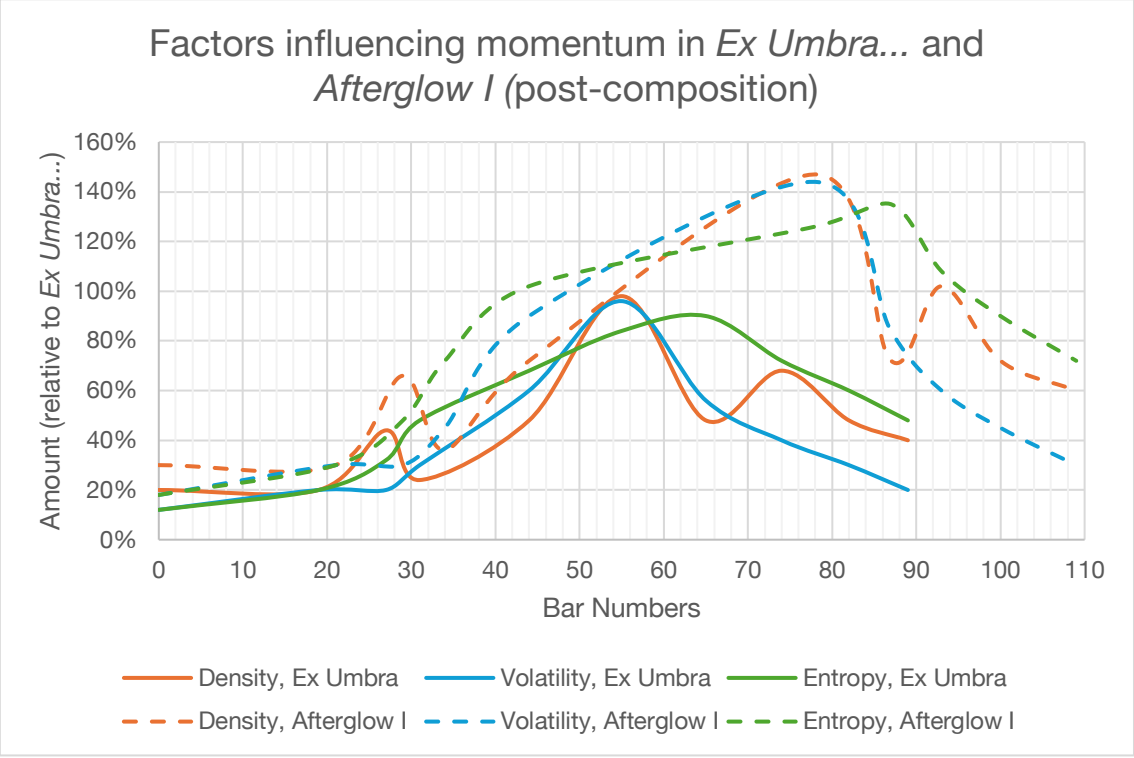


Fig. 14b Line graph showing resultant, density, volatility, and entropy in *Ex Umbra...* and *Afterglow I*

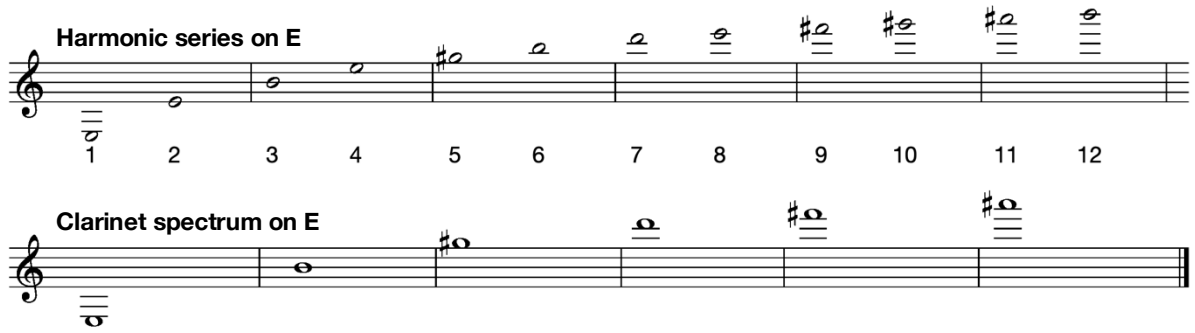


Fig. 15 Harmonic series (adapted into equal temperament) and clarinet spectrum

Then to generate harmonic material that I could use to further increase the density, I employed a process comparable to Boulez' method of chord multiplication. This involved taking the harmony derived from the overtone series, splitting it into two separate chords, and then transposing one chord onto each pitch of the other. The resulting pitches were then combined into a single composite harmony. I used this technique in order to ensure that the new chords retained a degree of similarity with the source harmonies, whilst avoiding overt tonal or twelve-tone serial connotations, which might undermine the intended sense of rising entropy. **Fig. 16** shows the (equally tempered) spectrum chord, and the multiplication of its constituent parts. I continually re-voiced the chord underneath the clarinet trills, narrowing the pitch range in order to form progressively tighter clusters, which contributed to the increasing density, enhancing the building urgency of this section, heading towards the apex at bar 45.

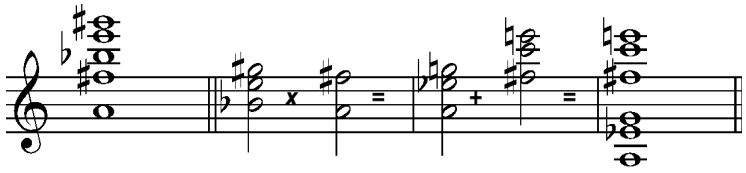


Fig. 16 Chord derived from clarinet spectrum. Constituent parts of that chord are 'multiplied' (the intervals in the first chord are transposed to start on each of the pitches in the second chord). The output is combined to produce a new harmony. These harmonies are used in bars 34-44 of *Afterglow I*, and bars 22-53 of *Afterglow II.*

The section from bars 45–77 expands the graph horizontally as well as vertically. This does constitute a deviation from my plan, as it results in a stretch in the x axis as well as the y – but I decided that it was musically necessary. As I began to try and amplify the impact of the material from bars 55-63 of *Ex Umbra…* in this new trio context, I felt that I was unable to sufficiently exaggerate the chaos and unpredictability, beyond the levels achieved in the solo work. It seemed that whilst the 'frozen time' material supported some amount of inherent

volatility, the double-trill gesture could only communicate a limited amount of chaos. In *Ex Umbra…* the amount of entropy available was sufficient, but in *Afterglow I*, I found that I needed to re-establish the propulsion of a fundamental pulse, in order to then create metric uncertainty and instability, which I could use to communicate greater intensification of volatility and entropy. Whilst experimenting with options here, I found that the immediate reintroduction of metre seemed to make momentum move along unexpectedly quickly, suggesting that it lacked sufficient preparation.

Faced with this challenge, I chose to work back from the chaotic peak (bars 78–85 of *Afterglow I*), deriving the preceding material from the apex, instead of extending the existing 'frozen time' material. I moved the sesquiquinquetone figures from *Ex Umbra* into the piano part, and then built supporting material around these gestures in the clarinet and cello, to reinforce the core line's rhythmic and gestural identity. Once I was satisfied with the intensity of the trio's apex moment, I stripped away some of the piano's sextuplet figures, fragmenting the line. This reduction in density and disruption of continuity created a stop-start effect – a deliberately weakened version of the original passage. I then structured the material so that this fragmented version would precede the full trio texture. Indeed, before this, I incorporated solo cello and the duo cello and clarinet material, developing the ideas that would later amplify the impact of the piano line. I effectively wrote in reverse, working back down from the apex to ensure that the progression felt cohesive. I was consequently able to gradually reintroduce metre, as I gradually increased the volatility, density, and entropy. Crucially, the full piano gesture is withheld during the earlier iterations – it is only gradually revealed as these layers accumulate. This approach draws on my learning from the 'unheard' technique used in *A Lost Chaconne and The Calm Estate*, temporarily concealing the core material, and allowing tension to build before its eventual emergence.

On the whole this solution was successful, in that in significantly enhanced the perception of entropy, volatility, and density. By the time the trio fully combine at bar 78, the music feels primed for eruption. Although this approach extends the work's duration, deviating from the planned process, this divergence serves to intensify vertical impact along the y-axis. As mentioned in previous works, this is not a compromise but rather a strength of the graphed compositional approach: the plan acts not as a rigid framework but as a flexible guide, enabling me to make purposeful deviations that I believe are measurable (in the sense that I can judge how significantly I diverge from the planned lines) and artistically justified.

There are further examples of the material in *Afterglow I* revealing previously unexplored variants and pathways that could not be incorporated into *Ex Umbra.* It is revealed in bar 93 of *Afterglow I* that the motif from bar 19 in the solo work is in fact a

derivative supporting line of the rapid minor triad section. This example in isolation doesn't serve any major role in directly shaping the musical momentum; however, I thought that this kind of concealed motivic connection would help to demonstrate the interconnectedness of the works, making it clear that they all draw from a common source, and therefore highlighting the impact of each graphical outline. As Berio said, it is as though '*the solo part appears to be generated by its own commentary.*'[88] In my mind, *Ex Umbra…* is the silhouette on the wall in Plato's allegorical cave – its imaginary listener doesn't realise that the work they hear is a shadow of some larger, fuller, and more complete version. They don't need to see the fuller version to enjoy the solo work and experience its sense of momentum; but having seen the bigger picture (i.e., having heard an *Afterglow* piece), more of the motion is revealed, and their understanding is expanded. The embedding of momentum into my decision-making process facilitates inherent opportunities for this kind of comparison, without necessitating an understanding of specific technical elements employed in its creation.

I enjoyed the process of hinting at interconnected layers, and creating the impression of a web of viable musical avenues. The global focus on momentum, combined with the motivic recurrence, made it easy to suggest a sense of connectedness, and I feel that the work in general is cohesive. In this relatively short, solo work, I was able to amalgamate non-systematised harmony with chords derived from overtones, quasi-serial techniques, and voice-led triadic movement. Timbrally disparate devices, such as multiphonics, double trills, and localised moments of microtonality (e.g., bars 2-6) were all incorporated into the sound world with ease. Similarly, I could easily transition between rubato-focused phrases, frozen time, and precise, rigid pulse. The various technical devices and constructs I employed were unified by their purpose (of attempting to express the pre-designed momentum). This was another obvious benefit, in terms of my both my creativity and the experience of working on the piece.

4.3 *Afterglow II*, for Pierrot ensemble and percussion

Where in *Afterglow I* I focused on heightening the intensity of the factors influencing momentum, in *Afterglow II* I stretched the x–axis, creating the impression of suspended time and implying that details that were left unearthed in the preceding works were now able to come to the fore. I expanded the ensemble again – it now includes flute, clarinet, violin, cello,

[88] Berio, 'Chemins IV (author's note)'.

piano, and percussion. This lineup ('the most common Pierrot ensemble form')[89] is well–balanced, and I chose it with the expectation that it would facilitate access to a wider array of sounds and colours, complementing each trio instrument with another instrument from the same family.

Graphs depicting density, volatility, and entropy in *Afterglow II* are shown in **Fig. 17a** and **17b**. The modification of the curves from *Ex Umbra…* brings issues of tempo and perceived musical time into focus once more. It might appear that simply slowing the tempo would create a uniform stretch in the x axis, without the need to rewrite or introduce new material (as the curves would naturally take place over a longer duration). However, I found that this is an inaccurate conclusion - tempo and pulse are intrinsically linked with the shape and flow of musical gestures, and simply reducing the tempo would have also affected the levels of density, volatility and entropy. To address this issue, I sought alternative methods of extending temporal duration while preserving the overall contour of the graphs, (i.e., maintaining the same peaks and troughs in the y-axis). One solution was to allow the melody to unfold at its original pace (as established in *Ex Umbra...* and *Afterglow I*), but to interrupt its flow periodically, pausing melodic motion to spotlight static harmonic and timbral textures instead. Though this introduced greater variability in the local momentum, making it harder to track movement at the most micro level, the overall amount of momentum reached the same peaks as in *Ex Umbra…*. Thus, the rate of progress across a given section seemed slower on average. I also made use of repetition, as explored in *Afterglow I*, and experimented with the removal of pitch from melodic gestures, as I anticipated that this might also affect the nature and rate of momentum.

The interruption process is exemplified from the work's outset: the clarinet opens the work, lining out the core melody as before. However, in the third bar, I deliberately disturbed the core line, suspending its progress as though frozen on G♭. The timbre is gradually modified, as other instruments swell in, joining the solitary pitch and then expanding it into a chromatic cluster. This is the first instance of this recurring compositional strategy. I interrupt the melody in a similar fashion in bars 7, 12, and 18. Each time the core line tries to continue, I intervene to destabilise it, forcing it to veer away from the trajectories mapped out in *Ex Umbra…* and *Afterglow I*. This disruption usually leads to the formation of dissonant clusters, which function as points of suspension. I used remnants of these clusters (often a single pitch, shared across the winds and strings, as in bars 8 and 14), as bridging pitches from

[89] Christopher Dromey, 'Pierrot ensemble', *Grove Music Online*, Jul 1, 2014, accessed Jul 12, 2024, https://www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo–9781561592630–e–0002261027

which the prime line endeavours to re–emerge. This process repeats itself, until the music reaches the overtone–based chord first used in *Afterglow I*. My judgement of the appropriate balance between progress and suspense was handled intuitively, with the graph used as a reference to assess the implementation of timbre, harmony, and orchestration on case-by-case basis.

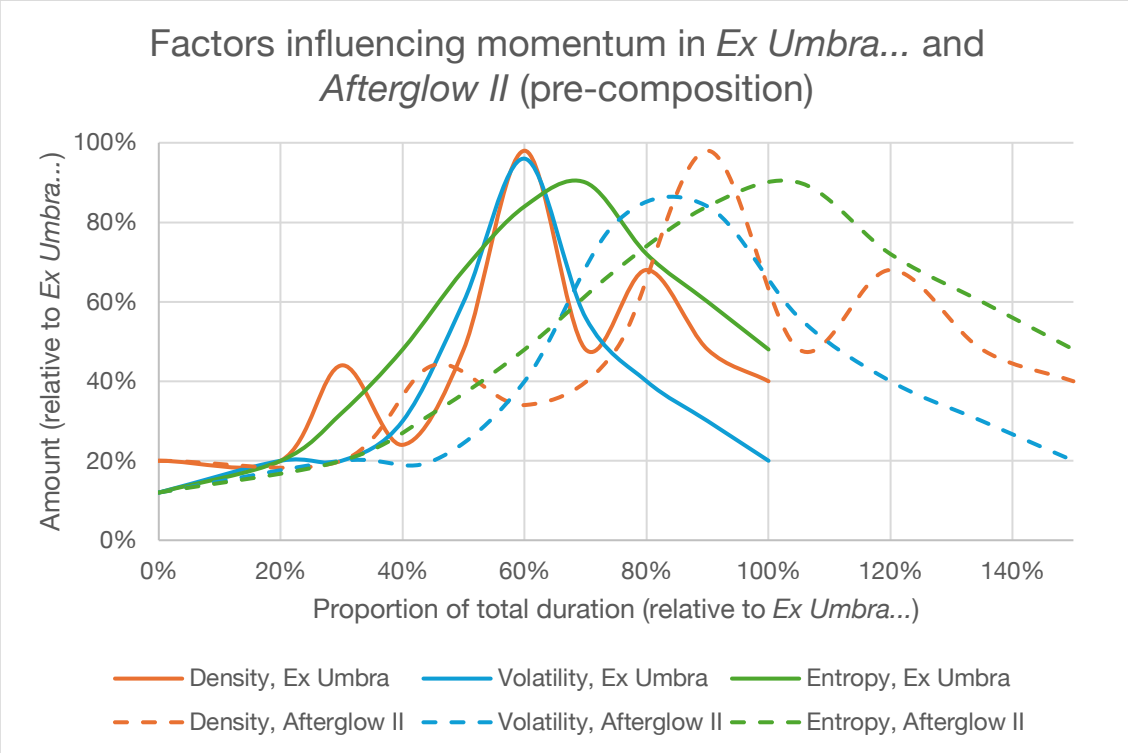


Fig. 17a Line graph showing intended, density, volatility, and entropy in *Ex Umbra…* and *Afterglow II*

This localised suspension and resumption of motion was difficult to reflect in **Fig. 17b**. Minor variations in the levels of density, volatility, and entropy happened within the space of one phrase or a couple of bars. While the graph reflects the average momentum reasonably well, it does not fully account for this pinpointed fluctuation, and this detracts from its analytical utility. However, as this issue only relates to the post-compositional graph, this weakness did not compromise **Fig. 17a**'s usefulness as a compositional tool.

At bar 22, the spectrum-based harmony introduced in *Afterglow I* is expanded into a substantial passage of fragile suspense – the double trills are delayed until bar 47 (helping to slow the rate of change). The harmony operates in the same way as it did in *Afterglow I,* using pitches derived from overtones and from the Boulez-style chord multiplication. Timbre, dynamics, and orchestration once again became principal concerns, in the absence of clear melody. I used the spectrally derived quality to imply stasis: the arrangement of these pitches creates a subtle harmonic pull toward D (the clarinet fundamental, at concert pitch). By

avoiding scalic or melodic motion, and by restricting the pitch content for all instruments to the notes from the clarinet spectral chord, I shaped the musical momentum to evoke the type of grounding and steadiness that would occur if a sustained low D pedal were present between bars 22 and 46 (even though there is no pitch lower than middle D in this section). Fragments of melody are introduced – but in unpitched percussion (temple blocks). Slowly, an unpitched version of the original melody emerges. The rhythm, contour, and dynamics of each fragment are gesturally strong enough for their origin to be perceived. The melodic nature of the unpitched line is enhanced by the harmonic expansions and remnants surrounding it. Eventually, the double–trill figures from the original work arrive once more, pulling the music towards the Slonimsky–inspired content.

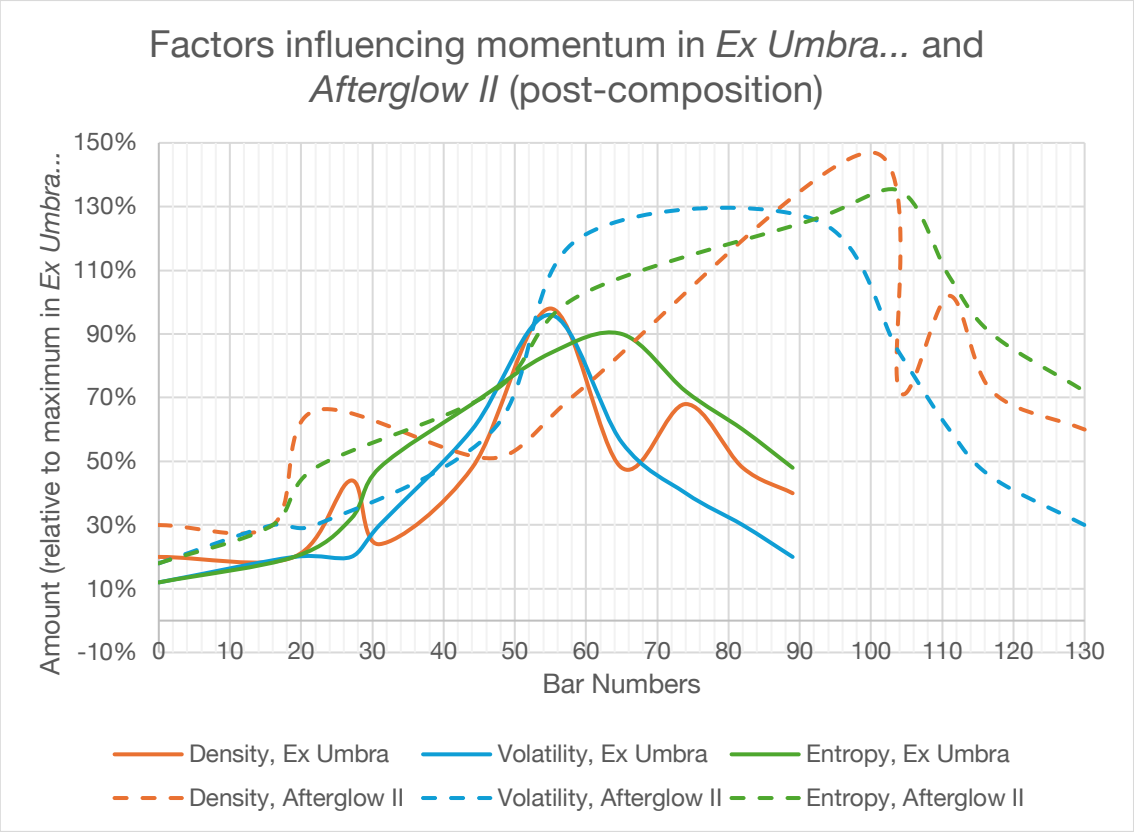


Fig. 17b Line graph showing resultant, density, volatility, and entropy in *Ex Umbra…* and *Afterglow II*

In the next section, the horizontal expansion was already completed in *Afterglow I*. I inserted the same tiered build up towards the climax, as discussed earlier in the chapter, and focused mostly on re-orchestration, dispersing the jittery, fragmented figures across the full ensemble, to maximise the inevitable sense of expansion towards implosion. This was successful, and it did still expand the factors influencing momentum beyond their peak in the solo work. However, the importance of shape and proportion were brought into relief once more here. Despite the increased ensemble forces, this rising action feels slightly less intense

than in the trio version, and I believe this is a consequence of the extension of the preceding section's stillness. Having occupied a musical zone that was near inert, the preceding music was grounded by overtone-based harmony and steady (if not 'frozen') metre and pulse. I would have needed to construct even more volatile and entropic material, in order to create the same sense of growth I achieved in *Afterglow I*. Though I am happy with the work overall, this section is one that I could consider revisiting in the future, to explore ways to improve this experience. Only in hindsight did I realise that stronger intervention might have been necessary to sustain the peak levels of momentum through this point.

When the entropic, Slonimsky-derived material finally reaches its point of collapse, around bar 103, the temple blocks again take the lead. In the final section of *Afterglow II*, the arpeggiated modal figure that concluded *Ex Umbra*… has been entirely stripped of pitch. Its contour remains powerful enough to move the music forward, but the absence of pitch relationships mean that this directed energy feels less goal-oriented than the equivalent material in *Ex Umbra…* and *Afterglow I*. This helped me to still achieve a sense of closure, but to arrive at the final moments in a steadier, calmer manner, which made it seem as though the deceleration happened over a greater period of time, realising my aims of 'stretching' the x axis. In this final section, the other instruments support the percussion line, with quiet, soft, sustained harmonic material, gently pushing the unpitched melody along towards the work's close.

Several conclusions can be drawn from my attempts to expand the x-axis in *Afterglow II.* Firstly, temporal expansion can be achieved through interruption, fragmentation, and suspension of melodic material, and such expansion is directly linked with the experience of momentum. I avoided simply lowering the tempo, as this might alter the density, volatility, and entropy of the work. Instead, by periodically pausing melodic flow and emphasizing static harmonic and timbral textures, I preserved the fundamental graphical contour and thereby maintained a relationship with the momentum in *Ex Umbra…* while also altering the perceived passage of time.

Secondly, I have confirmed that momentum does not require harmonic change. Even during harmonic and metric stasis, I can convey a sense of motion through timbre evolution, instrumental layering, and gestural fragments. This element of momentum is primarily managed as a consequence of increasing volatility. Indeed, my plans for momentum were not only implemented through pitch and rhythm but also through textural interplay and orchestration. The impact of these factors is dependent on context. For example, timbral swells or cluster formations acted as moments of tension early on the work, but provided stasis or support for the temple block 'melody' towards the end. The graphical approach

helped me judge such contexts, enabling more refined intuitive decisions about how different elements contributed to overall momentum.

This approach was not without flaws - while the graphs capture average trends, they overlook some of the most subtle fluctuations within short time spans. This meant that specific decisions regarding fundamental musical elements relied heavily on intuition and contextual judgement. This is not inherently problematic, but it occasionally proved frustrating when passages resisted clear proportional balance. In general, I found it easier to envision different ways of suggesting a stretch along the y-axis than the x-axis.

4.4 Reflection on *Afterglow* process

This extended exploration of graphed momentum shows that the practice of mapping out momentum can be enormously productive and rewarding. The graphs plotting my intentions for the factors influencing momentum successfully facilitated the interconnectedness I was hoping to achieve; developing these momentum graphs has had a huge impact on the way I think about motion, and about music in general. Attempting to heighten the extremes of graphed motion through orchestration and reinvention is an enjoyable creative process that yields effective output. Slowing the rate of change to a glacial crawl at targeted moments is equally revealing: modifying the momentum in this way made it easier to conceive of different compositional perspectives on similar source material.

The graphs depicting density, entropy, and volatility provided me with a sense of fundamental clarity regarding the nature of momentum in these works, acting as points of conceptual reference, and this alone was of great value. When engaging with localised temporal issues, the graphs were less useful, but as measures of general change, they served a valuable purpose in guiding intuition and facilitating the assessment of proportion. I would argue that the success of this approach is not sufficiently measured by how closely the resulting graphs match my intended designs. While maintaining a degree of aural similarity between the works was important, the conceptual and emotional engagement with the idea of stretching material was equally significant – sometimes more so than the specific transformations of pitch or gesture. The psychological and metaphorical role of momentum remains central, and overall, the graphical method effectively supported this approach by affording me confidence and security.

Apart from those moments where specific local content was insufficiently represented, the development of this graphical approach gave me a sense of freedom that I have not experienced before. I could confidently work towards the overall shape of the music, drawing upon harmonic, rhythmic, or motivic ideas however I desired, because I knew that

any momentary deviation according to intuition could be accommodated, so long as I ensured that those intuitive adaptations did not lead to a total divergence from the graphed direction and intensity of momentum. Even major structural changes, such as the insertion of material in the midsection *Afterglow I,* were absorbed without too much difficulty. The post-compositional graphs are of some analytical use, though they can struggle to accurately reflect granular information about momentum. This limitation was always anticipated – I did not set out to produce analytical implements. My intent was always to focus on the graphs as momentum-mapping tools, which guide creation and design. The pre-compositional charts do facilitate both cohesive management of pre-determined ideas, and intuitive deviation, where it seems appropriate.

The consistency, flexibility, and dependability of this approach helped me to work with a positive and confident mindset; I felt that I was in control of the material I developed, and this made it easier to find novel ways of engaging with the harmonic and melodic content of my music. The process of developing and refining this graphical approach has confirmed that confidence is essential to my practice. I need to feel that I can take musical risks, and I need to have a degree of confidence in taking those risks, to fully commit to my ideas and realise them to the best of my ability. As in the previous chapter, the performers also benefitted from this compositional clarity and confidence, both in discussion with me, and when interpreting the score independently.

I am especially pleased by the fact that both *Afterglow* pieces function comfortably as standalone works – their momentum is clear, and they move with expressive energy. Whilst an informed listener might be able to identify the relationship between the three works in this chapter, this is not compulsory part of the experience, and the works have distinct characteristics and individual merit. I expect that the momentum processes I developed through this graphical process will be transferable – their independence from the specific musical material means that they will remain useful tools within my practice for a long time, and, given that they are able to be separated from specific harmonic and structural approaches, they might be of use to many other composers.

5: Culmination and (re)synthesis

The final stage of this project brings together several of the folio's most impactful approaches and applies them within a large-scale piece. *Ashening*, for orchestra, amalgamates numerous techniques from earlier in the folio, confirming the benefits of a momentum–led approach for managing complex material. It uses external sources as the basis for its momentum–affecting processes, deals with those processes through global and local stratification, and is shaped by careful consideration of density, entropy, and volatility. Momentum also played a pivotal role as a communication tool during the design of this piece, helping me share my ideas with the ensemble, helping the performers to communicate their needs, and making it easier for the performers to independently situate their parts within the framework I constructed. At one stage this was planned to be the final work in the folio, but a late opportunity to condense one of the earlier works in the project into a lighter, more streamlined form means that *Microludes for the Black Path* is also discussed in this chapter. This extra work serves as a coda for the project: my successful reconstitution of the existing momentum in *The Black Path* into a distilled form evidences the positive impact that this project has had upon my practice, and it invites reflection on the utility of momentum-based composition in general.

5.1 *Ashening*, for orchestra

This piece is built from three folk songs and hymn tunes, all of which are connected to the Tees Valley. Some of these songs and tunes are native to the North East and North Yorkshire; others are characteristic of my experience playing and learning music on Teesside in the 2000s and early 2010s. The piece is split into three movements (which run continuously), and each movement incorporates one of these sources works into its design. Some transformations are relatively direct; others are layers deep, causing the final sound–world to be far removed from its source. Nonetheless, even if they are concealed, traces of melody, harmony, and musical energy are carried through from the source songs, and these traces are combined into a cohesive whole through the harnessing and management of momentum..

In the earliest phase of its design, this work was conceived for a professional ensemble. However, this changed when the opportunity to work with the Tees Valley Youth Orchestra arose. The orchestra consists of skilled young performers (some of whom play in national ensembles and will likely pursue careers in music), as well as less experienced student musicians, who can support the orchestra's sound, but who require more guidance, especially in terms of interpretating contemporary music. For several members of the orchestra, this was the first piece of new music that they had ever played – their usual

repertoire does not go much past Shostakovich or Rachmaninoff. So, I was tasked with creating music that these musicians could access and enjoy, without sacrificing my musical identity. I anticipated that momentum–led approaches would help enormously here: as I found in my previous collaborations, if performers can understand the musical motion and its influencing factors, then they should be able to make sense of their role and its purpose within the music, even if the sounds they are asked to produce are unfamiliar. I expected that this would hold true even in this amateur context, and that my approach would allow the ensemble to make a meaningful connection with the work.

To involve TVYO in the creation of *Ashening*, I first produced three orchestrated arrangements of the source works, and conducted the ensemble through these arrangements in an initial workshop in January 2024. This gave me the opportunity to show the orchestra the style, character, and motion in the source works, whilst also exploring the orchestra's familiarity with techniques and devices such as harmonics and boxed notation. This was enormously valuable for both the construction of the final work and its realisation in performance – I was able to gauge what the ensemble could tolerate, and could reassure them about any challenges that might arise. I was able to share my plans for momentum, discussing the nature of the planned music and its shape, even though I had not yet finished the final score.

During our first workshop session, many of the musicians in the orchestra shared that they felt exposed in unfamiliar harmonic territory; they were willing to learn, but apprehensive about non-tonal music, and also about improvising. Working through the three source arrangements and discussing their design helped link together the source material with the final score when I finally delivered it, and this alleviated many of the performers' concerns. They gained an understanding of my aims for momentum-through-transformation, and this allowed them to better fulfil their musical roles in the final piece, working backwards to unpick the relationship between their parts' melodic and harmonic content and the source songs.

The workshop arrangements are included as appendices to the main score so that they can similarly inform any subsequent performances of *Ashening*. They are not for public performance; perhaps their inclusion represents an evolution from the 'lost chaconne' idea that started this folio. In *A Lost Chaconne*, I did not fully understand how to communicate my intentions with the ensemble, and my attempt to separate a source melody from the final score was of limited use. This concept was improved in *The Calm Estate of Grief…* by the translation from poem to song to score, but it was here, on the largest scale, where this type of reference material for performers proved to be of greatest use. Unlike a small ensemble rehearsal, I could not meaningfully discuss every part with every performer in the orchestra.

Instead, I gave them access to the source material for their own reference and demonstrated how I had transformed that material to support my overall momentum and design. This helped the performers to independently develop a better understanding my intentions, finding their own points of connection with the music.

This work is large enough to entertain several methods of organising global and local momentum at once. At the most fundamental level, the work is governed by a tendency towards harmonic calm, moving from initial chromaticism, through modal and octatonic territory, towards diatonic harmony, and ultimately enclosure on a single E♭. This macro tendency is not rectilinear; it undulates and fluctuates throughout each movement, according to changes in both the source material and the factors influencing momentum, but its average trajectory remains basically constant. Within this fundamental directive, the three movements area each governed by their own large-scale processes, making separate considerations of density, volatility, and entropy. I planned for density to build gradually throughout each movement, reaching a peak which acts as a signal that the movement was about to close. I imagined volatility emerging as a natural consequence of these density-led climaxes, peaking either at the very end of a movement, or the start of the next movement, as though the sudden change in density excess instability. In accordance with the tendency towards calm, each peak was designed to be slightly less intense than the previous.

Though I expected entropy to play a role in the management and juxtaposition of local material, I intended to keep the global disorder consistently low. This choice was largely influenced by the concerns arising in the workshop process, and by my assessment of the orchestra's needs, but I was happy to explore the impact that this linear trajectory would have on my management of the other factors influencing momentum. During some of the first workshop sessions, some youth orchestra members responded with uncertainty when confronted with material that leaned too far into disorder. Many were still developing the skills required to navigate indeterminacy without losing track of the musical structure. Some expressed apprehension when faced with complex rhythmic patterns, and others were not yet equipped with the aural skills to interpret the chaotic sounds that could be produced through extended techniques (such as the noise and distortion sounds from *The Black Path*). Whilst I did want to challenge the ensemble, I did not want to alienate any of the players, and features that increased the level of entropy seemed to be the main cause of concern for the least experienced members of the group. I was able to incorporate some indeterminate elements, and some extended techniques that did not require exceptional technical proficiency, where they contributed to changes in density and volatility, and the orchestra responded well to this careful integration of such features. Nonetheless, I attempted to

maintain relatively low entropy in the final score in an effort to appease those players' concerns.

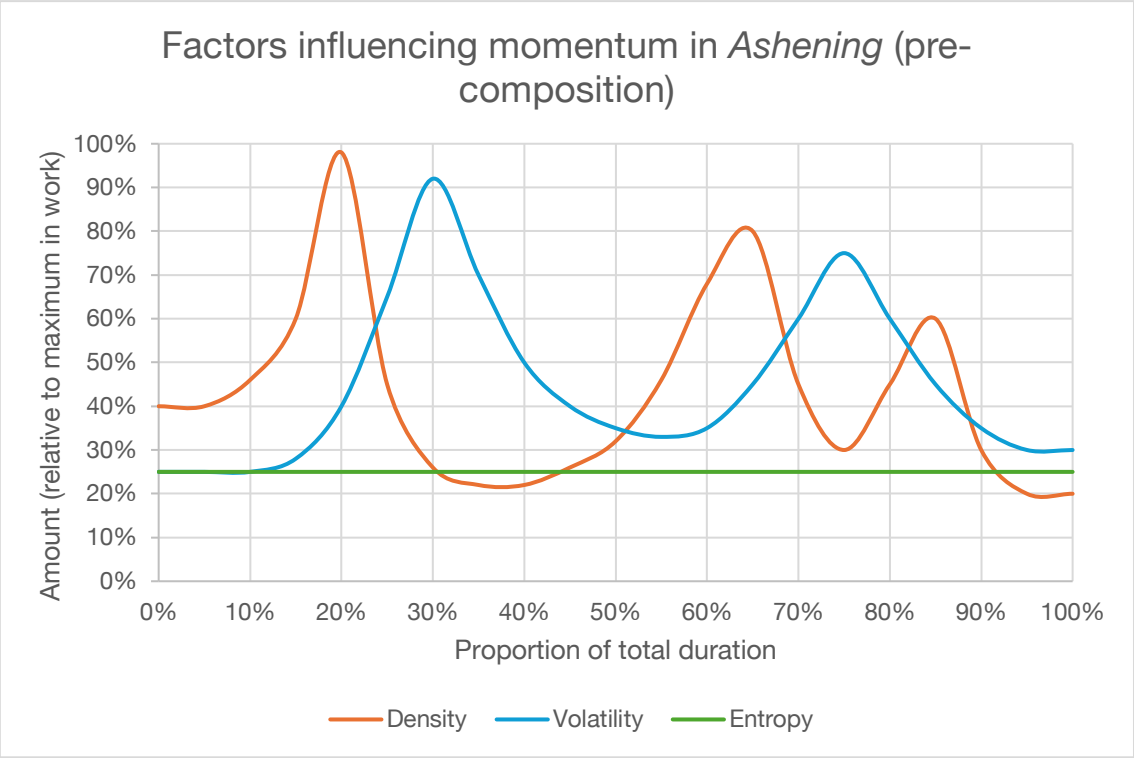


Fig. 18a Line graph showing intended, density, volatility, and entropy in *Ashening*

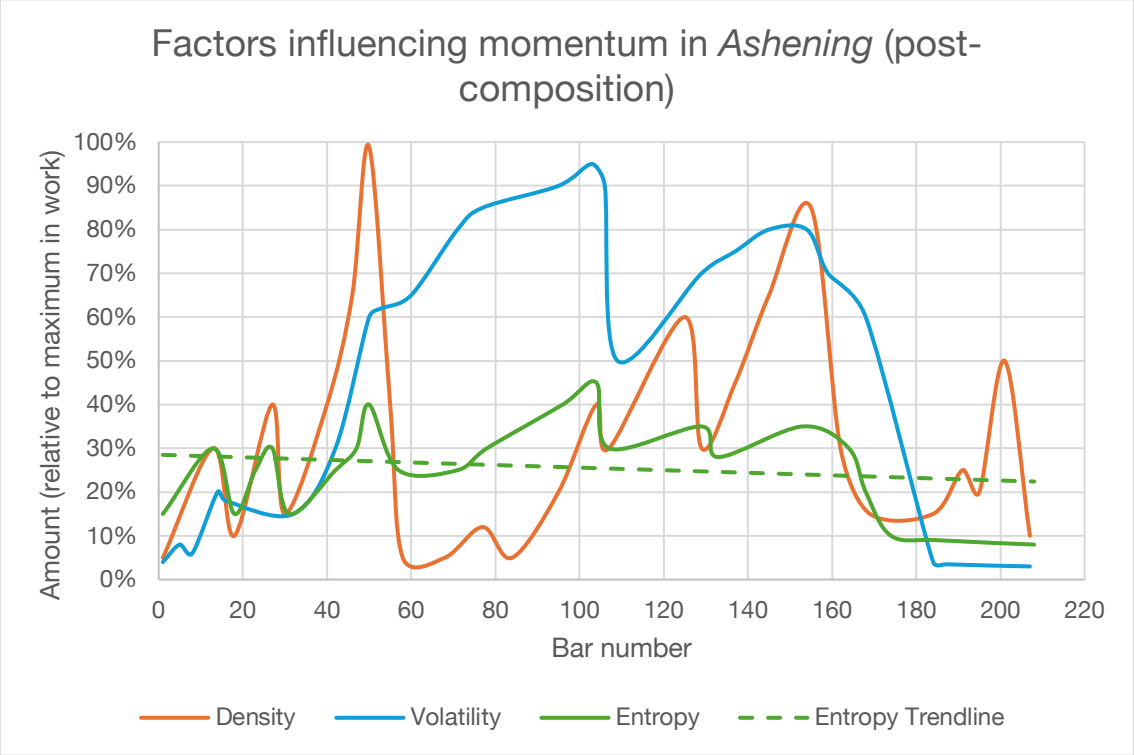


Fig. 18b Line graph showing resultant, density, volatility, and entropy in *Ashening*

Graphs showing the intended and resultant trajectories these factors are shown in **Fig. 18a** and **18b**. As in all previous cases, the resultant graph shows some deviation from intention, and whilst this partially reflects my efforts to follow intuition wherever it seemed musically necessary, it is also further evidence of the limits of these graphs as reflective tools. The scale of this work makes it very difficult to accurate track every increase and decrease sin density, volatility, and entropy. Different orchestral sections move in different ways at different times. The pre-compositional graph was still just as useful as before – it continues to helpfully organise general plans and decisions. I expected some amount of fluctuation in entropy, partly as an inherent consequence of local motion, but also due to the interconnectedness of the factors – they do not work in isolation, and despite my efforts, I expected that some changes in density or volatility would affect the amount of disorder, and that I would have to limit the impact of these changes, rather than totally prevent them from affecting the entropy. I have included a trendline in **Fig 18b**, showing the average level of entropy, and demonstrating how close to my aims I was, fluctuations notwithstanding.

The first movement's source piece is the *Lyke Wake Dirge*, a bleak, medieval funeral chant that originated in the Cleveland hills, near to the orchestra's base. The *dirge* also has a long-standing orchestral history, having been adapted by Bax, Britten, and Stravinsky. I based my music on the three–part arrangement popularised by The Young Tradition.[90] Small fragments of material derived from that group's modal interpretation emerge throughout the first movement. The opening oboe figure in my piece outlines a row built from the emergent pitches of the *dirge's* melody (initially in transposed form – the prime row enters at bar 16), and this row is presented in a way that matches the source song's austere tone. Solo instrumental passages grow into volatile, but ordered and sparse environments. Then, as the local density and entropy increase and the melody falters or is subsumed, the momentum seems to increase, even though volatility drops, as it appears there is a predictable logic behind the increasing rate of motion. Each time a cautious solo line gains momentum, it is broken apart into clusters and lingering string chords. The process then starts again, and new variations on melodic material derived from the *Lyke Wake* source emerge. My plan for the momentum in this movement was to repeat this process several times, with each peak becoming more dramatic than the last, until the *Lyke Wake* material seems to grow into a peak so large that it cannot sustain itself. That peak in bar 50 involves the entire orchestra playing as one, harmonising a melody with block chords containing nine pitches. This is as dense as the piece gets. In the aftermath of this apex's collapse, I abandon chromaticism

[90] The Young Tradition, 'The Lyke Wake Dirge', *The Young Tradition*, Transatlantic Records, 1966, CD.

and begin to transform the Lyke Wake material into the volatile content used in the second movement.

This next movement returns to a northern folk song from earlier in the folio: *Sea Coal.* My music is most closely linked to the version of the tune recorded by Jon Boden and Fay Hield,[91] but little of this original source is recognisable here, as the original mixolydian *Sea Coal* pitches are replaced by dissonant clusters and then whole–half diminished harmony. In line with the fundamental movement from chromaticism to tonality, this middle movement avoids serial handling of pitch, and instead it makes use of octatonic and diminished scale patterns, which contain a wider range of pitches than the diatonic canons that close the piece. Though the intervals used suggest modality, the scales' symmetrical nature helps to avoid the implication of hierarchy or modal resolution by hinting at multiple equally valid pitch centres. The *Sea Coal* fragments repeat many times, initially establishing a suspended and fragile atmosphere (where density, entropy, and volatility remain relatively constant for a time), before growing towards another dramatic peak at the end of the movement. I intended for volatility to peak near the start of this movement (somewhere around bars 58-70), as a consequence of the decreasing density. Whilst the volatility certainly increased here, on reflection, it continues to grow beyond this passage, rather than decreasing and the increasing once more. This is another example of volatility growing as a result of stasis – the longer that this passage suggests suspense and a lack of resolution, the more it seems to search for resolution, and therefore, the more likely it is that there will be change. This means that volatility actually peaks at bar 104. This prolongation and delay of the line's trajectory was one of the most significant diversions from my graphed intentions, but it does not negatively impact the general sense of momentum. The drop in density sufficiently slowed the overall suggestion of slowed progression, meaning the musical momentum still builds towards its next peak. I was conscious of this deviation at the time of writing, and was able to identify and assess this change, thanks to my pre-developed graph. Once again, I was comfortable accommodating this deviation into my plans, due to my ability to assess its impact on the related factors, and the overall experience of global momentum.

In the second half of this movement, the prioritisation of momentum helped me to negotiate one of TVYO's weaknesses. I wanted to create the impression of increasing musical velocity in this section, accelerating towards the next density and volatility apexes. But, during workshops it became clear that fast tempos and intricate lines that varied between parts had the potential to destabilise the ensemble. The differing abilities of the various

[91] Jon Boden, 'Sea Coal', *A Folk Song a Day: October*, Navigator Records, 2010, https://open.spotify.com/track/7rUkZ3yW6o99hdA8NHkHRA?si=80da8d8a26c84e29

members meant that their control of technique was not consistent, and the impact of technical insufficiencies was exacerbated when the music moved quickly. They were able to handle challenging lines as a unit en masse, but struggled to maintain balance if I asked for too many competing individual parts. This is relatively common for developing young musicians, but it was a particular challenge for this orchestra at that time.

I overcame this problem by establishing a process which implied that the rate of momentum was increasing, but which did so without any actual increase in tempo beyond a 120 beat-per-minute pulse. At bar 107, upper brass and woodwind continue to outline variations of the *Sea Coal* melodies, maintaining a sense of continuity from the previous material. The violins outline a repeated semiquaver figure (only the first violins actually play semiquavers – second violins reinforce the quaver pulse instead). This figure is inherently more energetic than the sustained notes from the previous section, but it is not the primary source of directed energy. Beneath that melody, lower strings outline the harmony via a descending scalic figure. I used dynamics in this section to start creating the impression of increasing intensity – slow building crescendos provided a useful aural cue that a change in the directed energy was about to occur. From bar 129, bass clarinet and bassoons begin to play a rising sequence of triads, inverting the previous lower part. This figure is continued by trombones and tuba from bar 137. It is this part which has the largest impact on the increasing rate of metaphorical motion. By carefully arranging these parts, I was able to disguise the occasional falling octave leaps, producing an illusion of constant climbing, ascending through a chain of major and minor triads from bar 137, almost like a Shepard tone. The symmetrical nature of the octatonic harmonic field enhanced that suggestion, as did the number of triadic voice leading options available within the mode. Whilst the violins play trill-like figures that give a surface-level impression of increasing speed, it is this rising lower part that implies a more fundamental sense of direction and propulsion, and the smooth voice leading contributes to the impression that this section's momentum could continue to gain speed forever. The metaphorical sense of incessantly increasing momentum is communicated convincingly, without requiring the ensemble members to play at speeds beyond their control. Eventually, this music does reach another apex, before it collapses into long string figures once again. While the techniques employed in these movements may not be especially novel or groundbreaking when considered in isolation, their true significance lies in how seamlessly I was able to bring them together conceptually and apply them in an integrated way to support my broader aim of conveying the mapped momentum.

The hymn tune *Lloyd* is the only source work that is present in the final score in unmodified form. Its arrival at bar 170 signifies the end of the cascading waves of energy that

brought both the second movement and the overall work to its apex, and it acts as an emotive symbol of the brass tradition that permeates much of the community music of the North East. The performance of hymn tunes is a hallmark of the brass band tradition – 'the first recorded instance of a wind band accompanying hymn singing' has been traced to Sheffield in 1836.[92] Scott claims that this is 'a tradition in Yorkshire and other northern counties that has become world famous.'[93] Consequently, the tune's arrival served as both a tonal landmark within the music, and a conceptual point of arrival for many of the performers (and the audience),), who had a close relationship with that musical tradition. The four-part presentation of Lloyd adheres to tonal expectations, being constructed of phrases with regular length, smooth voice leading, and containing definite, unambiguous cadences. The steady trend towards consonance that governs the macro process of the work as a whole reaches completion here: having moved through various complex and intricate harmonies, the piece now arrives at what seems to be a functional landscape. There is a corresponding sharp decline in the levels of density, volatility, and entropy. Two simultaneous canons (a mensural canon in strings and a modular translation pattern in percussion) then create a blanket of sound, which is perhaps better understood as being derived from the Ionian mode, rather than the major scale, as it does not resolve through tonality-implying cadential motion, but which creates a satisfying denouement nonetheless.

The string canon is constructed from the melody of *Lloyd*, and its design is shown in **Fig 19**. This canon provides the foundation for this passage – it is a steady wash of rich strings upon which other layers are placed. The sense of rising and falling motion is significantly augmented by a simple crescendo; this steady dynamic change is as impactful on the local momentum as any of the other techniques applied here. I also introduced a separate canon in percussion, cycling the melodic pitches from *Lloyd* through a recurring rhythmic cell. This rhythm is built using a cipher, which assigns each letter of the alphabet a numeric value (either 2, 3, 4, or 5) that determines the duration of the note in semiquavers (shown in **Fig 20**). The rhythmic pattern of the cell spells the title of the source work – 'Lloyd'. This canon is busier and more syncopated, adding colour and energy on top of the slow strings. It is enhanced by the addition of trumpets and horns at bar 197, as twelve separate layers build density, working together towards one final crescendo. The brass and percussion then bring the work to its close. Unlike Turnage's canons in *Momentum* (discussed in chapter one), these layers combine to produce an aural blurring effect that consolidates the Ionian

[92] Jack L. Scott, The Evolution of the Brass Band and Its Repertoire in Northern England, vol. 1 (PhD diss., University of Sheffield, 1970), 194.
[93] Ibid.

harmonic field, rather than subverting it. They do not challenge the prime version of the motivic material – it is clear from the slowing momentum that they are disintegrating, fragmented parts of the unified whole. They are fractal-like, and do not challenge the main melody for primacy. Any dissonant moments that arise (such as instances of the leading note overlapping with the tonic) are sufficiently softened by my management of attack, dynamic, and by the surrounding pitches, such that they do not imply any local desire for the music to move towards another new goal.

Part	Canon information
Vln 1a	Melody
Vln 1b	Melody, entry delayed by one bar
Vln IIa	Melody, entry delayed by one bar, proportionally slower (duration: ratio of 2:3)
Vln IIb	Melody, entry delayed by two bars, proportionally slower (duration: ratio of 2:3) entry delayed by one bar
Vla a	Melody, entry delayed by four bars, 8vb
Vla b	melody, entry delayed by five bars, proportionally slower (duration: ratio of 2:3), 8vb

Fig. 19 Organisation of mensural string canon on 'Lloyd'.

Number	Letter
2	A, E, I, M, Q, U, Y
3	B, F, J, N, R, V, Z
4	C, G, K, O, S, W
5	D, H, L, P, T, X

Fig. 20 Numeration of alphabet for percussion canon on 'Lloyd'

It was necessary to make small adjustments to the percussion loops, to make them more idiomatic. A three–semiquaver rest was added to the end of each cell in the percussion canon, so that each iteration of the pattern begins on a strong beat of the bar. The initial entries of the percussion instruments were also adjusted, to align with regular subdivisions of the bar. This technically disrupts the cyclical pattern, but it made particular sense considering the level of difficulty I was aiming for. This is already an exposed section, and I didn't want to overburden the young percussionists with needlessly complex parts.

Consideration of the performers' skill level is as important as any other factor influencing momentum – it does not matter how precisely constructed particular process are, if the intended performers cannot faithfully reproduce them in performance. Indeed, in the final score, those added rests were ultimately incorporated into the end of the pitched material. This means that it is harder to decipher the construction of the canon when reading the score, but it makes each part significantly easier to read, and given that these instruments are not damped, there is no perceptible difference in terms of the sound produced. These minor adjustments have no detrimental impact on the resultant momentum – they ensure the successful communication of my ideas, in a realistically achievable manner. See **Fig. 21** for the original construction of this secondary canon (including rests).

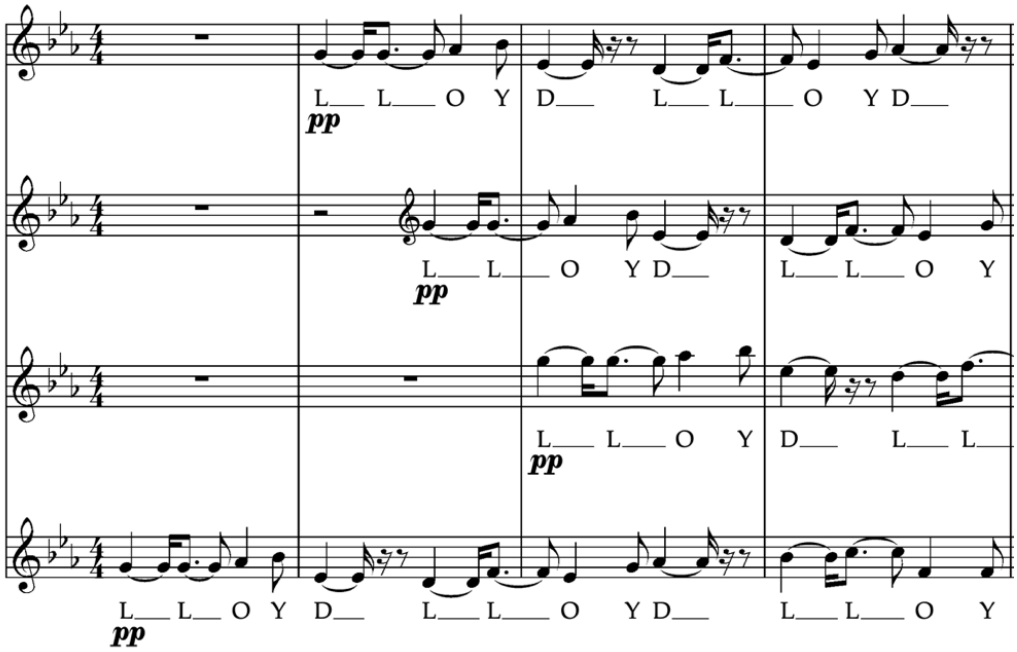


Fig. 21 Percussion canon on 'Lloyd' (with unadjusted rests)

The pre-determination of material here played an important role in ensuring that there was no rise in the level of entropy. Pitch, duration, and (consequently) harmony are fully systematically controlled from bar 185 onwards, and (as per similar discussion in chapter two regarding the relationship between deterministic elements and entropy) I believe that the overall degree of entropy should seem to be lower here than in randomised or improvised passages. As before, composers who share the views of Xenakis might refute this position. He astutely notes that 'human sensitivity does not necessarily follow the variation in entropy even if it is logarithmic to an appropriate base.'[94] In other words, even if we mathematically

[94] Xenakis, *Formalized Music*, 76.

quantify changes in musical entropy, the human listener's perception of that entropy does not necessarily correlate proportionally with those changes. In *Formalized Music*, he uses Ravel's *Bolero* as an example: *Bolero* has 'virtually zero entropy after the third or fourth repetition of the fundamental idea. However, the interest, or rather the psychological agitation, grows with time through the very fact of this immobility and banality.'[95] I would argue that here, Xenakis' analysis can be explained by my separation of entropy and volatility – the entropy remains low, as the content in *Bolero* repeats, but the volatility rises, on account of the inherent implication that the repetition must change at some point. The longer the repetition goes on, the more likely that a change will occur.

So, from my perspective, the canon processes employed at the end of *Ashening* do ensure that the level of entropy remains low. To guarantee that this was effectively communicated, I made careful choices regarding timbre and dynamics. I instructed the strings to play with a tone that is 'soft, but clear and well-projected', and asked for a 'tender, proud, very fragile' delivery from the orchestra as a whole. Dynamics change very gradually, and new timbres enter softly, so that their arrival does not disrupt the ordered steady flow. For example, the brass entries in bars 197 and 198 are marked pianissimo, even though the violins, violas, and celli reach forte at the same point. This helps to confirm the tendency towards stability at this stage in the piece, even as the density increases for a final time. This section reaches an expressive peak at bar 201, in line with the final apex of density, before easing to its final delicate conclusion.

In conclusion, the creation of *Ashening* demonstrated how a performer-focused, momentum driven approach can integrate contemporary techniques into an accessible and meaningful work for young musicians. By using momentum as a unifying principle, shaped through evolving textures, densities, and energies rather than conventional formal divisions, I was able to express complex ideas that utilised the full potential of the orchestra, while writing individual parts that remained intuitive for performers. Adaptations tailored to the ensemble's capabilities ensured a high-quality realisation of the score without compromising artistic intent. At the same time, the transformation of external folk and hymn tunes into motivic and structurally decisive elements grounded *Ashening* in cultural familiarity, reinforcing both the coherence and the emotional impact. The pre-compositional graphs guided the management and balancing of these various source elements (even if the post-compositional graph struggled to accommodate the scale of the work). *Ashening* stands as

[95] Ibid.

a practical example of how composers can harness musical momentum to make complex and sophisticated music that still maintains accessibility.

5.2 *Microludes for the Black Path*, for string quartet

Just after a timeline for *Ashening* was agreed with TVYO, I was invited to write a piece for the 2024 edition of the Diotima Academy. This project paired three string quartets with three composers from across Europe, and invited them to a week–long residency of rehearsals, workshops, and masterclasses led by the members of the Diotima quartet. The project culminated with a concert of premieres by the quartets, at the *Arsenal* in Metz. This was a fantastic opportunity for me to test my progress – a chance to discuss momentum with high calibre performers and use directed motion to overcome potential barriers of communication. The timeframe for submitting the completed work was very compressed, and it overlapped with the deadline for the orchestra piece. I decided that trying to create an entire new quartet at the same time as working on *Ashening* was likely to be a stressful and possibly wasteful process. Instead, I returned to the sketches I made for *The Black Path* and looked for new ways of engaging with that material and those ideas. I predicted that the process of reconstituting the global momentum designs from that work into a condensed format might offer another informative perspective on the use of momentum as a guiding tool.

Rather than applying stretches to functions, as in *Afterglow I* and *II*, here I needed to compress the motion into its most essential form. In effect, this meant finding ways to express the global momentum from *The Black Path* on a smaller, neater scale. The result was *Microludes for the Black Path* – five very short images of the brutal post–industrial landscape I explored in *The Black Path*, in 2021. The first, third, and fifth of these microludes are direct reductions of approaches to momentum implemented in the original quartet. The first microlude recreates gradual movement from unpitched sound towards a single pitch and then chromatic cluster that opens to original *Black Path*. The middle movement plays with the tendency for gentle harmonic pulsating patterns to slide towards dramatic outbursts, re-deploying some of the chaotic and indeterminate extended techniques used in the original work. The final microlude takes a previously unused variation on the folk melodies from the end of the original *Black Path* and brings it to the fore, reducing density and volatility through soft, quiet, quasi-bisbigliando harmonics, to suggest a slowing of momentum. This decrease in intensity complements the folk-derived melody. Then enabled me to generate the kind of steadfast, consonant, but non-tonal resolution that I once found difficult to control.

The second and fourth microludes are built from sketches which were not used in the original *Black Path*. These pizzicato ideas were replaced by the similar, but more angular and

nervous 11/16 patterns that appear in *The Black Path*'s second movement. The rhythmic complexity of these passages demands a great deal of close communication from the ensemble. Though I ultimately replaced this material in *The Black Path* with passages that combined standard notation with indeterminate gestures and boxed figures, in order to make the transfer of power between composer and performers more apparent, these pizzicato shapes serve a useful role on this compressed scale - the lighter tone and the interplay that these pizzicato movements facilitate make them excellent diversions from the other microludes, and they serve as useful moments of relief, as well as miniature studies in performer interaction.

The workshops for this piece at the Diotima Academy were some of the most intense sessions that I have experienced. It is rare to be able to spend hours with performers of this calibre, and to have time to focus on very small details within the music; I learned a great deal from their insistence on getting every detail just right. In rehearsal, we were able to test multiple possible interpretations and agree upon solutions for nuanced problems. My understanding of momentum, and my ability to discuss my music through momentum, was crucial to the success of these sessions. Having a clear and immediate understanding of the intended musical motion meant that I could explain almost all of my choices to the performers quickly and effectively, wherever they sought guidance. In fact, I was able to explain the factors that might have influenced my unconscious process, and the ensemble (Quatuor Una Corda) were able to infer decisions of mine independently – often only needing to verify their interpretations with me, rather than enquire about them. Any requests or comments I needed to make could be focused on the directed energy, and therefore expressed without a critical tone. This is perhaps the most valuable outcome of my momentum–based study – the ability to interface with performers and share complex, multi–layered ideas with relative ease.

This work is more than just an abridged version of the original quartet: it is a crystallisation of the most evocative and influential musical features that generate the sense of motion. The fact that I could quickly and effectively distil the crucial momentum elements and restructure them so that they fit into the new five–part microlude shape is testament to the utility of my momentum–based approach, and the extent to which I have been able to integrate it into my practice. I do not believe that I would have been equipped to write this piece at the outset of my research. But, having significantly developed my practice, identifying, understanding, and transplanting the key gestures which most heavily impact the sense of motion was wholly achievable, and doing so under time pressure was manageable. This gave me access to an opportunity that would have otherwise been unavailable, and helped me to maximise that opportunity's value.

6: Conclusions

My aims at the outset of this project were threefold: to investigate the prioritisation of momentum within my practice; to develop compositional approaches that allow me to engage with momentum as a tool, informing decision-making and helping me to find a balance between pre-determined choices and intuitive alteration; and to consider the impact of integrating approaches associated with momentum from external sources into my own compositions. Addressing these aims has had positive consequences for my musical output, enhancing the quality of my work and streamlining the process by which I make music. It has also significantly improved my ability to share and discuss my intentions with my peers – be they performers, composers, or musicologists. I am consistently able to facilitate more impactful performances of my music, which capture a truer reflection of my compositional aims, thanks to the fact that I can share my intentions with performers with greater accuracy, in an understandable format.

My primary aim was successfully tackled: I have developed a detailed understanding of the ways in which a prioritisation of momentum impacts my practice. A focus on momentum helps me to generate ideas that are dynamic, well-articulated, and gesturally strong; it helps me to manipulate those ideas, giving me confidence to follow my intuition, safe in the knowledge that my overarching designs for the direction and intensity of the work are both coherent and flexible enough to absorb any unexpected outcomes that arise as a consequence of intuitive decision-making. If needed, I can easily adapt my designs for a work, without becoming overwhelmed by potential possibilities or issues that arise.

The second of my three aims was also productively addressed. Several of my attempts at creating new strategies for harnessing momentum were ineffective, but these unsuccessful attempts ultimately informed the creation of impactful and reusable techniques. The stratification of momentum into global and local tiers is an effective way to filter and organise ideas, and it allows me to engage with multiple concurrent concepts in a way that avoids saturation. The three factors influencing momentum (density, volatility, and entropy) can all serve as useful interfaces between abstract conceptualisations of directed energy and constructive processes that generate specific musical content. All three factors have been shown to impact both the overall motion and the propulsion of small-scale ideas through a work. The graphical approach to these factors is useful in the early stages of composition, during the refinement of a work, and even when returning to reconstruct a finished piece into something new. Pre-compositional graphs are especially useful for assessing the significance and impact of any intuitive divergence from planned structure. Engaging with the balance of

power between composer and performers is also impactful – especially through improvisation and indeterminacy. In certain ensemble contexts, particularly solo works, it is not as actively useful as the other two strategies, but it remains worthy of regular consideration. Momentum can usefully serve as a tool for communication regarding improvisation, as it can be used to discuss aims and intentions without referring to specific musical content. I have demonstrated the ways in which a focus on momentum has helped me to guide performers, providing them with immediate insight into my aims and intentions, and sometimes inviting them to contribute to management of momentum through improvisation and ensemble communication. Though composers such as Xenakis might see this as an 'act of resignation',[96] I have found that affording performers a limited amount of agency over progression and motion can enhance communication of my ideas.

The integration of external ideas into my practice has been educational and valuable. I have successfully integrated features from a variety of genres, from other musical works, and from poetry, into pieces in this folio. I have learned that the best kind of engagement with external factors is deliberately imprecise – as far as momentum is concerned, using an external idea as inspiration, or as a tool for creativity, is much more consistently impactful than trying to precisely reconstruct a specific approach found in one particular source. This was a lesson I learned early in the project, and as a result, I was largely able to mitigate the potential downsides of overly specific practice.

Completing this project has had an immensely positive impact upon my overall composition. The development of my output from *A Lost Chaconne* through to *Ashening* and *Microludes…* demonstrates that my handling of momentum as a compositional tool (and consequently, the shape and balance of my music) has undergone a process of continuous refinement, and to that end, my writing is both significantly more sophisticated, and more authentically representative of my musical identity. I have found new ways to understand and extend my intuition for musical motion, and I feel a greater sense of clarity and security within my overall practice. Practice–based research such as this is inevitably personal, but I hope that my peers find this research informative, and I encourage them to experiment with an active consideration of musical momentum in their own work.

[96] Xenakis, *Formalized Music*, 38.

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