

# Spatial Listening

portfolio of original compositions with written commentary



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## Abstract

In response to a contemporary (Western) cultural disposition that is variously described as ocularcentric and disembodied, this project situates sound and listening as alternate potentialities for relating to, and understanding, the concrete spatial environment. This commentary puts forward a practice of listening — communicated through a series of works — that engages subjects in methodical and embodied modes of thinking-through-sound as a way to create sonic knowledges of the architectural environment; in relation to the acoustic phenomena of echo, resonance, and reverberation. Works situate these phenomena as individual sounding and listening affordances for interacting with the built. They engage subjects in various modes of listening *through*, or sounding and listening in relation *to* them, in pursuit of understanding the spaces in which they manifest. This practice is located between a body of sound works that engage acoustic phenomena and a body of spatial practices which configure listening. It makes an original contribution to the field through the way in which it engages subjects in reflexive modes of sounding and listening that are contingent on the perception of acoustic phenomena. Works are grounded in a phenomenological conception of listening, drawn largely from the work of Maurice Merleau-Ponty, Jean-Luc Nancy and Salome Voegelin. Commentaries discuss the works in relation to the paradigms of sonic knowing put forward by Steven Feld, Julian Henriques, and Annie Goh. *Ear Pieces* preface the portfolio. These works defamiliarise the ear as a way to create situations of listening that prepare subjects for engagement with other works in the portfolio. *Reflection // Position* is a four-loudhailer array that creates complex milieux of sonic reflections that are 'worked through' by listeners. *RT60* is a network of loudspeakers and microphones that organises sound around the reverberant temporalities of spaces. In the *Spatial Drone* pieces, performers use either synthesiser or tuba to uncover the resonant profiles of enclosed spaces through reflexive cycles of sounding and listening. The *Resonant Topographies* works instigate moving-listening engagements with resonant interference distribution. Finally, *Spatial Listening* — inspired by the work of Pauline Oliveros — is a series of text scores, manifesting as an itinerant listening practice that engages subjects in reflexive modes of sounding and listening through echo, resonance and reverberation. The sonic knowledges of architectural space produced by the works in this portfolio are characterised by the combination of the acoustic phenomenon in question and the mode of listening that engages it. Generally, they are contingent, relational, transient, 'situated', and explicitly bound to the body with regards to both the perception and emission of sounds. Works instigate sonic modes of being in space that challenge ocularly dominated dispositions; defined by a mixing with it rather than a separation from it. They bring subjects into their bodies and into the present moment, whilst fostering situations in which people relate sonically, coming together through, and in, listening.

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# **Spatial Listening**

## **Prolegomenon**

You shout loudly and sharply into a large reverberant space. You are mindful of the sound that you make, and the energy and corresponding muscular feedback that was required to create it. Trains of soundwaves unfurl from you — as if from a rocking boat on a calm lake — radiating in all directions before colliding with material surfaces.

With each collision, these trains of soundwaves reflect back into the space, filtered by its material properties. They intercept you at different times. Each perceptible interception testifies to a passage: each passage expresses an element of the space in which you find yourself.

These passages of sound continue onward: perceptible reflections become reverberant haze. As the sound reverberates, the architecture energetically reinforces the frequencies that match its proportions, whilst attenuating those that do not. The timbre of your voice is thus subsumed by the space.

This sound is your muscular energy translated into vibratory force. Over time, the air through which it propagates and the surfaces of the space gradually claim this energy and the sound decreases in intensity until it crosses the threshold of silence.

Just as sound requires energy, listening requires energy. From the moment that you stop sounding, you follow your voice as it leaves your body, taking on an agency of its own and mixing with the architecture. The first reflections articulate the proportions of the space in relation to your position within it. As the timbre of your voice is subsumed by the space, you hear your surroundings as frequency. As the threshold of silence is crossed, you hear the space as temporality.

By sounding, you act on the space, and in return it acts on you. As you stretch your ear towards these sonic essences you create the architectural environment in your listening, but you also constitute your auditory self, here, now in *this* space. You exist alongside the sounds of your creating in approach of the spatial environment and in approach of your auditory self, from moment to moment as the sound gradually dissipates.

Through this act, you become mindful of a sonic way of being in space; a becoming present, which is defined by a mixing with it rather than a separation from it. In your listening you create an auditory timespace that is restless and dynamic, rendered by your attention and awareness. Ocular conceptions of your surroundings as a stable, material volume are replaced with intensities, envelopes, and timbres, perpetually modulated by the contours of the built.

## Introduction

Our senses and perceptions are shaped by an addiction to high definition visual experiences through technological interfaces between our bodies and our environment. So as the perception of space is inhibited by the excess of visual stimuli, other senses remain dormant in the background of our daily experiences. Ubiquity immediacy and saturation make it difficult to perceive between noise [sic] and to be aware of the shifts taking place. With a loss of corporeal experiences and physical references, this mode of perceiving space is affecting our understanding, consciousness and actions in the everyday.<sup>1</sup>

We shape our buildings, and afterward our buildings shape us.<sup>2</sup>

In what Mark Augé describes as a late-capitalist era of super modernity, there is a prevalent rise in 'non-places', which lack history or relationality and strip individuals of their individuality.<sup>3</sup> An abundance of handheld digital technologies, despite the utility and connectivity they provide, bring users out of their bodies and away from a sensory experience of our environment.<sup>4</sup> Noise-cancelling technologies block out the sonic experience of surroundings and transport users to alternate auditory environments.<sup>5</sup> Juhani Pallasmaa suggests that this contemporary sensory and perceptual disposition is a product of Western philosophical biases toward the eye and has led to a pathology of the architectural environment:

I believe that many aspects of the pathology of everyday architecture today can likewise be understood through an analysis of the epistemology of the senses, and a critique of the ocular bias of our culture at large, and of architecture in particular. The inhumanity of contemporary architecture and cities can be understood as the consequence of the negligence of the body and the senses and an imbalance in our sensory system.<sup>6</sup>

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<sup>1</sup> *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle (Berlin: Errant Bodies Press, 2011), p.xi.

<sup>2</sup> Winston Churchill made this statement in relation to the rebuilding of parliament following the blitz. For the full transcript, see, Winston Churchill, 'House of Commons Rebuilding', *Parliament* <<https://api.parliament.uk/historic-hansard/commons/1943/oct/28/house-of-commons-rebuilding>> [18/12/2018].

<sup>3</sup> See Mark Augé, *Non-Places: Introduction to an Anthropology of Supermodernity*, trans. by John Howe (London; New York, NY: Verso, 1995).

<sup>4</sup> For example, there has recently been a marked rise in mobile phone lanes. See, Leo Benedictus, 'Chinese city opens 'Phone Lane' for texting pedestrians', *The Guardian* <<https://www.theguardian.com/world/shortcuts/2014/sep/15/china-mobile-phone-lane-distracted-walking-pedestrians>> [14/12/2018].

<sup>5</sup> Sony recently ran an advert with the tagline, 'in noise we escape', in which a man puts on a pair of headphones and is transported away from the noisy city environment to a lush, green jungle. See Sony, 'Sony's 1000XM3 Headphones | Only Music. Nothing Else', *YouTube* <<https://www.youtube.com/watch?v=tK9toNgPvBU>> [14/12/2018].

<sup>6</sup> Juhani Pallasmaa, *The Eyes of the Skin* (Chichester: Wiley-Academy, 2008), p.17. The notion of an ocular bias crops up across multiple discipline areas. See, for example, Tim Ingold, 'Stop, Look and Listen! Vision, Hearing and

An ocular bias, Pallasma goes on to say, can be shown to be responsible for the prevalence of feelings of, 'alienation, detachment and solitude'.<sup>7</sup> He further argues that a 'gradually growing hegemony of the eye seems to parallel the development of Western ego-consciousness and the gradually-increasing separation of the self and the world.'<sup>8</sup> Henri Lefebvre's magnum opus, *The Production of Space*, is centred on the notion that '(social) space is a (social) product': every society secretes a space that in turn defines and regulates that society.<sup>9</sup> Read through Lefebvre's model, this human disposition feeds into the production of desensitised spaces that in turn perpetuate and reinforce it. In this context, non-ocular sensory modalities become increasingly compelling mediums through which to explore overlooked ways of knowing and being that might act to re-contextualise cultural dispositions and subvert a compromised cycle of spatial production.<sup>10</sup>

To listen is to open up to the world in all its vibratory complexity. Sound provides an alternate potentiality for relating to the spatial environment. This commentary puts forward a practice that creates situations in which subjects come to sonically know architectural spaces through sounding and listening. Works engage the acoustic phenomena of resonance, echo and reverberation as mediums that are sonically thought through, in pursuit of understanding the spaces that contain them. This project does not argue for the ear above the eye. Rather, it seeks to pursue listening spatially as a way to produce modes of knowing that might enhance the sensory whole. The commentaries begin by discussing *Ear Pieces*, a selection of works that intend to bring subjects into their sonic bodies and prepare them for a spatial approach to listening. Chapter six discusses two works which engage with the temporal phenomena of reverberation and echo. The works discussed in chapter seven engage subjects in dialogues with space through the phenomena of resonance. The final chapter puts forward a collection of text scores that form the basis for an itinerant practice of spatial listening which brings groups of subjects together in knowing space through reflexive sounding and listening. The sonic knowledges created by the practice are embodied, situational and transient, and the modes of listening that this project espouses facilitate alternate approaches to space, social relations, and self.

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Human Movement', in *The Perception of the Environment* (London: Routledge, 2000), pp.243-287, Pnina Avidar, Raviv Ganchrow, Julia Kursell, 'Editorial', *OASE Journal of Architecture*, 78 (2009), 2-13, Martin Jay, *Downcast Eyes* (Berkeley and Los Angeles, CA: University of California Press, 1993), and David Michael Levin, *Modernity and the Hegemony of Vision* (Berkeley and Los Angeles, CA: University of California Press, 1993).

<sup>7</sup> Pallasma, p.19.

<sup>8</sup> *Ibid.*, p.25.

<sup>9</sup> Henri Lefebvre, *The Production of Space*, trans. By Donald Nicholson Smith (Oxford: Blackwell, 1991), p.30-31.

<sup>10</sup> See, for example, the following article which argues for a return to the art of communal bathing as a way to combat 'urban alienation': Jamie Mackay, 'Why We Need to Bring Back the Art of Communal Bathing' *Aeon* <<https://aeon.co/ideas/why-we-need-to-bring-back-the-art-of-communal-bathing>> [20/12/2018].

## 1 Towards Listening Spatially

Listening structures the audible world in a different way. Attention to hearing literally changes the experience of ‘surroundings’, possibly in a more potent manner than equivalent tunings of vision, because with vision you always have the relatively static material referents to fall back upon. In sound, the space you experience is in flux — it is exactly what you make of it. It is a quintessential perceiver-centric space. In that sense addressing the sonic aspect of architecture is not so much about adding sound into the built environment, it is really about rethinking listening.<sup>11</sup>

### A Phenomenological Approach to Listening

This project is concerned with rethinking listening as a way of knowing space. Picking up on Pallasmaa’s critique of the ‘negligence of the body and the senses’, it takes an approach which places the individual at the centre of the experiential question.<sup>12</sup> Maurice Merleau-Ponty’s paradigm for a phenomenology of perception provides a basis for the consideration of listening in this project. For Merleau-Ponty, phenomenology

places in abeyance the assertions arising out of the natural attitude, the better to understand them; but it is also a philosophy for which the world is always ‘already there’ before reflection begins — and an inalienable presence; and all its efforts are concentrated upon re-achieving a direct and primitive contact with the world, and endowing that contact with a philosophical status.<sup>13</sup>

The ‘natural attitude’, is a state in which the essences of things themselves are overlooked, due to an ‘unquestioned belief in the world’, or in other words, a bias towards accepted truths;<sup>14</sup> this disposition is undoubtedly in part responsible for the concerns outlined in the introduction. The mission of Merleau-Ponty’s phenomenology is to place this natural attitude in abeyance by seeking to re-establish roots in the body and awaken people to, ‘an appreciation of the ambiguity

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<sup>11</sup> Raviv Ganchrow and Arie Altena, ‘Approaches to Space and Sound: Interview with Raviv Ganchrow and Arie Altena’, in *The Poetics of Space: Sonic Acts XIII*, ed. by Arie Altena (Amsterdam: Sonic Acts Press; Paradiso, 2010), pp.32-50 (p.37).

<sup>12</sup> Pallasmaa, p.17.

<sup>13</sup> Maurice Merleau-Ponty, *Phenomenology of Perception*, trans. by Colin Smith (London; New York, NY: Routledge, 2002), p.vii.

<sup>14</sup> *Ibid.*, p.lxxvii.

of our lived experience'.<sup>15</sup> It aims to achieve this by re-establishing a dialogue with the 'pre-objective', and thus restoring a sense of, 'wonder vis-à-vis the world'.<sup>16</sup>

For Merleau-Ponty, in contrast to Newtonian absolute space, or Cartesian space, phenomenological space opens up in relation to, and from the perspective of, an individual at a given moment in time. He mentions that 'rather than a mind and a body, man is a mind with a body, a being who can only get to the truth of things because his body is, as it were, embedded in those things.'<sup>17</sup> Merleau-Ponty encapsulates this sentiment in evoking the post-impressionist paintings of Cézanne:

The lazy viewer will see 'errors of perspective' here, while those who look closely will get the feel of a world in which no two objects are seen simultaneously, a world in which regions of space are separated by the time it takes to move our gaze from one to the other, a world in which being is not given but rather emerges over time.<sup>18</sup>

This conception of space foregrounds embodiment, drawing attention to the fact that in lived experience, space is not a 'medium without point of view, without body and without spatial position'.<sup>19</sup> Instead it is emergent, defined by a subject's position within it and trajectory through it in relation to the interplay of the senses.

Another key element of this phenomenological paradigm is that the world is produced in intersubjective dialogues between body and objects. Merleau-Ponty conjures the image of honey running over the hand, describing its properties: its stickiness, viscosity and colour. He emphasises that these qualities are not innate to the honey, but a product of its interaction with the subject. As he describes, 'the living, exploring, hand which thought it could master this thing instead discovers that it is embroiled in a sticky external object.'<sup>20</sup> What is here referred to as 'being honeyed', describes an interaction between subject and object where the two things constitute each other as such. For Merleau-Ponty, things 'can only be understood in the light of the dialogue between [...] an embodied subject and the external object which bears [a] quality.'<sup>21</sup> By extension, the qualities which things possess determine the types of behaviours that they may provoke in us.<sup>22</sup> Listening, when conceived

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<sup>15</sup> Monika Langer, *Merleau-Ponty's "Phenomenology of Perception": A Guide and Commentary* (Basingstoke; London: Macmillan, 1989), p.149.

<sup>16</sup> *Ibid.*, p.163.

<sup>17</sup> Maurice Merleau-Ponty, *The World of Perception*, trans. by Oliver Davis (Abingdon, Oxfordshire; New York, NY: Routledge, 2004), p.56.

<sup>18</sup> Maurice Merleau-Ponty, *The World of Perception*, p.54. O.F. Bollnow further theorises phenomenological space: See Otto Freidrich Bollnow, *Human Space*, trans. by Christine Shuttleworth, ed. by Joseph Kohlmaier (London: Hyphen Press, 2011).

<sup>19</sup> Merleau-Ponty, *The World of Perception*, p.54.

<sup>20</sup> *Ibid.*, p.61.

<sup>21</sup> *Ibid.*, p.61.

<sup>22</sup> *Ibid.*, p.63.

from a phenomenological standpoint, then, is not to simply perceive the world but to engage with it, to create it and to form a sense of oneself in the process.<sup>23</sup> Salome Voegelin extends Merleau-Ponty's phenomenological concerns towards listening thus:

The listening subject invents, he practises an innovative listening that produces the world for him in a phenomenological sensory-motor action towards the heard, and his auditory self is part of the heard in reciprocal intersubjectivity. Listening as a critical motility practises Merleau-Ponty's phenomenology as a process of doubt: the critical listener himself is full of doubt about the heard, and doubtful in his complicity he needs to hear and hear again, to know himself as an intersubjective being in a sonic life-world.<sup>24</sup>

By engaging with the works in this portfolio, subjects produce their spatial environment. As they listen through acoustic phenomena, their sense of space emerges as part of an intersubjective dialogue in tandem with their sense of 'auditory self'. Listening can be further defined by its distinction from hearing. For Jean-Luc Nancy, to hear is to 'understand the sense', whilst to be listening 'is to be straining towards a possible meaning and consequently one that is not immediately accessible', a sensibility that echoes Voegelin's notion of doubt.<sup>25</sup> Listening, then, may be associated with a certain effort. For Nancy, this is encapsulated in the expression '*tendere l'oreille*', translated literally as 'to stretch the ear'. If hearing is concerned with understanding, or decoding what is coded, then we, 'never *listen* to anything but the non-coded [...] what is not yet framed in a system of signifying references.'<sup>26</sup> Listening, at least for the purposes of this project, is concerned with sound *qua* sound, or sound beyond coded representation.

Both Nancy and Voegelin argue that in listening, one cannot conceive of sound and space as separate components. Instead they form a complex composite, a monistic ensemble.<sup>27</sup> Voegelin collapses time and space into timespace, a term which takes into account how, 'listening builds, trashes and connects places in time, and tracks and diverts times in space [...] [it] hears space as sonic dynamics and produces a reciprocal time that is full of thickset materiality, and both are mutually generated rather than separately constituted.'<sup>28</sup> Echoing Merleau-Ponty's conception of space, timespace is always situated, experienced from the embodied positionality of the perceiver. The body, therefore, is an instrument and a language of listening:

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<sup>23</sup> This project also acknowledges Don Ihde's contribution to a phenomenology of listening. See, Don Ihde, *Listening and Voice: Phenomenologies of Sound*, 2<sup>nd</sup> edn (Albany, NY: State University of New York Press, 2007).

<sup>24</sup> Salome Voegelin, *Listening to Silence and Noise: Towards a Philosophy of Sound Art* (New York, NY; London: Continuum, 2010), p.10.

<sup>25</sup> Jean-Luc Nancy, *Listening*, trans. by Charlotte Mandell (New York, NY: Fordham University press, 2007), p.6.

<sup>26</sup> Nancy, p.36.

<sup>27</sup> See Nancy, p.13.

<sup>28</sup> Voegelin, p.125.



movement varies and defines the sonic experience. Further to this, the whole body is an ear, a resonant architecture that receives sound both aurally and somatically.

For Nancy, listening is defined as a 'space of the self'.<sup>29</sup> This notion originates in his suggestion that both sound and self may be defined in terms of a referral. He posits that, 'a self is nothing other than a form or function of referral: [...] made of a relationship to self, or of a presence to self.'<sup>30</sup> Sound shares this property: 'in the external or internal space, it resounds, that is, it re-emits itself while still actually "sounding", which is already "re-sounding" since that's nothing else but referring back to itself.'<sup>31</sup> The act of listening, then, encompasses a reconciliation between sonic resonance — a series of external spatial referrals where sound is heard in relation to itself — and a series of internal referrals, a constant referral of self to self, an arriving into every moment. This is not a permanent formulation of being, but rather a dynamic relationship, 'in self, so to speak, as it forms a 'self', or a 'to itself'.<sup>32</sup>

Whilst listening affords the making present of a sense of self, it is also an act which is intensely relational. Brandon LaBelle's essay *Restless Acoustics, Emergent Publics*,<sup>33</sup> picks up on Nancy's assertion that the sonorous is 'tendentially methexic'.<sup>34</sup> For LaBelle, listening 'locates us within a field of events in such a way as to instigate a sociality of strangers', by rendering a relationality to others that is 'never fully identifiable, ocular and represented'.<sup>35</sup> In this setting, listening is also overhearing. It opens the subject out into an 'emergent public' whose dynamics are defined by doubt, temporality and contingency.<sup>36</sup>

The practice in this project explores listening as a gateway to knowing and understanding the acoustic environment. These knowledges and understandings open up uniquely for each subject through intersubjective dialogues in which the built is sonically constituted in parallel with the making present of their sense of auditory self. As a perceptual modality, listening transforms the architectural environment from what is ocularly conceived, rendering it as a dynamic timespace whose contours are perpetually modulated by sound and the agency and attention of the listener.

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<sup>29</sup> Nancy, p.7.

<sup>30</sup> Ibid., p.8.

<sup>31</sup> Ibid.

<sup>32</sup> Ibid., p.12.

<sup>33</sup> Brandon LaBelle 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Marcel Corbussen, Vincent Meelberg and Barry Truax (Oxford; New York, NY: Routledge, 2017), pp.275-285, (p.284).

<sup>34</sup> Nancy, p.10.

<sup>35</sup> LaBelle, 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Corbussen, Meelberg and Truax, pp.275-285 (pp.283-284).

<sup>36</sup> Ibid.

## Sonic Ways of Knowing

Works in this portfolio situate acoustic phenomena as mediums for auditory exploration that are methodically worked-through in listening to form sonic knowledges of space. Julian Henriques's *Thinking Through Sound* or *Sonic Logos* and Steven Feld's *Acoustemology* (a neologism of acoustics and epistemology), both conceive of sounding and listening as powerful alternative means for knowledge creation. Feld's *Acoustemology* emerges from a sustained research project investigating the Kaluli people of Papua New Guinea.<sup>37</sup> The project of *Acoustemology* intends to collapse the damaging separation between studied culture and researcher typical of traditional anthropological research methodologies, by conceiving of embodied 'sounding and listening as a knowing-in-action: a knowing-with and a knowing-through the audible.'<sup>38</sup> *Acoustemology* is grounded in a relational ontology from which sound is always experienced situationally and among 'related subjects'.<sup>39</sup> Feld posits that in *Acoustemology*, knowledge isn't simply gained, but that rather, 'one knows through an ongoing cumulative and interactive process of participation and reflection'.<sup>40</sup> He places a particular emphasis on what is gained through, 'the reflexive feedback of sounding and listening',<sup>41</sup> and sonic knowledges are described as, 'experimental, contextual, fallible, changeable, contingent, emergent, opportune, subjective, constructed, [and] selective.'<sup>42</sup>

Henriques's publication uses an ethnography of Jamaican sound-system culture as a basis to develop the idea of thinking through sound. This model engages the mechanics of the propagation of sound through a medium as the basis for thought.<sup>43</sup> Henriques implicitly echoes an intersubjective phenomenological conception of listening in describing working through a sounding medium 'so that we become part of it and it becomes part of us'.<sup>44</sup> Thinking through sound is distinguished from thinking *about* anything and posed in opposition to — and as a critique of — established western epistemologies. In thinking through sound, objects are replaced

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<sup>37</sup> See Steven Feld, 'Waterfalls of Song: An Acoustemology of Place Resounding in Bosavi, Papua New Guinea', in *Senses of Place*, ed. by Steven Feld and Keith H. Basso (Woodbridge, Suffolk: Boydell and Brewer), 1996, pp.91-135.

<sup>38</sup> Steven Feld, 'Acoustemology', in *Keywords in Sound*, ed. by David Novak and Matt Sakakeeny (Durham, NC: Duke University Press, 2015), pp.12-21 (p.12).

<sup>39</sup> Steven Feld, 'On Post-Ethnomusicology Alternatives: Acoustemology', in *Perspectives on a 21<sup>st</sup> Century Comparative Musicology: Ethnomusicology or Transcultural Musicology*, ed. by G. Giuriati and F. Giannattasio (Udine, Italy: Nota, 2017), pp.82-99 (p.86).

<sup>40</sup> Ibid.

<sup>41</sup> Ibid.

<sup>42</sup> Ibid.

<sup>43</sup> Julian Henriques, *Sonic Bodies: Reggae Sounds Systems, Performance Techniques and Ways of Knowing* (London; New York, NY: Continuum, 2011), p.2.

<sup>44</sup> Ibid., p.xviii.

with processes, coded-representations are replaced with a medium, and thoughts are replaced with feelings — often independent of conscious reflection.<sup>45</sup> This model foregrounds embodiment in its conception of the ‘sonic body’. To Henriques, sonic bodies are attuned to, and defined by, sound. They experience and produce sound, and hold the corpus of sonic knowledge.<sup>46</sup> Where Henriques’s study begins with a model of sonic thinking, it concludes with broader paradigmatic theorisations of sonic knowledge. Following Aristotle, Henriques proposes *techné* and *phronēsis* as modes of sonic knowing, alternate to the traditional *epistēmē*.<sup>47</sup> He closes with a characterisation of the sonic *logos* as a series of triangulations in opposition to the dialectics which he argues prevail in established visual ways of knowing.<sup>48</sup>

Annie Goh builds on Feld and Henriques’s studies to put forward the feminist model of *Situated Sonic Knowledges*, which intends to disturb destructive subject-object, nature-culture, and mind-matter dualities prevalent within sound studies, as a way to unlock overlooked epistemological opportunities within the emerging field of archaeoacoustics. Building on Donna Haraway’s concept of ‘situated knowledges’,<sup>49</sup> she argues for a mode of embodied sonic-thinking which emphasises the, ‘partiality, anti-universalism, and political-ethical demands of situatedness.’<sup>50</sup> Goh proposes the echo as a material-semiotic figure which affords a ‘sounding disturbance into traditional subject-object relations’.<sup>51</sup> Encompassing both reflection, and diffraction, the figure of echo incorporates the reflexivity promoted by standpoint feminism as, ‘mobilising an awareness of heterogeneous subjectivities’, whilst metaphorically acknowledging Haraway’s diffraction methodology as a way to, ‘get to a political and epistemological elsewhere’, in which, ‘traditional dualisms are disturbed and diffracted’.<sup>52</sup>

The paradigms considered here provide the theoretical vocabulary to articulate the ways in which the situations of listening created by the practice in this portfolio formulate knowledges of architectural space. Sonic ways of knowing are fundamentally different to the ocular epistemologies which Pallasmaa so vehemently criticises.<sup>53</sup> They emerge through the doubtful phenomenological act of listening, engaged either as a way of working through a medium, as in Henriques’s paradigm, or in reflexive combination with sounding, as in Feld’s paradigm. Sonic knowledges

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<sup>45</sup> Henriques, p.14.

<sup>46</sup> *Ibid.*, p.xv.

<sup>47</sup> *Ibid.*, p.243.

<sup>48</sup> *Ibid.*, p.265.

<sup>49</sup> See Donna Haraway, ‘Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective’, *Feminist Studies*, 14.3 (Autumn, 1988), 575-599.

<sup>50</sup> Annie Goh, ‘Sounding Situated Knowledges: Echo in Archaeoacoustics’, *Parallax*, 23.3 (2018), 283-304, (p.289).

<sup>51</sup> *Ibid.*, p.298.

<sup>52</sup> *Ibid.*, p.296.

<sup>53</sup> Pallasmaa, pp.15-24.

are 'situated', taking into account a diversity of unique, embodied subjectivities. They are formulated situationally and as a product of acoustic and social relations. What is known is transient, ephemeral, and emergent.

### Not Sounds but Phenomena

The acoustic phenomena of echo, reverberation and resonance are in equal parts architectural and sonic, ephemeral and structural: they offer an intelligible 'way-in' to the complex entanglement between sound and space. They describe to a listener their spatial surroundings as a function of location, and their location as a function of spatial surroundings: any given position in an architectural space defines which resonant phenomena may be perceived, or which sonic reflections may be intercepted, whether perceived as echo or reverberation. Here I briefly recall the decaying sound of the voice in the prolegomenon. The very first reflections of the subject's voice are perceived as echo. These reflections resolve into a reverberant milieu, which, as it decays, timbrally morphs towards the resonant frequencies of the space. These phenomena are inextricably symbiotic, whilst at the same time, intelligibly distinguished. Works explore them separately as distinct sounding and listening affordances, each constituting its own language for unpacking and sonically knowing spaces. Each phenomenon implicates a subject in a distinct phenomenological intersubjective listening dialogue. The nature of these dialogues in turn suggest forms of interaction, such as movements, modes of sounding, and forms of social relations. Works situate these interactions as ways of thinking through phenomena which give rise to spatio-sonic knowledges.<sup>54</sup>

Analytical engagement with acoustics tends toward the abstract, and thus away from a present and embodied sense of architectural space. Like Steven Feld's acoustemology, this project 'engages acoustics at the plane of the audible', rather than at the plane of the scientific.<sup>55</sup> Phenomena are predominantly articulated and listened to by bodies rather than through acoustic analysis. In the cases where analysis is employed, for example in the *Resonant Topographies* works, this is simply to facilitate the presentation of phenomena as a basis for listening engagement.

Perhaps the key reason for placing an emphasis on phenomena rather than specific architectural spaces is that they are ubiquitous. That works create situations of listening in relation to phenomena and not specific sites, positions them as methodologies of sounding and listening for unpacking all manner of spaces in which

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<sup>54</sup> The individual dynamics of each work are explored in the commentary chapters. For an in-depth account of the experiential and symbolic elements of resonance and reverberation see Jean François Augoyard and Henry Torgue, *Sonic Experience: A Guide to Everyday Sounds* (Montréal: McGill-Queen's University Press, 2005), pp.99-110, and pp.111-123 respectively. For an account of echo, see Casey O'Callahan, 'Echoes', *The Monist*, 90.3 (2007), 404-414. For an acoustical account of these phenomena, see, Eric J. Heller, *Why You Hear What You Hear: An Experiential Approach to Sound, Music and Psychoacoustics* (Princeton, NJ; Woodstock, Oxfordshire: Princeton University Press, 2013).

<sup>55</sup> Feld, 'Acoustemology', in *Keywords in Sound*, ed. by Novak and Sakakeeny, pp.12-21 (p.12).

these phenomena manifest. Here architecture becomes ‘aural architecture’. This term, coined by Barry Blesser and Linda-Ruth Salter refers to ‘the properties of a space that can be experienced by listening’.<sup>56</sup> The portfolio in general — and the *Spatial Listening* collection in particular — situates the built environment as an acoustic playground, a field of potential spatio-sonic knowledges. In what follows, I briefly outline the portfolio works:

- *Reflection // Position* is a four-loudhailer array that emits constant impulses, or repetitive patterns of impulses over 360 degrees. These interact with spaces to produce complex milleux of sonic reflections that are perceived as varying reverberant intensities or patterns of discreet echoes, depending on the architectural environment. Subjects work through these fields of sonic reflections by moving and listening. A series of micro-scores specify further engagements, such as imitating patterns of reflections, or placing objects where particularly interesting phenomena occur. Spatial environments become known in this work through varying patterns of sonic reflections articulated by autonomous subjects’ moving interactions.
- *Spatial Drone* describes to a performer how to use a subtractive synthesiser to identify the strongest perceptible resonant frequency in an enclosed space. The synthesiser is tuned to this frequency and a series of synthesis parameters are used to control the manifestation of resonant phenomena. The performer comes to know the space in resonance through a reflexive process of parameter adjustment and listening that is contingent on the ways in which phenomena play on ear and body.
- *Spatial Drone II* takes the same approach as its sister piece, however it situates the tuba as the medium through which a player conducts reflexive cycles of resonant sounding and listening.
- In the *Resonant Topographies* installation, visitors’ interactions create dynamic visualisations of resonant interference distribution by way of a smartphone application, a suspended camera and projections. Subjects work through a space in resonance by reconciling between movement, what is aurally and somatically perceived, and what is seen.
- In *Resonant Topographies: Listening-led Movement*, dancers create choreographies in response to their aural and somatic experiences of

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<sup>56</sup> Barry Blesser and Linda-Ruth Salter, *Spaces Speak, Are You Listening? Experiencing Aural Architecture* (Cambridge, MA: MIT University Press, 2007), p.5.

resonant interference distribution. These choreographies are externalisations of sonic knowing that in turn act to bring an audience into engagement with the standing waves in the space.

- *Spatial Listening* is a series of text scores, manifesting as an itinerant listening practice that engages subjects in reflexive modes of sounding and listening through echo, resonance and reverberation in any spaces that contain these phenomena. Pieces formulate sonic knowledges through both individual and group engagement.
- *Ear Pieces* defamiliarise the ear as a way to create situations of listening that prepare subjects for engagement with other works in the portfolio. They may also be considered as a way to develop and extend the modes of listening espoused by the main body of practice.

## A Revolt

Henri Lefebvre argues that capitalism and neocapitalism have produced what he defines as abstract space, which ‘includes the ‘world of commodities’, its ‘logic’ and its worldwide strategies, as well as the power of money and that of the political state.’<sup>57</sup> Within abstract space, ‘lived experience is crushed, vanquished by what is conceived of’.<sup>58</sup> He proposes a revolt against this harmful spatial formulation:

[...] a question arises [...] it concerns the silence of the ‘users’ of this space. Why do they allow themselves to be manipulated in ways so damaging to their spaces and their daily lives without embarking on massive revolts?<sup>59</sup>

This practice aligns itself with Lefebvre’s revolt by proposing modes of engaging with the built environment which subvert the ocularly dominated, or disembodied disposition that he argues is perpetuated by abstract space.<sup>60</sup> By implicating subjects in phenomenological sounding and listening with and through spaces, it constitutes ‘an uprising of the body against the non-body’.<sup>61</sup> Space is claimed in sound as sensory, embodied and socially-connected. It is the aim that these corporeally-orientated, sonic ways of being in — and knowing — space permeate the psyches and memories of those who engage with the works and that these

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<sup>57</sup> Lefebvre, p.53. Lefebvre’s notion of abstract space interfaces neatly with Mark Augé’s conception of ‘Non-Places’. See Augé, pp.75-115.

<sup>58</sup> Lefebvre, p.51.

<sup>59</sup> Ibid.

<sup>60</sup> Ibid., p.201. This is particularly the case with *Spatial Listening* and *Reflection // Position*, though this sentiment applies to all works.

<sup>61</sup> Ibid.

experiences, in their own small way, play into the cycle of spatial production. The emphasis in this practice is not on the works themselves, but on their working through, by bodies in spaces.

This chapter has laid the theoretical groundwork for the commentaries that follow. The works, which have been briefly introduced, engage subjects in a variety of modes of listening through, or sounding and listening in relation to, resonance, echo and reverberation as ways to know architectural space. They deploy listening both as an individual activity and through social interaction. In engaging with these works, a subject renders spatial environments through acoustic phenomena as dynamic timespaces, whilst simultaneously constituting an auditory sense of themselves in a phenomenological intersubjective dialogue. Sonic knowledges are formulated through methodical listening. These knowledges — theorised in relation to the paradigms put forward by Feld, Henriques and Goh — are situational, relational 'situated', corporeal, contingent, and ephemeral. The next chapter contextualises the research among existing bodies of practice.

## 2 Contextualising the Research

This project may be placed within a broad, interdisciplinary field of research and practice-based inquiry which considers the relationship between subjects, sound and the built environment.<sup>62</sup> A significant number of research endeavors and creative practices as well as conferences, festivals and courses of study have emerged in recent years which contribute to this field.<sup>63</sup> Whilst there already exists a considerable body of sonic practice which engages with architectural acoustics, as well as a body of spatial practices which engage listening, there exist a lack of practices that explicitly engage subjects in embodied spatial listening.

### Cultures of Spatial Listening

Juhani Pallasmaa leads on from his critique of ocularcentricism by positing that, 'a primordial dominance of hearing has only gradually been replaced with that of vision.'<sup>64</sup> In responding to a cultural disposition defined as ocular and disembodied, this research is inspired by cultures for whom sound has played an integral role in sense of space and place.<sup>65</sup> Archaeoacoustic investigations, for example, suggest an early human preoccupation with the transcendental power of spatial resonance. Igor Reznikoff's research argues that the placement of paintings in Paleolithic caves in France corresponds with the locations where the strongest resonant frequencies may be perceived.<sup>66</sup> He suggests that those responsible for the paintings must have navigated the caves by means of sonar-like processes of sounding and listening, and draws parallels between the animals represented in different paintings and the sounds required to articulate the resonances in their respective locations.<sup>67</sup> Fundamentally, he argues that the occupants of these caves might have, engaged in, 'a deep communion with earth, stone and the mineral elements of Creation' through resonant sounding and listening practices.<sup>68</sup> A number of other

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<sup>62</sup> Blesser and Salter stake out this field by carefully merging a broad array of discipline areas into the central theme of 'Aural Architecture'. See, Blesser and Salter, pp. 1-11. See also, Alex Arteaga, 'Auditory Architecture: Introduction to a new Discipline', *KunsteTexte.de*, 4. (2010) <<https://edoc.hu-berlin.de/bitstream/handle/18452/7497/arteaga.pdf?sequence=1&isAllowed=y>> [14/12/2018].

<sup>63</sup> See, for example Shannon Mattern's course on Sound and Space at the New School in New York City (2014): Shannon Mattern, 'Sound and Space' *Words in Space*, <[http://www.wordsinspace.net/course\\_material/sound\\_space/sound\\_space\\_F05.html](http://www.wordsinspace.net/course_material/sound_space/sound_space_F05.html)> [14/12/2018]. See also the *Tuned City* Festivals: Carsten Stabenow, 'home', *Tuned City* <[http://www.tunedcity.net/?page\\_id=5013](http://www.tunedcity.net/?page_id=5013)> [14/12/2018].

<sup>64</sup> Pallasmaa, p.24.

<sup>65</sup> For a far more in-depth account of these than I am able to give here, see Blesser and Salter's chapter 'Aural Spaces from Prehistory to Present', Blesser and Salter, pp.67-126.

<sup>66</sup> Igor Reznikoff, 'On Primitive Elements of Musical Meaning', *Journal of Musical Meaning*, 3.2 (2004/2005) <<http://www.musicandmeaning.net/issues/showArticle.php?artID=3.2>> [19/12/2018].

<sup>67</sup> Ibid., para 45.

<sup>68</sup> Ibid., para 44.



archaeoacoustic projects have investigated man-made prehistoric structures in the United Kingdom and Ireland, finding them all to have fundamental resonant frequencies in the human vocal range.<sup>69</sup> A pilot study by Ian A. Cook, Sarah K. Pajot and Andrew F. Leuchter tested the neurological impact of these frequencies, discovering that they have a notable impact on brain function.<sup>70</sup> Anthropological literature contains numerous accounts of cultures for whom sound plays, or has played, an essential role in knowing and understanding place, social, relations and space.<sup>71</sup> Steven Feld's in-depth ethnographies of the Kaluli tribe in Papua New Guinea, for example, describe a culture whose highly attuned auditory sense is resultant from, and responsive to, the dense rainforest environment in which they live.<sup>72</sup> Feld describes that Kaluli emplacement is brought into being through voicings and song, which are themselves entirely emergent from the acoustic environment of the jungle. Barry Blesser and Linda-Ruth Salter in their book, *Spaces Speak, Are You Listening?* provide a history of echolocation, which demonstrates that humans possess the cognitive ability for detailed aural engagement with space. They posit that the echolocation skills of some individuals are 'so extraordinary as to border on the magical', further arguing that, '[we] are how we live. There is no generic human being.'<sup>73</sup> These listening cultures expose the sensory imbalances prevalent in contemporary Western culture, and point to alternate sonic ways of knowing, doing and being. This research project — and particularly the *Spatial Listening* collection — inspired by these accounts, intends to materialise micro-cultures of listening within architectural spaces. Works make emergent in subjects the kind of primordial spatio-sonic instincts to which Reznikoff alludes.

### Sonic Spatial Practices

As an endeavour which aims to engender situations — micro-cultures — of listening through architectural space, this project is closely related to, but can be distinguished from, sound works which frame the acoustic properties of space as an object of experience or compositional medium. The body of work to which I refer is neatly categorised as 'acoustic space' by Frederico Macedo in his article

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<sup>69</sup> See, for example, Paul Devereaux, 'Ears & Years: Aspects of Acoustics and Intentionality in Antiquity' in *Archeoacoustics*, ed. by Chris Scarre & Graeme Lawson (Cambridge: McDonald Institute for Archaeological Research, 2006), pp.23-30. Blesser and Salter provide a comprehensive survey of archaeoacoustic investigations into aural architecture. See Blesser and Salter, pp.73-78.

<sup>70</sup> Specifically, between 95-110hz. See Ian A. Cook, Sarah K. Pajot, Andrew F. Leuchter, 'Ancient Architectural Acoustic Resonance Patterns and Regional Brain Activity', *Time and Mind: The Journal of Archaeology Consciousness and Culture*, 1.1 (March 2008), 95-104, (p.95).

<sup>71</sup> Tim Ingold outlines a number of these studies. See Ingold, p.249.

<sup>72</sup> Feld, 'Waterfalls of Song: An Acoustemology of Place Resounding in Bosavi, Papua New Guinea', in *Senses of Place*, ed. by Feld and Basso, 1996, pp.91-135 (pp.98-134).

<sup>73</sup> Blesser and Salter, pp.35-51.

*Investigating Sound in Space: Five Meanings of Space in Music and Sound art.*<sup>74</sup> This body of work must, in turn, be distinguished from a canon of instrumental compositions that use the acoustic properties of space as part of a compositional palette.<sup>75</sup> Alvin Lucier's *I am Sitting in a Room* (1970) is perhaps the most well-known work to use the acoustic properties of space as a medium. Human speech (most often Lucier's speech) is subjected to an iterative process of recording and playback such that it gradually reveals the resonant frequencies in a given space.<sup>76</sup> In the decades since this piece, a body of work has emerged that significantly expands the field, examples of which are richly documented in Brandon LaBelle's *Site of Sound: of Architecture and the Ear* books and the *Tuned City* festival publication.<sup>77</sup> Raviv Ganchrow's *Crescents* (2010), for example, is an exploration of the sound-shaping properties of the domed ceiling of a defunct hanger in Tallinn, Estonia. This site-specific work creates arcs of sound by using microphones to capture sound from the environment, before sending it through loudspeakers up into the domed ceiling, which in turn channels it back to the microphones.<sup>78</sup> The works of Michael Brewster, Angie Atmajaja, and Scott Arford and Randy Yao present resonant standing waves in architectural spaces, creating situations which place an emphasis on the phenomenological experience of the listener.<sup>79</sup> A recent work by *Emptyset* — a collaboration between James Ginzburg and Paul Purgas — involved the construction of a site-specific instrument designed to excite the acoustic properties of its containing space.<sup>80</sup> Works by Edwin Van Der Heide and Adam Basanta

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<sup>74</sup> Frederico Macedo, 'Investigating Sound in Space: Five Meanings of Space in Music and Sound Art', *Organised Sound*, 20.2 (2015), 241-248, p.243.

<sup>75</sup> On this subject, see, Maria Anna Harley, 'Space and Spatialization in Contemporary Music: History and Analysis, Ideas and Implementations' (unpublished doctoral dissertation, McGill University, Quebec, 1994).

<sup>76</sup> See 'Every Room Has its own Melody', in Alvin Lucier, *Reflections*, ed. by Gisela Gronemeyer, 2<sup>nd</sup> edn. (Cologne: MusikTexte, 2005), pp.74-85.

<sup>77</sup> See, Brandon LaBelle and Steve Roden, eds., *Site of Sound: Of Architecture and the Ear* (Los Angeles, CA: Errant Bodies Press, 1999) and LaBelle and Martinho, eds., *Site of Sound #2: of Architecture and the Ear*. Also, see Anne Kockelkorn, Doris Kleilein, Gesine Pagels and Carsten Stabenow, eds., *Tuned City: Between Sound and Space Speculation* (Berlin: Kook Books, 2008). For the most recent practice, see the *Tuned City* twitter feed: Carsten Stabenow, 'Tuned City', *Twitter* < <https://twitter.com/tunedcity> > [20/12/2018]. See also Arie Altena, ed., *The Poetics of Space: Sonic Acts XIII*, (Amsterdam: Sonic Acts Press; Paradiso, 2010).

<sup>78</sup> See Raviv Ganchrow, 'Crescents', in *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle (Berlin: Errant Bodies Press, 2011), pp.290-296.

<sup>79</sup> See *492.40m3 51.7Hz TILT* by Angie Atmajaja: Casino Luxembourg, 'Interview with Angie Atmajaja', *Vimeo* <<https://vimeo.com/101082165>> [24/12/2018]. See, Scott Arford and Randy Yao 'Filling the Void: the Infrasound Series' in *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle (Berlin: Errant Bodies Press, 2011), pp.195-210. See also, Michael Brewster, 'Where, There or here?' in *Site of Sound: of Architecture and the Ear* ed. by Brandon LaBelle and Steve Roden (Los Angeles, CA: Errant Bodies Press, 1999), pp.102-106.

<sup>80</sup> James Ginzburg and Paul Purgas, 'David Roberts Art Foundation', *Emptyset* <<https://emptyset.org.uk/projects/David-Roberts-Art-Foundation>> [14/12/2018].

implicate subjects in interactions with architectural space. Van Der Heide's *The Speed of Sound* (2009) used the acoustics of the Wasserpeicher building in Berlin as a basis to network and redirect audience-created sound through passages and corridors, thereby rendering the building, 'a dynamic form of sonic architecture.'<sup>81</sup> Basanta's *A Room Listening to Itself* (2015) consisted of a network of loudspeaker cones and microphones suspended in a gallery space. These three elements combine to create a network of feedback that triggers different resonant modes of the gallery space as a result of visitors' movement through it.<sup>82</sup> The key difference between the works put forward in this commentary and the practice considered here is these examples constitute 'works in themselves', whereas, the works which I present exist in order to facilitate a practice of listening towards space. In Lucier's *I am Sitting in a Room*, for example, architectural resonance is articulated through a technological process, whilst in the *Spatial Drone* pieces, performing subjects systematically articulate spatial resonances in relation to their embodied sonic experience as a practice of listening. Whilst Atmajaja and Brewster's works present listeners with resonant interference distribution patterns, the *Resonant Topographies* works organise situations that engage subjects in listening *through* them. These modes of listening are not 'provoked' by works, as in Van Der Heide and Basanta's installations, but are rather systematic: concerned with working through the mediums of different acoustic phenomena to form sonic-spatial knowledges.

### Spatial Sonic Practices

In aiming to disrupt ocularly-dominated sensibilities, this research resonates with calls for a broader and more creative consideration of the sonic in architectural practices.<sup>83</sup> In the relatively early publication *Experiencing Architecture*, Steen Eiler Rasmussen argues that a consideration of the sonic is fundamental to the experience of the built.<sup>84</sup> Both Bernhard Leitner and Raviv Ganchrow side with Pallasmaa's claims of a pathology of architecture as resulting from an ocular dominance.<sup>85</sup> Leitner argues that, '[b]ecause modern architecture has underestimated if not completely ignored these [sonic] phenomena, it certainly has caused substantial damage.'<sup>86</sup> In aligning itself with these opinions, this project writes against the practice of remedial

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<sup>81</sup> Edwin van der Heide, 'The Audience Inside the Instrument', in *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle (Berlin: Errant Bodies Press, 2011), pp. 283-288 (p.288).

<sup>82</sup> Adam Basanta, 'A Room Listening to Itself', *Adam Basanta* <<http://adambasanta.com/roomlistening>> [24/12/2018].

<sup>83</sup> See, for example Avidar, Ganchrow, and Kursell, 2-13.

<sup>84</sup> Steen Eiler Rasmussen, *Experiencing Architecture* (Cambridge, MA: MIT University Press, 1964), back cover.

<sup>85</sup> See Ganchrow and Altena, 'Approaches to Space and Sound: Interview with Raviv Ganchrow and Arie Altena', in *The Poetics of Space: Sonic Acts XIII*, ed. by Altena, pp.32-50 (p.37). And Bernhard Leitner and Ulrich Conrads, 'Acoustic Space: a conversation between Bernhard Leitner and Ulrich Conrads', *Diados Architecture Journal*, 17 (1985) <<http://www.bernhardleitner.com/en/texts/conrads.html>> [24/12/2018].

<sup>86</sup> Leitner and Conrads (para 2).

acoustics. Emily Thompson draws attention to the contemporaneity of early discoveries in architectural acoustics and the noise abatement movement, which is concerned with dulling the resonant properties of spaces, often in order to prioritise the requirements of working environments.<sup>87</sup> This account by Thompson surely outlines the material manifestation of the sonic stratum of Henri Lefebvre's abstract space. In opposition to this practice, which is concerned with the use of acoustic science to cleanse the resonant properties of spaces, this research intends to use acoustic phenomena as a basis to interact with and sonically know, a multitude of architectural spaces.

A number of artists and architects seem to respond to the concerns of Leitner, Pallasmma and Ganchrow by developing spaces that configure situations of listening. Michael Asher's work, for example, is concerned with space as a phenomenological composite beyond strictly visual terms. It evades categorisation as sonic practice or spatial practice, existing somewhere in-between to present situations that place an emphasis on the subject and their autonomous production of a spatio-sonic, multisensory experience.<sup>88</sup> Lukas Kühne has produced a number of architectures which consist of sequences of different-sized enclosures that resonate at particular frequencies. These bring about spatio-sonic dialogues by playfully inviting human excitation.<sup>89</sup> *Suspended Sound, Stair* by mk+h uses multiple layers of suspended fabric to progressively deaden the acoustic of a stairwell as one moves from bottom to top, thereby creating an acoustically liminal space.<sup>90</sup> Studio Weave's *Polyphony* consists of an enclosure studded with parabolic horns or 'auricules'.<sup>91</sup> These act to accentuate the directionality of outside sounds, whilst removing a visual sense of the environment. Whilst these architectural examples resonate with this practice in rendering situations of spatial listening, as architectures they are localised: the situations of listening that they stimulate are ever limited to the site of the work. Works in this project place an emphasis on the act of working through a site in listening, rather than the site itself. In this way, this research aligns with Raviv

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<sup>87</sup> See Emily Thompson's account of Sabine's work as the 'New Acoustics': Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge, MA: MIT Press, 2002), 59-107. See also Emily Thompson, 'Acoustic Materials and Modern Acoustics circa 1929: The New York Life Insurance Company Building', *OASE - Immersed: Sound and Architecture*, 78 (2009), 39-49.

<sup>88</sup> See, for example, 'November 7 — December 31, 1969 La Jolla Museum of Art, La Jolla, California', and 'December 30, 1969 — March 1, 1970, Spaces, Museum of Modern Art, New York, New York', in Michael Asher, *Writings 1973- 1983 on Works 1969-1979*, ed. by Benjamin H.D. Buchloh (Halifax, Nova Scotia: The Press of the Nova Scotia College of Art and Design, 1983), pp.18-24 and 24-30 respectively. See also, Kirsi Peltomäki, *Situation Aesthetics: The Work of Michael Asher* (Cambridge, MA; London: MIT Press, 2010).

<sup>89</sup> See, for example, 'Chromatico' (2011) and 'Tvisongur' (2012): Lukas Kühne, 'home', *Lukas Kühne* <<http://www.lukaskuehne.com/>> [20/12/2018].

<sup>90</sup> Melissa Kit Chow and Helena Leclair, 'Suspended Sound, Stair, *mk + h* <<http://www.mkandh.com/Suspended-Sound-Stair>> [19/05/16].

<sup>91</sup> Studio Weave, 'Polyphony', *Studio Weave*, 2013, <<http://www.studioweave.com/projects/detail/sound-matters/>> [19/05/16].

Ganchrow, Julia Kursell and Pnina Avidar's assertion that, 'a shift towards aural form-giving in [architectural] design can only take shape under parallel paradigmatic shifts in listening habits.'<sup>92</sup>

### Towards a Spatial Listening Practice

In 2014, Gascia Ouzonian and Sarah Lappin published an article entitled *Soundspace: A Manifesto* in which they argue that '[i]n order to better respond to the city's built environment as a whole, architects and urban planners must develop a listening practice that informs their understanding of, and approach toward, a site.'<sup>93</sup> Whilst this project is not a direct response to Ouzonian and Lappin's manifesto, the authors put forward several edicts which underline its key concerns. First, they argue that 'we must, first and foremost, learn how to listen.'<sup>94</sup> Beyond 'works', this research is concerned with the creation of situations which invite the listening participation of subjects — not solely architects and planners — as a way to uncover the spatial environment in sound. Unlike the bodies of practice considered in the last two sections, this endeavour is explicitly focussed on the subject, rather than the organisation of sound, or the shaping of material environments.

In another edict, in which they ask the reader to 'listen deeply', Lappin and Ouzonian reference the work of Pauline Oliveros.<sup>95</sup> Oliveros's *Deep Listening*, is a meditative practice that involves 'noticing listening' or 'listening to listening'.<sup>96</sup> The composer describes her scores as 'human algorithms', which define situations and systems of listening.<sup>97</sup> These scores together with a series of activations and preparations form a practice, which manifests in workshops, retreats and performances. The manner in which Oliveros pursued listening as practice has inspired the structure and approach of this project: portfolio works are all methods for exploring the central concern of spatial listening. The collection of text scores entitled *Spatial Listening*, explicitly puts forward a practice of spatial listening that is focussed on engaging groups of people in listening deeply towards the spatial environment.

The final edict espoused by Lappin and Ouzonian that is particularly pertinent to this research is 'think sonically'.<sup>98</sup> As outlined in the previous chapter, works engage sonic thinking that emphasises 'situatedness'. Bernhard Leitner describes the

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<sup>92</sup> Avidar, Ganchrow and Kursell, 2-13 (p.10).

<sup>93</sup> Gascia Ouzonian and Sarrah Lappin, 'Soundspace: a Manifesto', *Architecture and Culture*, 2.3 (2014) 305-316.

<sup>94</sup> *Ibid.*, p.306.

<sup>95</sup> *Ibid.*, p.307.

<sup>96</sup> See Pauline Oliveros, *Deep Listening, a Composer's Sound Practice* (Lincoln, NE: iUniverse, 2005).

<sup>97</sup> Pauline Oliveros, *Anthology of Text Scores*, ed. by Samuel Golter and Lawton Hall (Kingston, NY: Deep Listening Publications, 2013), p.v.

<sup>98</sup> Ouzonian and Lappin, 305-316 (p.310).

emergence of this type of embodied sonic thinking in relation to architectural spaces:

The power of acoustics has its roots in the way which ties a person into the sound of a room, into the particular time of a room [sic]. Yet it is man himself who must make the room resound-with his steps, his speech, with any activity that generates sounds, even with his breathing. This interconnection between man and space, which is achieved with sounds and affects even our innermost being, is like a kind of dialogue which is determined by the acoustic premises. This dialogue enables us to experience ourselves in the sound of a room.<sup>99</sup>

Here, Leitner describes a feedback loop between human agency and acoustic phenomena, which captures a subject in awareness of themselves and the space in which they are located. Practice in this project systematically pursues this dynamic as a methodology for knowing space. What Leitner describes shares a resonance with Alvin Lucier's work *Vespers* (1968), which is based on the principle of echolocation and takes inspiration from the navigational capabilities of bats. Four blindfolded listener-players navigate their way through a large space by way of reflections returned from the pulsed sounds emitted from sondols (megaphone-like handheld loudspeakers).<sup>100</sup> Lucier's work, as LaBelle articulates — and this piece in particular, I would argue — explores 'one's own presence as situated within various spaces or environments and their conditions: in this regard the aural is used to discover and investigate how one occupies space and in turn, how one is implicated within auditory space and events.'<sup>101</sup> In this sense *Vespers* captures the essence of what this project aims to achieve: works in the portfolio implicate subjects in active listening-led dialogues with spatial environments in which they simultaneously produce a sense of that environment and themselves within it.

Unlike *Vespers*, though, the act of sound creation — where it occurs in works — is embodied and reflexive: dependent on, and responsive to, the acoustic phenomenon in question. Michael Gendreau's 'sense-conceptual' framework for the development of a site-specific language captures this notion of embodiment.<sup>102</sup> Gendreau proposes the notion of a dynamic interaction with acoustic space where

the response from the building modifies how we make the sound; we respond to this feedback with further modifications. We are engaging in dynamic interaction with our environment.<sup>103</sup>

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<sup>99</sup> Leitner and Conrads (para 4).

<sup>100</sup> See 'Taking Slow Audio Photographs of the space', in Lucier, *Reflections*, pp.74-85.

<sup>101</sup> Brandon LaBelle, *Background Noise: Perspectives on Sound Art* (New York, NY; London: Continuum, 2006), p.127.

<sup>102</sup> Michael Gendreau, 'Concerted Structures' in *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle (Berlin: Errant Bodies Press, 2011), pp.33-42. Gendreau's work also explicitly writes against the practice of remedial acoustics.

<sup>103</sup> *Ibid*, p.33. Gendreau's conceptual framework is also concerned with the structure-born resonances of architectural spaces, whilst this project is only concerned with air-born acoustic phenomena.

In this situation, Gendreau argues that ‘the space of performance becomes part of the second sense of the brain [...] an extension of the mind into the resonant structure’.<sup>104</sup> Curiously, this framework manifests in Gendreau’s work as a series of installations, rather than the embodied manner of sounding and listening that is implied.

This project is situated between a body of sound works that engage acoustic phenomena and a body of spatial practices which configure listening. Its original contribution to knowledge is a practice of listening — rendered through a series of works — that engages subjects in embodied or ‘situated’ modes of thinking through sound and sounding in relation to the acoustic phenomena of echo, resonance and reverberation, as a way to create knowledges of the architectural environment. The approach taken in this project builds on the modes of embodied sonic thinking that are present in Alvin Lucier’s *Vespers* and put forward by Michael Gendreau in his sense-conceptual framework. The article of practice within the portfolio that best exemplifies this approach is the *Spatial Listening* collection of text scores. These scores constitute a spatial listening practice, which is inspired by the *Deep Listening* practice of Oliveros. Individual scores exist to facilitate the practice of spatial listening. Each score, in turn helps expand the concept of spatial listening and define the ways of knowing that it may open up. In responding to critiques of disembodiment and ocularcentricism, this project takes inspiration from listening cultures for whom sound is integral to sense of space and place. The works — especially those that exist in the public realm — intend to deploy micro cultures of listening as a way to disrupt and problematise these sensory dispositions. Whilst the original contribution to knowledge may be viewed as an addition to a body of practice, the site of knowledge creation in this project is in the experience of the works themselves.

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<sup>104</sup> Ibid., p.41.

### 3 Methodology

The process of practice has involved a reconciliation between subject, space and sound that might be interpreted as an intuitive and reflexive ‘working through’ of the themes in existing practice outlined in the last chapter. The phenomenological listening-based approach put forward in chapter 1 is the outcome of this process and is best encapsulated in *Spatial Listening* (chapter 8). In what follows, I articulate the research process in four key phases.

In the first year of the project, research was concerned with the composition of sound works that engaged the resonant properties of spaces. *Modes of Resonance* (not included in the commentary) involved the development of a Max/MSP patch which would calculate the prominent frequencies in a space by means of a number of impulse responses, before playing them back into it as a series of overlapping, sustained tones.<sup>105</sup> *Resonances of Patrick Studios* (not included in the commentary) was a temporary installation which excited fundamental resonant frequencies at three locations in a stairwell. In an attempt to make the manifestation of resonance emergent to listeners, loudspeakers would gradually bend in and out of these resonant frequencies.<sup>106</sup> A series of experiments which explored resonant interference distribution completed this phase of work.<sup>107</sup> This phase of practice involved introductory research into acoustics and my development of an experiential knowledge of resonant phenomena.<sup>108</sup> Whilst these early forays were effective, they did little to engage active listening.

The *Listening Devices* project marked the second significant phase of practice. This endeavor examined the potential of the material to configure listening, by creating wearable acoustic ear pieces. Intended as experimental rather than scientific, this work foregrounded the listening responses and interactions of those who engaged with the devices. This phase of research began with a collaborative making session with the architect Lara Karady, followed by a series of workshops which engaged members of the general public with the devices. *Listening Devices* were then deployed in gallery exhibitions at the National Science and Media Museum as well as the Houston Health Museum (USA). In contrast to the previous phase of work, this

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<sup>105</sup> See, Alex De Little, ‘Modes of Resonance’, *Alex De Little* <<http://www.alexdelittle.com/modes-of-resonance/>> [24/12/2018]. This work was installed as part of a symposium organised early on in the project that intended to map out the landscape around sound and space. See Alex De Little, ‘A day about Sound, Space and Play’, *Alex De Little* <<http://www.alexdelittle.com/a-day-about-sound-space-and-play/>> [15/10/2017]. See appendix 12 for the event poster.

<sup>106</sup> See, Alex De Little, ‘Sensing Space through Sound at East St Arts’ Patrick Studios’, *Alex De Little* <<http://www.alexdelittle.com/sensing-space-through-sound-at-east-st-arts-patrick-studios/>> [15/10/2017].

<sup>107</sup> For details of these experiments, see Alex De Little, ‘Oxford Place: Resonances’, *Alex De Little* <<http://www.alexdelittle.com/oxford-place-resonances/>> [15/10/2017].

<sup>108</sup> During this time, I also performed Lucier’s *I am Sitting in a Room* in Hackney Round Chapel with Joseph Kohlmaier. See Alex De Little, ‘Musarc folk meet on a midsummer day until dusk — I am Standing in a Room’, *Alex De Little* <<http://www.alexdelittle.com/musarc-folk-meet-on-a-midsummer-day-until-dusk/>> [15/10/2017].



phase of the project placed an emphasis on — and demonstrated the value of — the interactions and ways of being that listening makes emergent. *Listening Devices* also brought to the fore the value of a workshop practice for exploring the concerns of this research.

The third phase of practice produced the *Resonant Topographies* and *Spatial Drone* works. These address the problem of the first phase of research with the outcome of the second: they direct attention towards acoustic phenomena by engaging the listening autonomy of subjects. Knowledge from acoustic research in the first phase of the project was used to facilitate situations which could be explored through listening. The pieces themselves emerged from working through these situations in collaboration with others.<sup>109</sup> Whilst this phase of practice was successful in developing an embodied mode of sonic thinking through acoustic phenomena, these works are limited in their rootedness in performance settings: they do not take advantage of the full potentiality of spatial listening. The mobile loudhailer intervention *Reflection // Position* was developed in response to this concern, constituting a means to take situations of spatial listening into the public realm.<sup>110</sup>

The fourth phase of practice combined a workshop approach with the embodied mode of sounding and listening through acoustic phenomena developed in the *Spatial Drone* pieces as a way to create an itinerant practice of listening which could be deployed in a multitude of architectural spaces. Some of the scores in *Spatial Listening* were originally developed for a *Listening Devices* workshop as part of the London College of Communication 'Points of Listening' series, curated by Salomé Voegelin and Mark Peter Wright.<sup>111</sup> The remainder of ideas for the collection were developed experientially with groups of people across a number of workshops, both formally and casually.<sup>112</sup> The scores themselves emerged from a personal process of testing and refining workshopped ideas in an array of different spaces. This collection of scores will be published as a workbook on Wild Pansy Press in early 2019.<sup>113</sup> This phase of practice has undoubtedly had the most impact of any work in the project. This research has produced and set out the practice, but there is much scope for it to be developed. This, in itself, defines a clear direction for future research.

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<sup>109</sup> See appendices 1, 2, and 3 for transcriptions of interviews that represent some of these working processes.

<sup>110</sup> See Chapter 5.

<sup>111</sup> See Mark Peter Wright, 'PoL #33 Listening Devices', *Points of Listening* <<https://pointsoflistening.wordpress.com/2017/03/21/pol-33-listening-devices/>> [20/12/2018].

<sup>112</sup> See, for example, appendix 15. This programme documents recent workshop activities with attendees of the Venice Architecture Biennale. See also Alex De Little 'Exercises in Aural Architecture // Kosmologym // Den Frie Centre of Contemporary Art // Copenhagen', *Alex De Little* <<http://www.alexdelittle.com/exercises-in-aural-architecture-kosmologym-den-frie-centre-of-contemporary-art-copenhagen/>> [15/10/2018].

<sup>113</sup> See Simon Lewandowski and Chris Taylor, 'About', *Wild Pansy Press* <<http://wildpansypress.com/index.php/about-wild-pansy-press/>> [30/12/2018].

As the listening-based approach of this project has necessitated a dynamic and situational approach to making practice, the only score submitted which was used in a performance setting was the *Resonant Topographies: Listening-led Movement* audience score. The scores that accompany this submission, then, primarily act to capture the works as a form of documentation. Whilst the scores may act as the basis for future engagements with spatial listening, I anticipate that this practice will continue to develop in dynamic collaborative settings that rely on verbal communication and use listening as their basis: to rely on textual cues in situations of listening is paradoxical to the concerns of this project.

This research process has underpinned my own transformation as a practitioner-researcher. As this project has progressed, initial interests in composing from acoustic analyses have given way to a preoccupation with opening my ears to the world in all its vibratory complexity, and using this listening aptitude to seed situations which engage others.<sup>114</sup> The practice that I put forward is a product of my own listening engagement with the spatial environment. I believe that my auditory experience of the world has shifted in a way which mirrors this statement from Raviv Ganchrow:

The more I learn to listen in a certain way, the more the everyday environment surrounding me seems to have changed. When I am bicycling I am attentive to the difference in reflected ambient sound bouncing off various surfaces in the city. You can hear the difference between a brick wall or a facade with vegetation — a glass bus-stop along the bike path is an enormous acoustic event. I am listening to those kinds of things.<sup>115</sup>

In undertaking this project, I have experienced the extent to which an awareness of sound can transform the world around me. It is this shift in experience which continues to be a motivation for making practice. Responses to workshops and works have been marked by enthusiasm for — and surprise at — the experiences that emerge from spatial listening.

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<sup>114</sup> A key turning point in this respect was when I had the chance to work as a tutor on 'Field Studies: Listening After Pauline Oliveros'. During this time, I took part in workshops with lone (partner of Pauline Oliveros) and Sharon Stewart from the *Deep Listening* institute. See Joseph Kohlmaier, 'Listening After Pauline Oliveros', *Field Studies* <<http://www.field-studies.org>> [27/12/2018].

<sup>115</sup> Ganchrow and Altena, 'Approaches to Space and Sound: Interview with Raviv Ganchrow and Arie Altena', in *The Poetics of Space: Sonic Acts XIII*, ed. by Altena, pp.32-50 (p.38).

# **Commentaries**

## 4 *Ear Pieces*

Unlike Pauline Oliveros' *Deep Listening*, these works intervene with the ear to transform auditory perception. They create altered sonic realities, in which subjects may move away from the habits of the naked ear: *Listening Devices* are micro-aural architectures which de-familiarise the ear. *Auricula Alium* and *Auricula Suum* use binaural microphone-headphone technology to rearrange the relationality between ear and body. These acts of transformation also occur in order that, upon the return to a normative auditory modality, subjects may be more acutely aware of the sonic. Ear pieces have two functions within this project.<sup>116</sup> First, they function as ways to practice listening. Recognising a contemporary sensory disposition that is variously described as ocularly biased and disembodied,<sup>117</sup> they acknowledge a need for subjects to arrive in their sonic bodies, so that they may engage fully in listening. In bringing subjects into listening, these pieces prepare them for engagement with other works in this portfolio. Second, *Ear Pieces* may be considered as a way to develop and extend the modes of listening espoused by other works in this project.

### 4.1 *Listening Devices*

This project is not concerned with the creation of works that configure modes of listening through acoustic phenomena, but rather the creation of material structures in order to configure modes of listening. *Listening Devices* are inspired by acoustic defence structures, which were developed across Europe during World War One. These are aural architectures that afford augmented hearing and enable users to detect enemy aircraft.<sup>118</sup> To Raviv Ganchrow, acoustic defence marked a 'solitary instance within much broader reconfigurations of listening occurring in the late 19th and early 20th century', owing to the employment of an acoustic model of listening over an optic model of viewing: a rare precedence of the ear over the eye.<sup>119</sup> In the brief period in which they were in use before being superseded by radar, these architectures gave rise to a configuration of listening which had at its heart a consideration of the spatial. The *Listening Devices* project tracks back to this solitary configuration of listening in order to reinvigorate it as an open-ended, playful investigation.<sup>120</sup>

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<sup>116</sup> The title is an homage to *Ear Piece* by Pauline Oliveros. See Oliveros, *Deep Listening*, p.34.

<sup>117</sup> Here, I refer to the concerns outlined in the introduction, particularly with reference to Pallasmaa and Martinho.

<sup>118</sup> For an introduction to the concept of aural architecture, see Blesser and Salter, pp. 1-9.

<sup>119</sup> Raviv Ganchrow, 'Perspectives on Sound-Space: The Story of Acoustic Defence', *Leonardo Music Journal*, 19 (2009), 71-75, (p.71).

<sup>120</sup> The project may also be contextualized amongst more recent aural architectures. See, for example the work of mk+h: Melissa Kit Chow and Helena Leclair, 'Hear, There', *mk + h*, <<http://www.mkandh.com/filter/art/Hear-There>> [19/05/16], or Liminal's Organ of Corti: Liminal, 'Organ of Corti', *Vimeo* <<https://vimeo.com/39394940>> [19/05/16].

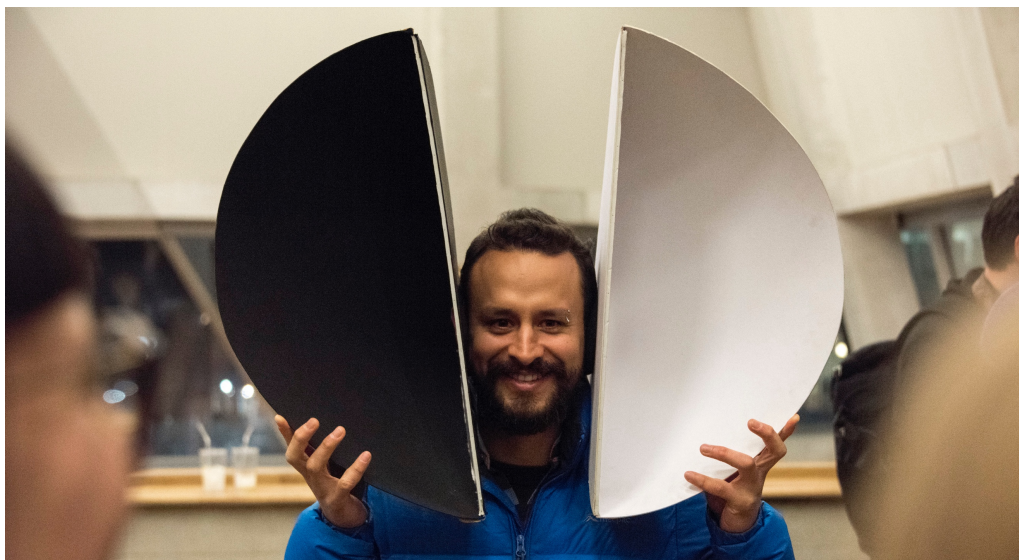


Figure 1 'Big Ear' Listening Devices at 'Tate Lates', Tate Modern, London, January 2017

*Listening Devices* are a set of miniature, wearable aural architectures. Worn over the ear, they configure situations of listening through acoustic space by engaging the physical at the plane of the audible.<sup>121</sup> Each set employs a different acoustic design, which affords its own configuration of listening: devices variously block, channel, resonate, or focus sound. Unlike the acoustic defence structures, *Listening Devices* are experimental rather than functional, and they are not fixed in a landscape but worn and thus activated by bodily movement. An original set of six was designed in collaboration with the architect Lara Karady for a series of workshops at the National Science and Media Museum in April 2016.<sup>122</sup> These were then developed for workshops at the Tate Modern, Manchester Museum of Science and Industry, and Shoreditch Church, London, as part of the London College of Communication *Points of Listening* series.<sup>123</sup> I redeveloped *Listening Devices* for the Science Gallery *Biorhythm* exhibition at the Health Museum in Houston, Texas.<sup>124</sup>

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<sup>121</sup> For images of some of the listening devices see appendix 6. There are more images at the 'Tate Lates' link below (note 122). In a sense, this project is a realisation of Alvin Lucier's *Chambers*. See '...and listen to the ocean again', in Lucier, *Reflections*, pp.74-85. The crucial distinction is that *Listening Devices* are concerned with listening through, rather than listening 'to' resonant enclosures. This act of listening through places the emphasis on the listening engagement of the subject.

<sup>122</sup> For original sketches, see appendix 5. For more information, see Alex De Little, 'Listening Devices: Designing and Making', *Alex De Little* <<http://www.alexdelittle.com/listening-devices-designing-and-making/>> [15/10/2017] and Alex De Little, 'Miss Are You an Architect? What's Sound Got to do with Architecture?', *Alex De Little* <<http://www.alexdelittle.com/miss-are-you-an-architect-whats-sound-got-to-do-with-architecture-national-media-museum-listening-devices-workshops/>> [15/10/2017].

<sup>123</sup> See, for example, Alex De Little, 'Tate Lates // Listening Devices // Trevor Cox', *Alex De Little* <<http://www.alexdelittle.com/tate-lates-listening-devices-trevor-cox/>> [15/10/2017].

<sup>124</sup> See Alex De Little, 'Biorhythm // Science Gallery // Health Museum // Houston, TX', *Alex De Little* <<http://www.alexdelittle.com/biorhythm-science-galley-health-museum-houston/>> [15/10/2018].

By defamiliarising the ear, *Listening Devices* bring sound to the experiential fore and create situations of listening. Each device is an acoustic proposition: a set of tensions and characteristics that specifies a hearing affordance. Different hearing affordances in turn define possible perceptions of, and interactions with, the sonic environment. Whilst some *Listening Devices* cause sounds in certain frequency bands to resonate, other pairs specify the subject's hearing directionality. One pair almost completely mutes sound, whilst the 'big ears' (see Figure 1, above) collect and focus sound, affording augmented hearing.<sup>125</sup> Some of the affordances that these various acoustic forms provide are described by wearers:

It feels like the sound's coming from another, like it's almost coming from above in a way. Like it's coming from another room. You're surrounded by people, but you're surrounded by sound coming from a different space to where the people are [...]

My own voice sounds different and I'm not sure whether I'm talking louder than usual [...] I think it's very easy to get lost in what's going on [...]<sup>126</sup>

The hearing affordance of each *Listening Device* recalibrates a subject's sonic relationship to the world, bringing them away from the habits of their naked ear and into an altered sonic reality. Each hearing affordance demands listening, a stretching of one's ear in an 'intensification of a concern, a curiosity or an anxiety', toward this altered sonic reality.<sup>127</sup> Manifestations of listening play out differently from subject to subject. For some, things were 'sped up'. Some felt more engaged with the environment, whilst others described feeling less present.<sup>128</sup> For some, the devices gave rise to modes of sonic doing and being — externalizations of listening — which propagated outwards as interactions that implicated others. For others, the devices caused them to cease interactions and reach into themselves. Whilst it was expected that subjects' responses to the devices were stimulated by the ways in which their acoustic properties shaped hearing affordances, perhaps less expected was the way in which they seemed to stimulate people's imaginations:

[...] I think I'm kind of going to another universe, but all the sounds are still in this planet, but just my hearing is going to another universe [...]

[...] It blurs together, like nothing stands out, nothing stands out. It sounds like waves, like water [...] I thought it would make it more specific but it makes it all washes together you know [...]

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<sup>125</sup> The pair which focus sound are the 'Big Ears' in figure 1. For the rest, see above web links.

<sup>126</sup> Taken from recordings made at a *Listening Devices* workshop with Trevor Cox at a 'Tate Lates' event, Tate Modern, 27/01/2017. See audio appendix 1 and appendix 4.

<sup>127</sup> Nancy, p.5.

<sup>128</sup> Taken from recordings made at a *Listening Devices* workshop with Trevor Cox at a 'Tate Lates event, Tate Modern, 27/01/2017. See audio appendix 1 and appendix 4. Interestingly, these listening responses did not seem to map logically onto the acoustic properties of the devices.

[...] There is a melody. The noise becomes a sort of tune and all the people are singing together. There is a rhythm! Really! It's a mantra, it's like a mantra [...]<sup>129</sup>

As well as *Listening Devices* creating situations where the mode of listening might be characterised as 'straining towards a possible meaning',<sup>130</sup> listening clearly acts as a way to transport and transform: as Voegelin states, listening has the potential for 'pulling us into an auditory imagination.'<sup>131</sup> These comments serve as an important reminder that whilst works across this entire portfolio aim to create sonic knowledges of space, they also likely engage incidental, unplanned modes of listening that digress from this intention, pulling subjects in unexpected directions.

Upon the removal of a listening device, one might be moved to reconsider the nature of their original sense of auditory perception, their innate auditory modality. Each device creates a mode of listening in approach of the essence of an altered sonic reality.<sup>132</sup> To this end, when a device is removed, a subject is required — if only for moments — to listen back into their default auditory sense, becoming aware of the properties of their naked ear and how these articulate their sonic being in the world. As each device constitutes a mode of 'listening away from', towards an altered sonic reality, each device affords a different route back into an innate auditory modality. A refreshed sense of the innate auditory modality galvanises the potential for listening engagements with other works in the portfolio.

*Listening Devices* are an overture to this project. As aural architectures that are attached directly to the ear, they intend to underscore and make explicit the relationship between the physical and the aural. Each pair of listening devices might be understood as a way to propagate — in miniature — the power of architecture to shape sound. Devices are whispering galleries, sound mirrors, resonant auditoriums, each of which — as an architectural space — has its own distinct acoustic possibilities and capabilities, and calls up its own cultural significance. As microcosmic constructed forms that engage listening, they call — however implicitly — for broader architectural engagement with sound.

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<sup>129</sup> Ibid.

<sup>130</sup> Nancy, p.6.

<sup>131</sup> Voegelin, p.12. Jonathan Sterne also writes on this concept. See Jonathan Sterne, 'Sonic Imaginations', in *The Listening Reader*, ed. by Jonathan Sterne (New York, NY; Abingdon, Oxfordshire, 2012), pp.23-28.

<sup>132</sup> This notion of 'straining in approach of', calls to mind Jean-Luc Nancy's conception of listening. See Nancy, p.6.



Figure 2: 3D-printed Listening Devices, 'Supersenses', National Science and Media Museum, July-November, 2017

A 3D-printed set of *Listening Devices* were commissioned for the 'Supersenses' exhibition at the National Science and Media Museum in Bradford. I conceptualised and designed this set of devices, and they were fabricated by Nick Fry; a 3d-printing expert based in the school of mechanical engineering at the University of Leeds.<sup>133</sup> They are scale replicas of a 3D scan of the ear of a *Plecotus Auritus* bat, resized and remodelled around the human head. The ear was scanned from a collection at the Smithsonian Museum in Washington D.C. by Dr Rolf Mueller of Virginia Tech.<sup>134</sup> In addition to creating an altered sonic reality, their physical appearance influences the act of listening. These devices seem to ask the wearer to imagine themselves occupying the sonic reality of a bat.<sup>135</sup> In their symbolism, they direct the wearer towards an auditory imaginary based on a creature for whom the world is sound.<sup>136</sup>

*Listening Devices* bring sound to the experiential fore. The acoustic properties of each pair create for the wearer an altered sonic reality that engages them in listening. As architectures, *Listening Devices* allow people to listen through physical space and demonstrate in microcosm the potential of the built to interact with the sonic conscious, calling implicitly for a more creative aural approach to spatial production. In creating situations of listening in which people listen through an altered sonic reality, *Listening Devices* require subjects to listen back towards the naked ear, affording a renewed sense of the innate auditory modality.

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<sup>133</sup> See appendix 7 for an outline of the design process. For more images, see Alex De Little, 'Listening Devices // Supersenses // National Science and Media Museum', *Alex De Little* <<http://www.alexdelittle.com/listening-devices-beta-supersenses-national-science-and-media-museum/>> [15/10/2018].

<sup>134</sup> For information on Mueller's research, see Virginia Tech, 'Rolf Mueller', Virginia Tech *College of Engineering* <<http://www.me.vt.edu/people/faculty/rolf-mueller/>> [17/12/2018].

<sup>135</sup> This notion calls to mind Nagel's essay, 'What is it Like to be a Bat?'. See Thomas Nagel, 'What is it Like to Be a Bat?', *The Philosophical Review*, 83.4 (Oct., 1974) 435-450.

<sup>136</sup> There is a resonance here with Donna Haraway's concept of the Chthuluscene. The Chthuluscene, for Haraway, 'is made up of ongoing multispecies stories and practices of becoming-with in times that remain at stake, in precarious times, in which the world is not finished and the sky has not fallen — yet.' Donna Haraway, 'Tentacular Thinking: Anthropocene, Capitalocene, Chthuluscene', *e-flux journal* (Sep., 2016) <<https://www.e-flux.com/journal/75/67125/tentacular-thinking-anthropocene-capitalocene-chthulucene/>> [17/12/2018] (para 31).



## 4.2 *Auricula Suum* and *Auricula Alium*

These interventions intend to bring those who interact with them into their sonic bodies. As Julian Henriques asserts, '[s]onic bodies produce, experience and make sense of sound.'<sup>137</sup> Sonic bodies are phenomenal bodies that are attuned to the auditory sense. They take into account the temporality, spatiality, transience and propagation of sound. They are present and listening; thinking through sound. *Auricula Suum* and *Auricula Alium* alter the relationship between ears and body as a way to bring subjects into this way of being. It is the aim that experiences of these reconfigurations may result in a heightened auditory awareness that may be directed towards other works in the project.<sup>138</sup>

In *Auricula Suum*, which translates from Latin as 'his pinna', a single subject wears binaural microphone-headphones that are connected to sending and receiving radio packs. The radio packs send the signal captured by the microphones to a laptop running a Max/MSP patch that processes it before sending it back to the headphones.<sup>139</sup> The microphone-headphones capture sound directly in terms of a wearer,<sup>140</sup> reflecting the precise spacing of their ears, height, the changing orientation of the wearer in relation to architectural space and sound events, and the unique shape and size of a wearer's pinnae, which to a significant degree determines the localisation of sounds.<sup>141</sup> The fact that processed signals — which return in their altered form — remain 'of' a subject at the time of capture, makes these reconfigurations tantalising in their fundamental relevance to the listener. During the course of the intervention, the Max/MSP patch cycles between three modes of signal processing. The first swaps the stereo field, causing participants to hear sounds captured in their left ear in their right ear and vice-versa. The second mode of processing applies a gradually changing time delay to the incoming signal. The third mode of processing combines the first two. These reconfigured states, or altered sonic realities, implicate the body in sound: movements have altered sonic consequences and sounds are perceived in changed relationalities to the body. This intervention develops the whole body as a tool for listening: it asserts the body as

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<sup>137</sup> Henriques, p.xvi.

<sup>138</sup> These interventions haven't been realised at the time of submission due to costs associated with hiring the necessary equipment. They have, however, been tested non-wirelessly.

<sup>139</sup> See Max/MSP appendix 1.

<sup>140</sup> The binaural headphone-microphones are Sennheiser CS10em: Roland, 'CS10em', *Roland* <<https://www.roland.com/us/products/cs-10em/>> [17/12/2018].

<sup>141</sup> See David Howard and Jamie Angus, *Acoustics and Psychoacoustics*, 4<sup>th</sup> edn (Oxford; Burlington, MA: Focal Press, 2009), p.113. The authors mention that 'sounds striking the pinnae are reflected into the ear canal by the complex set of ridges that exist on the ear. These pinna reflections will be delayed, by a very small but significant amount, and so will form comb filter interference effects on the sound the ear receives. The delay that a sound wave experiences will be a function of its direction of arrival, in all three dimensions.'

site and determiner of sonic experience in relation to the external world.<sup>142</sup> The manner in which the intervention is realised radically affects the types of listening that may emerge.

Each of the three modes of signal processing variously reconfigures a subject's ears in relation to their body. The first mode of signal processing inverts the relationship between the ear and the eye by placing the visual field in direct opposition to the sonic field: a crossing of auditory and ocular hemispheres. In this situation, a subject's orientation in space is sonically complicated: a physical turn to the left is perceived as a sonic turn to the right and vice versa. This ocular-auditory opposition draws attention to the sonic implications of left and right. It engages a mode of listening that brings into motion bodily movements and re-orientations, which interact with the architectural and sonic environment in approach of an understanding of this new situation. The second mode of signal processing stretches a subject's ear towards the past by delaying the signal sent to the headphones. Attention is drawn towards the varying displacement between visually registered, or physically created sounds, and aurally perceived sounds. A subject might be brought into a mode of listening that anticipates the aural manifestation of visually registered or physically created sounds, constantly comparing the nature of the context in which sounds are created or visually registered with the context in which the sounds are perceived. The length of the time delay defines the displacement between visually registered or physically created sounds, and therefore defines the types of interactions that occur. When the delay line is short, e.g. between two to five seconds, then quick-fire comparative dialogues between action and consequence are possible. The subject remains listening in relation to and in terms of the recent sonic past. When the delay line is long, e.g. over ten seconds, then a sense of dialogue with the past ceases to be possible. A subject no longer exists 'in relation' to their sonic past, but rather immersed in a parallel sonic reality, one which is indicative of the qualities, visual happenings, and sounds of the present but which does not relate to the present moment. In this reconfiguration, it is as if the subject is being trailed by a phenomenological spectre: an auditory past-self. In perceiving their sonic past-self, a subject might become aware — after the fact — of the acoustic implications of their various positionalities, their routes through space, and their physical relationships to sound events. In the third mode of signal processing, the first two modes are combined: opposition of visual and sonic is combined with varying temporal displacement.

By reconfiguring the relationship between ear and body, this intervention brings subjects out of their normal mode of hearing. Each of the three reconfigurations presents an altered sonic reality that brings sound to the experiential fore and sonically implicates the subject: movements have altered sonic consequences and

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<sup>142</sup> This calls to mind Merleau Ponty's phenomenology. Monika Langer mentions, 'the structure of the phenomenal body already implies the structure of the entire perceptual field. It remains for us to suspend our traditional detached knowledge of the thing and the world in order that we may become aware of our actual perceptual experience.' These reconfigurations aim to suspend the so called 'natural attitude' by directing awareness towards the sonic. Langer, pp.70-71.

sounds are perceived differently in relation to the body. The body becomes an instrument of listening and the means by which to think through sound and unpack each altered sonic reality. In this situation, a subject makes the sonic implications of orientation, movement, and relationality explicit to themselves and arrives in their 'sonic body'. They are no longer an observer of a sonic field but immersed in it, the centre of it, relative to it, and the driver of their own sonic experience and sonic knowing.

The acoustic space(s) in which the intervention is realised, the sonic situation within the space(s), and the manner in which a subject may interact with the intervention are factors that define the modes of listening that arise. First, if the acoustic of the chosen space or spaces is very responsive, then any sounds created will carry perceptible spatial information. A responsive space might have the effect of provoking a subject to listen towards it, unpacking the abundant acoustic information carried by sounds and the ways in which these might variously explain the altered sonic reality by clarifying the sonic implications of orientation and movement. If the space is acoustically unresponsive, then the listening awareness of the subject would likely be directed towards the spatial orientation and movement of sound sources in relation to them, rather than any meaning carried by acoustic information. Second, the presence, quantity and nature of sounds native to the chosen intervention space also shape a subject's listening awareness. If there are many sounds whose sources are not identifiable, then the subject measures themselves against a milieu of indistinguishable sound, which makes auditory relationality difficult to achieve.<sup>143</sup> If the intervention takes place in a space with native sounds, the sources of which are identifiable, then the subject is able to reach towards an understanding of their altered auditory reality in relation to the visual registering of sounds. If the intervention takes place in a space devoid of native sound, then understandings of altered sonic realities must be fuelled by a subject's sonic dialogue with themselves. Third, a subject's interaction with the intervention may be shaped in various ways. It may be specified that a subject should be stationary during the intervention, in which case a subject's listening focus may be directed towards the ways in which sound sources change in relation to them. Versions may be realised in which a subject moves through a space, or a series of spaces. If the intervention occurs in a single space, then a subject may be able to listen deeply to the qualities of that space and the ways in which they relate to it, whilst a series of spaces might offer a more diverse range of sonic and acoustic experiences.

*Auricula Suum* uses binaural technology to capture a subject in three modes of listening towards an altered auditory modality, in order to bring sound to the experiential fore and to make the sonic implications of orientation, movement, and relationality explicit. In these situations, the body becomes an instrument *for* and a language of listening, that engages with space and sound in order to 'make sense'

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<sup>143</sup> See, the concept of 'Ubiquity' in Augoyard and Torgue, p.130. See also Anahid Kassabian, *Ubiquitous Listening: Affect, Attention and Distributed Subjectivity* (Berkeley and Los Angeles, CA: University of California Press, 2013).

of altered sonic realities.<sup>144</sup> The acoustic and sonic situation, as well as a subject's possible interactions, define how this intervention may be experienced and the modes of listening that may occur. It may, therefore, have different functions within the broader project. Realisations that prioritise a subject's interactions with acoustic space through movement and sounding may prepare a subject for engagement with pieces such as *Reflection//Position*, the *Resonant Topographies* pieces and *Spatial Listening*. The same types of realisations may constitute ways to explore the types of listening that the other pieces espouse more open-endedly. Other realisations are emergent from, and tangential to, the concerns of this research project.

In *Auricula Alium*, which translates from Latin as 'the pinnae of another', a group of four subjects occupies an empty and acoustically responsive space that is devoid of native sounds. Each subject wears a binaural microphone-headphone headset and corresponding radio transmitters and receivers. Audio signals are captured in terms of the physicality and positionality of each subject and rerouted by the Max/MSP patch to the headphones of others.<sup>145</sup> The intervention is structured episodically: in each episode, a given subject hears 'through the ears' of a different subject. Over the course of the intervention, each subject hears 'through the ears' of every other subject. Whilst *Auricula Suum* creates listening situations for a single subject that emerge from reconfiguring the relationships between ear and body, *Auricula Alium* creates altered sonic realities by engaging subjects in hearing through the ears of others. The reconfigurations in *Auricula Suum* are embodied; they relate to a subject's physicality and movement, whereas in *Auricula Alium*, the movements and interactions of one subject define the hearing of another. Hearing relations are not configured in pairs where subject one hears through the ears of subject two and subject two hears through the ears of subject one. Rather, they are configured so that each subject hears through the ears of one person and 'possesses' the ears of another person.

Listening opens up as dialogues between subjects, who seek to make sense of the alternate sonic reality that each episode presents. Not-yet-explicit sonic relationships between individuals are revealed and made explicit through emergent dialogues of sounding and listening. Every sound that occurs results in a form of listening that is 'trying to make sense of' a present sonic relationality. Through this situation of sounding and listening, social relations, dynamics, and modes of communication come into existence that are entirely a product of the sonic. LaBelle's assertion that 'listening tends towards a sociability marked by temporality and contingency' is made explicit here.<sup>146</sup> A group of individual subjects is brought together as a listening organism, through cause and effect, and in relation to each other and the space in which these cycles of sounding and listening take place. Sonic ways of doing are adapted, refined, and redefined over time and in relation to the different social

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<sup>144</sup> Henriques defines sonic knowing as a 'making sense'. See Henriques, p.xvi.

<sup>145</sup> See Max/MSP Appendix 2.

<sup>146</sup> LaBelle, 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Corbussen, Meelberg and Truax, pp.275-285 (p.283).

dynamics that open up across the different episodes, thus bringing forward ‘an emergent public, whose devices nurture not so much the formation of a group identity, but the proliferation of all that may lie in-between and around such formations’.<sup>147</sup> In this situation, permanent notions of self and other give way to an ever present and dynamic relationality afforded by listening.

In engaging with this intervention, subjects create implicit sonic knowledges of space. Unlike *Auricula Suum*, which may be realised in diversely different circumstances, this installation is realised in an empty, resonant space devoid of native sounds. A lack of background sound focusses listening attention towards sounds made by subjects and, due to the spatial situation, these carry a maximum of acoustic information. Through emergent dialogues that seek to make sense of the alternate reality, subjects may also make sense of an acoustic space by listening through the spatial properties of sounds towards the ways in which they explain orientation and relationality within it.

As is the case in *Auricula Suum*, listening though an altered sonic reality in this intervention speaks back to, and offers a different perspective on, each subject’s normative auditory modality.<sup>148</sup> Jean-Luc Nancy posits that the act of listening is a calibration between external sonic resonance — a series of spatial referrals where sound is heard in relation to itself — and a series of internal referrals, a constant referral of self to self, an arriving into every moment.<sup>149</sup> *Auricula Suum* might be seen as an intervention that temporally or spatially displaces or disrupts the relationship between internal and external referrals, which relate to a given subject. In *Auricula Alium*, however, a subject listens towards, and in approach of, themselves through the actions and body of another person. This approach of self from the other might offer approaches to listening and modes of interaction that are not innate to a subject.

*Auricula Alium* uses binaural microphone-headphone headsets in order to create situations in which subjects hear through the ears of others. These alternate sonic realities create situations of listening that emerge through sounding dialogues and attempt to make sense of reconfigurations of hearing. Dialogues of sounding and listening also implicate subjects in forming implicit knowledges of the acoustic space in which the intervention takes place and constitute a mode of relating that is grounded entirely in the sonic. This intervention allows subjects to listen towards a sense of self from the perspective of another, offering alternate approaches to their normative auditory modality and approach to listening.

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<sup>147</sup> Ibid., p.227.

<sup>148</sup> See Howard and Angus, p.113. The authors mention that, ‘[w]e also find that if we hear sound recorded through other people’s ears we may have a different ability to localize the sound, because the interference patterns are not the same as those for our ears. In fact, sometimes this localization capability is worse than when using our own ears and sometimes it is better.’

<sup>149</sup> Nancy, p.8.

### 4.3 *Ear Pieces* Conclusions

Ear Pieces reconfigure hearing in order to bring sound to the experiential fore. These reconfigurations of hearing — altered sonic realities — in turn bring about situations of listening. By creating altered sonic realities, both projects present an opportunity for subjects to re-approach their normative auditory modality. Whilst they prepare subjects for listening, these interventions can also be used to revisit the types of spatial listening opened up by other pieces in the portfolio.

## 5 Echo and Reverberation

### 5.1 Reflection // Position



Figure 3: Reflection // Position at Odrathek Festival, London, March 2018

Sounds are never just their source: they are the product of what is emitted and its mixing with the world. They unfold, resonate, reverberate, reflect and refract, reaching a listener to describe the space in which they find themselves, its materiality, size, shape, the origin of the sound and the listener's position. Gunshots used by Justin Bennet in his *Shotgun Architecture* project clearly describe this dynamic:

A singularity, a small explosion, unfolds to become a musical structure [...] a sound that 'folds out, surrounds and fills space'. A single subjective act transformed in time begins to resemble a piece of music, a sonic space for the listener to inhabit.<sup>150</sup>

Bennett's gunshot, for just a moment in time, breaks through a soundscape, announcing a space in and as sound, and implicating those present in the hearing of it. Likewise, Davide Tidoni's popped balloons have claimed spaces across Europe.<sup>151</sup> The impulse is an acoustic signature, a potential sonic knowledge, which describes the creator's being in a space by describing the space. An issue with these works, though, is that they consist of single events, moments that are almost over before they begin. In the case of both projects, these impulses are principally relayed

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<sup>150</sup> Justin Bennett, 'Shotgun Diary', in *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle (Berlin: Errant Bodies Press, 2011), pp.15-32 (p.18).

<sup>151</sup> See, for example, Davide Tidoni, 'A Balloon for Linz', *Vimeo* <<https://vimeo.com/28686368>> [25/10/2018].

through documentation, removed from the space and time in which they were created.<sup>152</sup>

*Reflection // Position* is a loudhailer array accompanied by a collection of sound signals and a text score, which creates the possibility for a multitude of architectural spaces to be known in listening. In contrast to Bennet and Tidoni's singular impulses, it continuously outputs rhythmic and repetitive impulses or impulse loops through four loudspeakers, which together afford a 360-degree emission pattern in which each speaker covers a 90-degree radius. Sound signals physically interact with the acoustics of the chosen space, producing reflection patterns that form an environment of sounds — an impulse topography — waiting to be heard. In any given location, the pattern of direct and reflected sound — the impulse signature — describes to a listener, from their position and orientation in a space, its size, shape and quality relative to the position of the loudspeaker. This intervention renders the architectural spaces in which it is located as acoustic perceptual fields; potentialities for sonic exploration and sonic knowing.<sup>153</sup> It emerged from early work in the PhD that used systematic placement of loudspeakers and repeatedly emitted impulses to allow the exploration of spatial configurations.<sup>154</sup> Unlike these site-specific sketches, *Reflection // Position* is site-generic, allowing many spaces to be explored and unpacked through listening.<sup>155</sup>

The loudhailer array targets the human plane of movement. It takes into account that, as O.F. Bollnow states, 'man is bound with his life' to the earth's surface, and is thus designed to excite architectural spaces in the horizontal plane.<sup>156</sup> The array is transportable and weatherproof. The low-cost loudhailers that constitute it have a high sound power output and are arranged such that they emit sound at a roughly consistent intensity over 360 degrees. The array is designed to be placed on the ground in order that the speaker cones are directed significantly below the plane of the human ear, in order to achieve a balance between direct sound and the reflected sound that carries spatial information.

Whilst each impulse — a singular emission of sound from all four loudhailers — like Bennet's gunshot, propagates through space, reflecting, refracting, and eventually dying away, the continual emission of impulses creates a perceived static sonic map, an impulse topography.<sup>157</sup> Within this topography, each location in space might be defined by its own unique repetitive sound pattern, or impulse signature. An impulse

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<sup>152</sup> For example, Bennet's impulses are crystallised as an acousmatic work. See Justin Bennett, 'Shotgun Architecture', *Soundcloud* <[https://soundcloud.com/justinbennett\\_nl/shotgun-architecture](https://soundcloud.com/justinbennett_nl/shotgun-architecture)> [01/12/2018].

<sup>153</sup> This commentary follows Henriques's notion of thinking through sound.

<sup>154</sup> This work is a site-generic development of a series of sketches for site-specific loudspeaker installations that were originally called *Reframing a Reflection*. See appendix 8.

<sup>155</sup> See video appendix 2 for footage of *Reflection // Position*.

<sup>156</sup> Bollnow, p.45.

<sup>157</sup> See appendix 9.



signature is the sonic pattern perceived from a given location in space. It will invariably consist of a combination of direct sound from each speaker, and sonic reflections; versions of the emitted sound dynamically, timbrally, and temporally distorted by the acoustic properties of the architectural space in which the array is situated. Impulse signatures are compound: the product of sound radiation and reflection dynamics from each of the four loudhailers, each of which is distinguishable by its unique pitch or timbre.<sup>158</sup> They describe to a situated subject the configuration of reflective surfaces in a space, as well as their materiality in relation to the position of the loudspeaker array in terms of time, timbre and intensity. The expression of a space that an impulse topography forms is always relational. It comes about through and is defined in relation to the placement of the loudhailer array, the sounds that are used, the pre-existing sounds in a given space, listeners' engagement and the space itself.<sup>159</sup>

*Reflection // Position* is an experimental tool that may be implemented in any space that it is able to acoustically excite. There is no ideal realisation; rather, this work places an emphasis on the practice and process of unpacking spaces.<sup>160</sup> Realisations in enclosed and open spaces vary acoustically and produce different listening experiences. Impulse topographies created in enclosed spaces might be characterised as milieux of reverberant intensities, which form a sonic haze that qualitatively varies across space.<sup>161</sup> Impulse topographies created outside are comprised of discrete patterns of sound, where direct and reflected sounds are often clearly distinguishable.<sup>162</sup> Another notable distinction is that between private and public space. Realisations taking place in private space tend towards the performative, as they require an invited listenership, whilst public realisations are truly able to intervene and claim spaces as sonic.

The establishment of an impulse topography in an architectural space is the creation of a sonic medium through which that space may become known. An impulse topography is an environment of potential sonic knowledges or understandings, a mode of sounding that 'brings to the fore [...] auditory propagation as a mechanical

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<sup>158</sup> See appendix 9 for ray tracing diagrams that demonstrate crudely how the temporal discrepancies between the sounds of individual speakers form a compound impulse signature.

<sup>159</sup> This notion supports Feld's argument all sonic knowledge is relational, see Feld, 'Acoustemology', in *Keywords in Sound*, ed. by Novak and Sakakeeny, pp.12-21 (p.13). The stasis of sonic output in this intervention enables subjects to unpack spaces *through* varying relationality.

<sup>160</sup> I acknowledge that this intervention will not produce intelligible impulse topographies in every space. Some spaces may be too large for the speakers to sufficiently excite, some may be too noisy, others not sufficiently reflective. Rather than giving an acoustic account of this in the score, I instead place an emphasis on the act of using the speaker array to probe space; to discover these things through listening.

<sup>161</sup> Listen to audio appendix 3. This recording was made at Odrathek festival in London. For images, see Alex De Little, 'Odrathek Festival // London', *Alex De Little* <<http://www.alexdelittle.com/odrathek-festival-london/>> [15/10/2017].

<sup>162</sup> Listen to audio appendix 2.

process, as a model of a way of understanding that avoids being entirely bound up with language, notation and representation'.<sup>163</sup> To follow Henriques' model, space may be understood or known in listening to, and thinking through, this medium. Dimensions, configurations of surfaces, volume, material construction, and objects within a space may all come to be understood in relation to sounds used, placement of the loudhailer array and a listener's position in space, as patterns of temporalities, variations in timbre and intensity, a mixture of foreground and background sound, directionality, or a combination of diffuse or reverberant and discreet sounds. Owing to the multitude of possible sound situations that *Reflection // Position* might create, it makes little sense to describe potential sonic results in different acoustic spaces, but rather emphasise that these sounds are waiting to be listened to. The sounds native to the space — the acoustic ecology — may be heard in relation to a topography, acoustically contextualising it and contextualised by it.<sup>164</sup>

The language of listening (sonic thinking) is the language of movement.<sup>165</sup> Whilst a subject may garner a sonic understanding of a space from the hearing of a single impulse signature, movement through a space enables the sonic understanding of it from multiple positionalities. As Monika Langer argues in relation to Merleau-Ponty's phenomenology:

[t]he body is a potentiality of movement, and the perceptual field is an invitation to action; by responding to this invitation, the incarnate subject receives, what Merleau-Ponty calls 'the enjoyment of space', through the existential constitution of a 'spatial level'.<sup>166</sup>

For any movement within this sound field, some signals will increase in intensity and others will decrease; sonic feedback occurs in relation to all four loudhailers simultaneously, each intelligibly distinguished by its unique timbral or pitch characteristics and impulse signature. Movement uncovers the emergence and subsidence of sonic objects, which pertain to surfaces and architectural features. To move in this situation is to measure the body against a sound field. With each measurement, the space speaks back. The subject creates themselves, their dimensions, their corporeality in sound and in doing so creates the space. Movement effects sonic change and sonic change activates listening: an awakening of the sonic body.

When realised as an intervention, *Reflection // Position* acknowledges that people will engage differently with it, from concerted listening to just noticing. It does not force itself on a subject but gently implicates them as they move through a space; sonic feedback playfully offers and suggests continued engagement; deeper listening. The bounds of a space come to signify a sonic playground which might be

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<sup>163</sup> Henriques, p. xvii.

<sup>164</sup> This is particularly evident in the video documentation of the work: external environmental sounds impinge on and contextualise the sounds of the intervention.

<sup>165</sup> This language of listening is prepared by the *Auricula Suum* and *Auricula Alium* pieces.

<sup>166</sup> Langer, p.83.

traversed and explored; visual perspective indicates sonic potential. This situation at the same time invites and describes. Over time, subjects may become attuned to the sonic implications of an autonomous auditory-corporeal dialogue with the sound field, and listen through the changing topography in approach of the space. Sonic objects become surfaces and architectural features. A sense of depth of the impulse signature — foreground and background sound — pertains to a spatial perspective, an orientation. Sense is made of an impulse topography, and in this sense, a sonic knowledge of a space. This knowledge is emphatically a know-how rather than a know-what: it is based on cause and effect, it is situational, and contingent on attention. It is a knowing that is not concerned with an absolute perspective or essence of a space, but a knowing which is itself a presence, unique and ephemeral. A multitude of impulse signatures become a language, a music, which describes acoustic space to listening subjects in direct relation to their autonomous physical interaction with it and listening attention towards it.

Perhaps the most effective space for the realisation of *Reflection // Position* is the public square or quad. Public squares are nexuses for the coming together of people. They also focus sound: buildings that constitute them in the majority of European cities and towns are sonically reflective, constructed in brick or stone. To Michael Kimmelman, a square is an 'organism, not just a work of art and architecture.'<sup>167</sup> As an intervention, *Reflection // Position* draws attention to this communality by implicating anyone within earshot of an impulse topography in a listening dialogue with architecture. It brings people together in listening, formulating a sociality of strangers.<sup>168</sup> The loudhailer, traditionally used as a device for making announcements, in this context announces the acoustic attributes of a space to those present and in doing so, announces the potential for a sonic way of being in space. As an intervention, *Reflection // Position* represents the revolt that Henri Lefebvre calls for against so called abstract space:

Indeed the fleshy spatio-temporal body is already in revolt. This revolt, however, must not be understood as a harking back to the origins, to some archaic or anthropological past, it is firmly anchored in the here and now, and the body in question is 'ours'. [...] This is not a political rebellion, nor is it a revolt of thought, a revolt of the individual or a revolt of freedom: it is an elemental and worldwide revolt which does not seek a theoretical foundation, but rather seeks by theoretical means to rediscover — and recognize — its own foundations.<sup>169</sup>

In the claiming of space as sonic, *Reflection // Position* injects a way of being which is body-centric, present and sensate, and which combats the ubiquity,

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<sup>167</sup> Michael Kimmelman, 'Part One: Culture: Power of the Place — Introduction' in *City Squares: Eighteen Writers on the Spirit and significance of Squares Around the World*, ed. by Catie Marron, pp.15-37 (p.18).

<sup>168</sup> Again, I call up LaBelle's notion of emergent acoustic publics: See LaBelle, 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Corbussen, Meelberg and Truax, pp.275-285, (pp.283-284).

<sup>169</sup> Lefebvre, p.201.

disembodiment and decentralization of abstract space, or non-places.<sup>170</sup> Like Justin Bennett's work in the Zuidas district of Rotterdam, this loudhailer array can target desensitized cityscapes as a way of taking back what is not willingly given: sensorily-barren environments of glass and steel can be transformed into auditory playgrounds, pulling people out of conscious thought and reflection and into phenomenological listening, engaged with in the here and now.<sup>171</sup> A public separated by the eye is in this instance joined in the perception of a topography.

### 5.1.1 Additional Versions

A number of micro scores shape situations of listening around impulse topographies. These may be realised publically as part of an intervention or formally as a performance. In *Microphones and Loudspeakers*, pairs of loudspeakers and microphones are used by performers to amplify the impulse signature in a given location and broadcast it to another location. Microphones act as listening points, either near or far away from the loudspeakers that they are connected to. This realisation networks impulse topographies, feeding them in on themselves, rearticulating and transforming the space.<sup>172</sup> *Percussionists* provides the opportunity for an audience or public to experience a number of performers' perceptions of an impulse topography through listening to the ways in which they move and sound in relation to it. This mode of sounding and listening in relation to a topography is an externalisation of the perception of impulse signatures. In this version, performers act as perceptual way-markers, much like the microphone. The human dimension in this piece, however, allows an audience to listen to perception unfolding, with all of its inconsistency and imperfection, as imitation rather than direct representation. Finally, in *Objects*, a set of markers are made available to a listening audience or public. These markers are to be placed on the ground where subjects perceive interesting or notable impulse signatures. What is created through the placement of these markers by a group is a subjective map of interesting or notable points within the topography: the imposition of a visual map onto an impulse topography that has the possibility to direct listening awareness. The space is coded through the perception of subjects' interactions with the impulse topography. This knowledge is subject to change: markers might move and the map might shift. *Objects* affords a crowd-sourced guide to the topography, a dynamic visualisation of an emergent sonic public.

*Reflection // Positon* is an experimental tool for knowing spaces through impulse. It creates impulse topographies — fields of sonic reflections — which convey the acoustic properties of an architectural space from a listener's position in relation to the position of the loudspeaker array and the sounds used. Movement provides a

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<sup>170</sup> See Augé.

<sup>171</sup> For a commentary on Bennett's work in Zuidas, see Bennett, 'Shotgun Diary', in *Site of Sound #2: of Architecture and the Ear*, ed. by Claudia Martinho and Brandon LaBelle, pp.15-32.

<sup>172</sup> This version is best realised in an indoor performance setting (as specified in the score).

gateway to listening and space is understood as a series of positionalities and perspectives, perceived through changing impulse signatures. Movement effects sonic feedback which, in turn, activates listening. Resultant spatio-sonic knowledge is ephemeral, a result of autonomous engagement, a series of situational contingent experiences. In co-opting spaces as sonic, it deploys momentary cultures of listening, of connectedness through sound, which are activated by the body and by movement. There is much scope for the development of this project. It might be reconceived as a longer term public installation with multiple loudspeaker arrays where people are able to manipulate their location and directionality.

## 5.2 *RT60*

Whilst reverberation since antiquity has shaped the creation of musical works and pervaded the collective acoustic psyche through symbolisms of 'solemnity and monumentality',<sup>173</sup> there are few practices that interrogate reverberation as a medium through which space may be known. Reverberation is the temporal essence of enclosed space. *RT60*, named after Sabine's formula, explores the potential for space to be known in and through reverberation.<sup>174</sup> It is a proto-installation that has not been realised. It is included in this commentary because the way in which it organises sound around the temporality of spaces forms the basis for the echo and impulse pieces in *Spatial Listening*. *RT60* is more explicitly focused on listening to the nature of reverberation as a way into knowing space than Raviv Ganchrow and Edwin Van der Heide's installations;<sup>175</sup> and unlike both of these works, it is site-generic: the site in which it is deployed and the way in which it is realised entirely defines its sonic manifestation.

*RT60* is a system that organises the emission of sound around reverberation. It is a network of pairs of loudspeakers and microphones that sounds the reverberant temporality of a space. A loudspeaker emits an impulse. As the sound reverberates through the space, a Max/MSP patch measures the sound levels of each microphone channel. The first microphone to have recorded a level having fallen by 60db then triggers the loudspeaker adjacent to it to emit the next impulse.<sup>176</sup> The installation continues indefinitely in this manner.

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<sup>173</sup> Augoyard and Torgue, p.116.

<sup>174</sup> See, Wallace Sabine, *Collected Papers on Acoustics* (Cambridge, MA: Harvard University Press, 1922), p.3. Also see Thompson, *The Soundscape of Modernity*, pp.33-44.

<sup>175</sup> See van der Heide, 'The Audience Inside the Instrument', in *Site of Sound #2: of Architecture and the Ear*, ed. by Martinho and LaBelle, pp. 283-288, and Ganchrow, 'Crescents', in *Site of Sound #2: of Architecture and the Ear*, ed. by Martinho and LaBelle, pp.290-296.

<sup>176</sup> See video appendix 14, which shows a working test of this principle using one loudspeaker and one microphone. I have yet to test this installation using multiple loudspeaker-microphone pairs. See also Max/MSP Appendix 6. This contains the patch used in the test and the JavaScript object, written by Stuart Mellor, that triggers sounds in relation to the reverberant threshold of a space.

For every loudspeaker positioned within the space, an impulse response is taken from each microphone. Each of these is convolved into a short impulse. These site-specific impulses are then mixed with an array of random impulse samples, creating a collection of sounds, which are triggered at random. Sounds created by subjects in the space play into this system, implicating their creators in reverberant listening. Augoyard describes the phenomenon of reverberation thus:

The notion of reverberation is linked to a measurement of time it takes for a sound to decrease by 60db. Etymologically, the word comes from the Latin *very reverberare*, meaning, 'to strike back, to reflect'. In the displacement of a sound from its source to the ear, only a small part of the sound energy travels in the most direct way. A large portion of the sound energy follows indirect paths, as it is reflected on the ground and the environment of the milieu: walls, ceilings, facades. Since these routes take longer, reflected sound energy takes more time than direct energy to reach the ear. This discrepancy is the basis of reverberation.<sup>177</sup>

This discrepancy tells a story about the space. The situated experience of pure reverberation is as a temporality articulated by a diminishing dynamic and timbral contour, where the subject from their position in space only intercepts a fraction of a multitude of propagating soundwaves. There is no singular reverberant essence of a space but only situational essences, articulations pertaining to located sound emission and located listener. Reverberation qua acoustic phenomenon connects subjects to space. Its qualities speak to them of size, material construction and shape. As a system, *RT60* organises sound around reverberation as a way to present reverberation in essence, so that it may be intently listened to. The system continually re-expresses the space in which it is located through reverberation via its arrangement, and through a multitude of different impulses that variously interact with the space's resonant profile.

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<sup>177</sup> Augoyard and Torgue, p.111.

## 6 Resonance

### 6.1 *Spatial Drone I+II*



Figure 4: *Spatial Drone* at LEGROOM, Manchester, November 2017

*Modes of Resonance* was the first work created as part of this PhD research. An installation for four loudspeakers, it derived a series of resonant frequencies from impulse responses taken in a space, and played them back into a space as a series of sustained sine waves in varying combinations.<sup>178</sup> Whilst this was an effective way of articulating the resonant profile of a given space to a listening audience, subjects remained outside of the process of its articulation, listening towards resonance, but not in terms of it, not thinking through it. The *Spatial Drone* pieces — developed during a residency at LEGROOM in Manchester (see Figure 4) — position the player at the centre of a process of articulating resonance as a way to know space sonically and somatically.<sup>179</sup> These pieces explore resonance through situated listening: listening from fixed positions in space places an emphasis on the innate aural and somatic sensations of the frequencies themselves, rather than the interference distribution patterns that they cause.<sup>180</sup> The processes of sounding in these pieces depend on reflexive listening; processes develop according to the way in which resonant sensations play on the ear and body of the player:<sup>181</sup> spaces may be

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<sup>178</sup> See video appendix 1 for footage of an installation of *Modes of Resonance*.

<sup>179</sup> For more information about the residency, see Alex De Little, 'Listening to Architecture // Artist Residency // Legroom Manchester // 20-26 November, 2017', *Alex De Little* <<http://www.alexdelittle.com/residency-legroom-manchester-20-25-november-2017/>> [15/10/2018].

<sup>180</sup> Moving engagement with resonant phenomena is discussed in the next chapter.

<sup>181</sup> Here I echo Feld's acoustemological model. Especially the notion that sonic knowledges are produced in reflexive feedback between sounding and listening, see Feld, 'Acoustemology', in *Keywords in Sound*, ed. by Novak and Sakakeeny, pp.12-21 (p.14).

discovered by sounding-listening subjects in terms of, and for, themselves.<sup>182</sup> This is a messy, human endeavour in which human and space perpetually reconstitute each other in resonance. The instruments that distinguish the pieces — subtractive synthesiser and tuba — represent mediums that determine the resonant elements of a given space that might be excited, as well as the nature of processes of sounding and listening.

### *Spatial Drone*

In *Spatial Drone*, a subtractive synthesiser acts as a tool for probing the resonant characteristics of a space. The piece consists of two phases. In the preparation phase, a performer uses a synthesiser to scan the chosen space to identify its strongest perceptible resonant frequency. The key of the synthesiser is weighted at this frequency in order to maintain a drone. The player then conducts a resonant listening-led exploration in relation to a series of processes. These processes refer to the manipulation of a range of synthesis parameters that control the manifestation of resonant phenomena relating to the tuned frequency and its upper partials. During this exploration, the performer forms resonant sonic knowledges of the space by experiencing the ways in which the changing manifestation of phenomena play on ear and body. What is heard — aurally and somatically — determines the manner in which the processes play out: where the player chooses to pause and the types of resonant phenomena they choose to emphasise. The player thus uncovers what may be excited by the synthesiser entirely in terms of their own experience. They create the space in resonance, whilst constituting themselves in the process. In a performance phase, resonant sonic knowledges are translated to a situated audience. The performance is an exposition of the prior process of resonant discovery, a transmission of resonant knowledge of the space. This is an intimate act in which a performer's physical response to resonant sensations determines the audience's experience: an audience is brought into resonant vibration with an architectural space in a manner that is entirely guided by the subjective physical experience of the performer.<sup>183</sup>

The piece is based on the principle that parameters used in subtractive synthesis have the potential to directly control the manifestation of resonant phenomena in architectural space.<sup>184</sup> Subtractive synthesis involves the attenuation of complex

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<sup>182</sup> Here I follow Voegelin and Nancy's auditory extensions to Merleau-Ponty's phenomenological model, as discussed in chapter 2.

<sup>183</sup> For a recording of the piece, listen to audio appendix 4. The performance was part of my 'Listening to Architecture' residency at LEGROOM in Manchester. This recording was made before the score was conceived so doesn't abide by exactly the same structure. It does, however, use the processes present in the score. N.B. In this recording, I change the fundamental to which the synthesiser is tuned from time to time. See appendix 14 for the event programme.

<sup>184</sup> The subtractive synthesiser is also commonly available, and thus a tool which can be used widely as a medium to explore space through resonance.



sound signals relative to their innate physical properties.<sup>185</sup> A complex signal such as a sawtooth waveform consists of a spectrum of partial content with a distinct distribution pattern that relates to the harmonic series. In subtractive synthesis, high and low pass filters attenuate or select portions of this partial spectrum, whilst resonance or peak settings amplify individual partials or groups of partials. If the fundamental partial of a complex waveform corresponds with one of the fundamental resonant frequencies of a space, some or many of the upper partials of that waveform will correspond to resonant partials of that fundamental frequency.<sup>186</sup> In this scenario, the processes of filtration, amplification and attenuation act as processes for articulating and shaping the manifestation of the resonant frequencies of the space, that relate to that fundamental partial: filter settings on the synthesiser become tools for scanning through and isolating resonant modes of the space that are multiples of the fundamental to which the synthesiser is tuned.<sup>187</sup> Peak or resonance settings become tools for accentuating specific individual partials or groups of partials. The detuning of one oscillator against another produces beating patterns of different frequencies, which cause a modal resonance to be articulated rhythmically. A low frequency oscillator, when mapped to filter or peak parameters, may be used to automate sweeps between groups of resonant partials, or the periodic accentuations of individual partials or groups of partials. Phase settings of waveforms may be used to alter the position of resonant interference distribution patterns caused by the manifestation of standing waves. Finally, the type of complex waveform that is used will define the resonant partials that may be articulated.<sup>188</sup>

*Spatial Drone* was initially an improvisation practice that I arrived at by spending time in various spaces, and, through trial and error, learning to use a synthesiser to excite — and manipulate the manifestation of — their modal resonances.<sup>189</sup> The sonic and technical knowledges that I accrued in this process have been redirected into a text score, which enables anyone who is able to listen deeply to resonant sensations and to manipulate the parameters of a synthesiser to create these knowledges for themselves and a listening audience, in any suitable space. The score describes the processes that I found to be the most effective and attempts to state them plainly enough that they may be easily interpreted. The realisation of the piece is always governed by the sensory experience of the subject in question: knowledge is created and disseminated on the terms of and in terms of the unique sensory perception of

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<sup>185</sup> See, for example, Martin Russ, *Sound Synthesis and Sampling*, 3rd ed. (Burlington, MA; Oxford: Focal Press, 2009), p.106.

<sup>186</sup> This is due to the fact that modal resonances correspond to the harmonic series. See Augoyard and Torgue, p.103. Due to the complexities of room acoustics, the situation will not always be this simple. This piece, however, places an emphasis on the act of probing and making evident: it is not about finding an 'ideal' space, but rather what may be uncovered.

<sup>187</sup> It is, of course, possible that unrelated modes may also be excited.

<sup>188</sup> For example, a triangle waveform has sparse odd-numbered harmonics, a square wave contains only odd harmonics, and a sawtooth wave contains both odd and even harmonics. See Russ, p.109-110.

<sup>189</sup> The synthesiser that I used was a Korg MS20 mini.

whomever performs the piece. Both of the *Spatial Drone* pieces use structuring principles and techniques of drone music as the vessel for the rendering and communication of resonant sensations. Drone music directs awareness towards the worlds within sounds: the nature, depths and qualities of sounds themselves rather than the ways in which they are arranged. In using these structural and aesthetic principles as the governing structural principles, it is intended that both performer and audience maintain focused physical and sonic awareness on the detail of each resonant sensation, rather than a broader semblance of musical structure.

Though not part of a performance, the first key process is the discovery of the strongest perceptible resonant mode of the space. A performer sets the synthesiser to a sine wave and plays upwards stepwise from the bottom of the range, whilst intently listening for a resonant spatial response in the form of changes in the volume and quality of sound. The listening awareness required to identify resonant phenomena and isolate the strongest resonant mode in this setup phase provides the basis for the rest of the piece. Which resonant frequencies will be audible is entirely a product of the space itself, the location of the player within it, and the location and frequency response of the loudspeaker in use.<sup>190</sup> The first and second processes in the score require the player to use filtration to systematically scan through the partials of different waveforms, first using one oscillator at a time and second using both oscillators.<sup>191</sup> In the third process, the player continues to sweep through resonant partials, pausing from time to time and increasing the resonance or 'peak' setting. This allows partials or groups of partials to be emphasised and isolated. In the fourth process, the player conducts meandering sweeps with numerous filters simultaneously, where the resonance or peak setting is at full value. These sweeps present the resonant partials that correspond to the fundamental in different 'harmonic' combinations. When the player experiences an interesting or notable instance of resonance, they pause this sweeping process and begin to gradually detune one oscillator against the other. This creates gradually changing beating patterns, which rhythmically articulate the resonant sensation.<sup>192</sup> In the fifth and final process, the player manipulates the low frequency oscillator to scan through the resonant partials associated with the frequency to which the synthesiser

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<sup>190</sup> The interference distribution caused by resonant standing waves means that in any given location in a space, a player will find themselves at nodal points of certain frequencies and anti-nodal points of others. The frequency response of the loudspeaker determines how much of the resonant profile of the space will be excitable.

<sup>191</sup> Listen to audio appendix 5. Here, I gradually close and open the high pass filter. The phase is caused by the fact that the two oscillators are not perfectly in tune. In the space at the time of the recording, it was as if different acoustic strata were revealed. The space was animated in resonance layer by layer.

<sup>192</sup> Listen to audio appendix 7 from 1'25'' for beating patterns. Because the peak setting is full, this doesn't have the effect of detuning the sound, but rather modulating the way in which it is presented. It is palpable even in the recording how the detuning process modulates the spatiality of the sound.

is tuned. This process is the most open: the score suggests the manipulation of a number of parameters that manipulate the manifestation of resonance.<sup>193</sup>

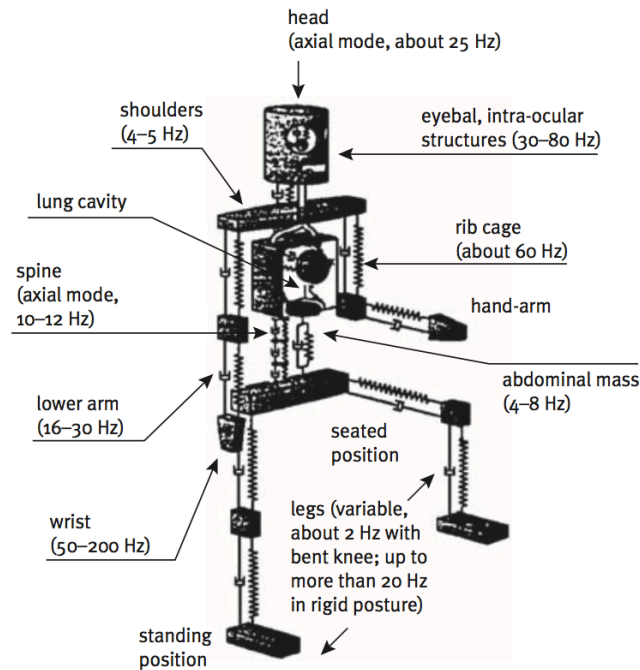


Figure 5: Human Body Resonance Frequencies: Augoyard and Torgue, p.106

Processes evolve and are articulated in terms of what ‘resonates’ with a given player. At any time, when a player discovers a phenomenon that moves them in some way, they are encouraged to slow down and explore it in more depth. Whilst earlier processes act as expositions to resonant phenomena, later processes open up in complexity, allowing more room to take the exploration of resonance into their own realm. Processes are articulated — through sounding and listening — in terms of the ear as well as the body. As the fundamental modal frequencies of architectural spaces are low, the subject is implicated in a full-body listening experience. This calls to mind Scott Arford and Randy Yao’s *Infrasound* project:

Hear with your body. This is not about music. This is not about performance or the performer. The goal is sound and the explicit translation of sound into physical force. The goal is internal and external realisation. [...] It is about the total acoustic sense of space — observing sound to measure the capacity of architecture. It is about the phenomenon of resonance or sympathetic vibration — all things working in one continuum.<sup>194</sup>

<sup>193</sup> Listen to audio appendix 6. Here, the LFO rate is set to minimum and the LFO is set to modulate the high pass cutoff frequency. I gradually change the cutoff frequency setting. The synthesiser periodically sweeps upwards from the fundamental through upper partials. The spatial response is palpable in the recording from 2’. N.B. In this recording, I change the fundamental to which the synthesiser is tuned from time to time.

<sup>194</sup> Arford and Yao ‘Filling the Void: the Infrasound Series’ in *Site of Sound #2: of Architecture and the Ear*, ed. by Martinho and LaBelle, pp.195-210 (p.196).

Unlike the sub-aural frequencies used in Arford and Yao's *Infrasound* project, the frequencies used in both *Spatial Drone* pieces straddle the aural and somatic domains. The goal of both works is for players to use their sounding mediums to create a multitude of resonant sensations that may be experienced to 'measure the capacity of architecture'. The experience of resonance in these pieces is one of aural sensation combined with physical sensation: the resonant overlap between the cavities of the body (see Figure 5) and the cavities of the space, combined with the ways in which these frequencies play on the ear. To be in a space that is in resonance is to be aurally and physically modulated by it. It is to resound with the dimensions of that space. It is to become part of the fabric of the space.

The processes in *Spatial Drone* constitute a manner of sounding and listening that provokes a multitude of articulations of an architectural space's resonant modes. Each articulation of resonance modulates the player in a different way, directing them to a specific part of a space's innate sonic profile. Each manifestation of resonance might be considered as a different way of understanding, or knowing a space, a different stratum of the resonant whole. This piece is an in-motion deployment of sonic presencing, which directs towards architecture through resonance. The processes in *Spatial Drone* implicate the subject in question in a listening dynamic where in listening, they constantly strain in approach of each resonant sensation that they produce. In every moment, they produce a space in resonance as well as a sense of themselves, a sense of their resonant body. Space and subject are constituted here in relation, from the position of the player in the space in relation to sound source. Knowledge is not final or totalising, but emergent and entirely contingent on listening attention towards resonance as experienced in terms of quality, depth, affect, frequency, physical force, spatiality, and many other less-tangible elements.

## *Spatial Drone II*



Figure 6: James Seabrook in workshops for *Spatial Drone II*, LEGROOM, Manchester, November 2017

Whilst *Spatial Drone II* follows a similar overall form to its sister piece, cycles of resonant sounding and listening open up through the medium of the tuba. In the preparation phase, the tuba player plays stepwise through the register of their instrument in different parts of a space, in order to find the location at which most resonant frequencies may be perceived. They settle in this location and note all of the pitches and tunings where their instrument provokes resonant responses.<sup>195</sup> For each of these pitches, the player then uses a number of instrumental techniques — embouchure manipulation, harmonics, pitch bending — which affect the nature of the manifestation of resonant phenomena in the space. During this process, the player only sounds in order to listen. They listen in order to evoke the broadest range of resonant sensations as is possible. In the performance phase, the player relays their process of resonant discovery: an audience is brought into resonant agreement with a space through the tuba player's intimate and personal process of sounding and listening.

The tuba constitutes an entirely different medium for resonant exploration to the synthesiser. It was predominantly chosen because it is the orchestral instrument that has the combination of lowest range and highest sound power, making it most

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<sup>195</sup> This calls to mind Ablinger's *Three Places* series. See, Peter Ablinger, 'Orte', *Peter Ablinger* <<https://ablinger.mur.at/orte.html>> [17/12/2018]. A version of this piece was composed by Ablinger for Leeds University Campus. For a recording, see Sound;Space;Play, 'Places Leeds', *Soundcloud* <<https://soundcloud.com/sound-space-play/three-places-leeds>> [17/12/2018]. The difference between the approaches between *Three Places* and *Spatial Drone II* underlines the approach of this project. *Three Places* uses impulse responses that are notated in order to provide a range of frequencies, which are performed by players in order to 'represent' a space in resonance. *Spatial Drone II* places an emphasis on the process of discovery as a way to sonically know a space.

equipped to excite strong resonances in architectural spaces. The timbre of the tuba is less rich in upper partial content than the synthesiser, with most energy focussed around the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> partials.<sup>196</sup> Across the brass instrument family, the second partial and above in any pitch maps almost exactly onto the harmonic series, meaning that the tuba may in some cases have the ability to excite multiple partials simultaneously. The fundamental frequency, however, is out of tune, making the second partial the 'heard' frequency. The range of the tuba is more limited than the synthesiser, from roughly 40hz to 262hz.<sup>197</sup> Although it is not able to maintain an indefinite pitch like the synthesiser, the tuba is at liberty to explore a broader range of resonant frequencies than those that relate to a given fundamental and its upper partials.<sup>198</sup>

Three playing techniques are deployed to control the nature of the manifestation of resonance. First, lipping and valving brings played notes in and out of resonance. Second, the embouchure shape is manipulated as a way to filter partial content. Third, pitches are sung on top of played tones in order to create harmonics. The voice here is the synthesiser's second oscillator, modulating the played tones to afford altered manifestations of resonance, either undermining them by creating beating patterns, or accentuating them.<sup>199</sup> The unifying structural element of this piece is that every entry fades in from nothing, fades to nothing, and lasts the length of a breath. The middle dynamic of any given entry is determined by the volume required to make the space 'speak', or for resonance to be perceived. The breath is a unit of thought: within each breath, the performer may only articulate one resonant gesture, one idea. Each breath informs the next: the player listens intently for the response from each gesture, registering its resonant response before deciding on the playing approach that will be taken in the next breath. In this way, the player remains in a state of instability, always listening in approach of resonance, always in approach of their next gesture. In the performance, the player moves stepwise, exploring breath-by-breath and technique-by-technique the weakest registered resonance to the strongest, before making their way back to the weakest.

These cycles of sounding and listening necessarily open up sonic knowledges in a different manner from *Spatial Drone*, because the player themselves manifests more audibly within them. The human-driven sound of the tuba is prone to inconsistencies and imperfections that carry with them marks of the effort, energy and listening attention required to create them. Breath is taken, an embouchure formed, the body stretches towards sounding. Sounding itself is determined by the duration that a

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<sup>196</sup> See Howard and Angus, pp.205-208. See also appendix 11 for graphs of the Tuba's frequency profile.

<sup>197</sup> The range is variable depending on what key the instrument is in and the ability of the player.

<sup>198</sup> In this case, the range of available pitches do not solely pertain to sustained fundamental frequency and its upper partials. Rather, each note recorded on the score constitutes a resonant mode that may be more or less related to other notes. Within notated pitch, the tuba may also be able to access upper partials through embouchure manipulation.

<sup>199</sup> These techniques were developed in workshop.

single breath can articulate, and the consistency of dynamic, pitch and timbre. This sound, then, is a manifestation of listening attention: the player's listening attention in approach of resonance made audible. It manifests in the performance space as resonance, modulating the bodies and ears of all present. As the player vacates themselves in sound, they return to themselves in resonance, bringing themselves into contact with the space, and in doing so, bringing themselves back into contact with their sense of self, here, in this moment. These referrals flow more freely than with the synthesiser; they are technologically uninhibited. Perhaps then, this act of auditory presencing manifests on a deeper level, creating a sonic knowledge which is more closely aligned with the performer.



Figure 7: *Spatial Drone III* at LEGROOM Manchester, November 2017

A version of *Spatial Drone* — '*Spatial Drone III*' — was performed at LEGROOM, featuring both synthesiser and tuba (see Figure 7).<sup>200</sup> As a dialogue between these two instruments, it contrasted human and machine articulations of resonance.<sup>201</sup> An installation realisation of *Spatial Drone* is proposed in the score. This offers an opportunity to immortalise processes of sounding and listening, leaving space to be perpetually animated in resonance, perhaps from multiple positions, and perhaps by numerous subjectivities.

*Spatial Drone* pieces develop a mode of sounding and listening in and through resonance, where focussed attention is placed on the detail of each resonant sensation and the way in which it plays on ear and body. Subjects bring themselves

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<sup>200</sup> See appendix 3 for a transcription of a conversation between James and I that was recorded in workshops for this performance.

<sup>201</sup> Listen to audio appendix 8. See also video appendix 3.

into resonant agreement with space again and again, through continual auditory presencing. The resonant knowledge afforded through this mode of situated listening is not final or totalising, but transient and relational, intensely embodied, predicated entirely on the subjective listening experience of the player. By resounding with it, subjects are modulated by space itself. What they experience is not the physical architecture, but a sonic stratum of it, a timespace that they create for themselves in listening. The embodied mode of phenomenon-contingent sounding and listening developed here lays the groundwork for the majority of the scores in the *Spatial Listening* collection.



## 6.2 Resonant Topographies

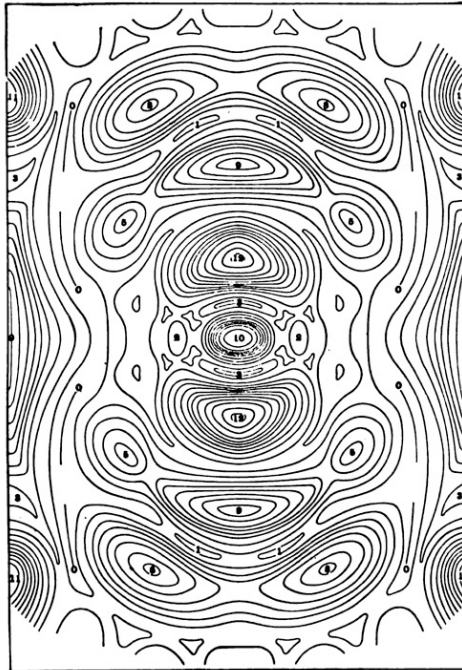


Figure 8: 'Distribution of intensity on the head level in a room with a barrel-shaped ceiling': Sabine, p.233

In these works, subjects form resonant sonic knowledges of architectural spaces through moving-listening. Resonant topographies are the 'sound geographies' caused by the interference distribution that occurs when resonant standing waves manifest.<sup>202</sup> When a resonant frequency of an enclosed space is constantly and steadily emitted within it, a train of sound waves propagate outward from the source, spreading through the space. Different parts of this train of waves meet with surfaces and reflect off them, folding back in on the space and interfering with one another to either reinforce or cancel each other out. As Sabine states:

Two sounds coming from the same source, in crossing each other, may produce silence [...] If [...] two trains of [...] waves so cross that the crest of one coincides with the crest of another and trough with trough, the effects will be added together. If the two sound waves be similarly retarded, the one on the other, their effects will also be added. If the two trains of waves be equal in intensity, the combined intensity will be quadruple that of either of the trains separately, as explained above, or zero, depending on their relative retardation.<sup>203</sup>

<sup>202</sup> 'Sound geographies' is a term used by Alvin Lucier. See Lucier, *Reflections*, p.152.

<sup>203</sup> Sabine, p.232.

After the sound waves have completely propagated through the space, and for as long as sound is emitted, a resonant topography is established.<sup>204</sup> Resonant topographies are spatio-sonic experiential milieux that are both defined by, and express, their housing architecture in sound, through frequency, distribution and amplitude. They are potentialities for sonically understanding space that must be activated by movement. These sound-spaces are at once essences and products of the physical spaces that contain them: they exist within physical space but are inseparable from the concrete environment. There is no definitive topography of a given site; every architectural space has a spectrum of possible resonant topographies, which constitute a spectrum of ways of approaching or understanding that space in sound. Each resonant frequency renders its own topography and every topography manifests in space in relation to the position of a sound source. The material composition of an architectural space defines the strength and clarity of the manifestation of topographies. The topographies rendered by axial, tangential and oblique modes pertain to different dimensions and planes of a space. Those that result from fundamental resonant frequencies are more directly relational to the physical dimensions of a given space and are felt more strongly than upper partials, which are ratios of the fundamental and have less energy. Whilst a number of artists have worked with resonant interference distribution — or resonant topographies — works predominantly only involve the presentation of the phenomenon.<sup>205</sup> The works that follow emerged from the personal discovery of this phenomenon during a series of resonance experiments conducted in the second year of the project.<sup>206</sup> They are ways of creating situations of moving-listening in relation to resonant topographies.

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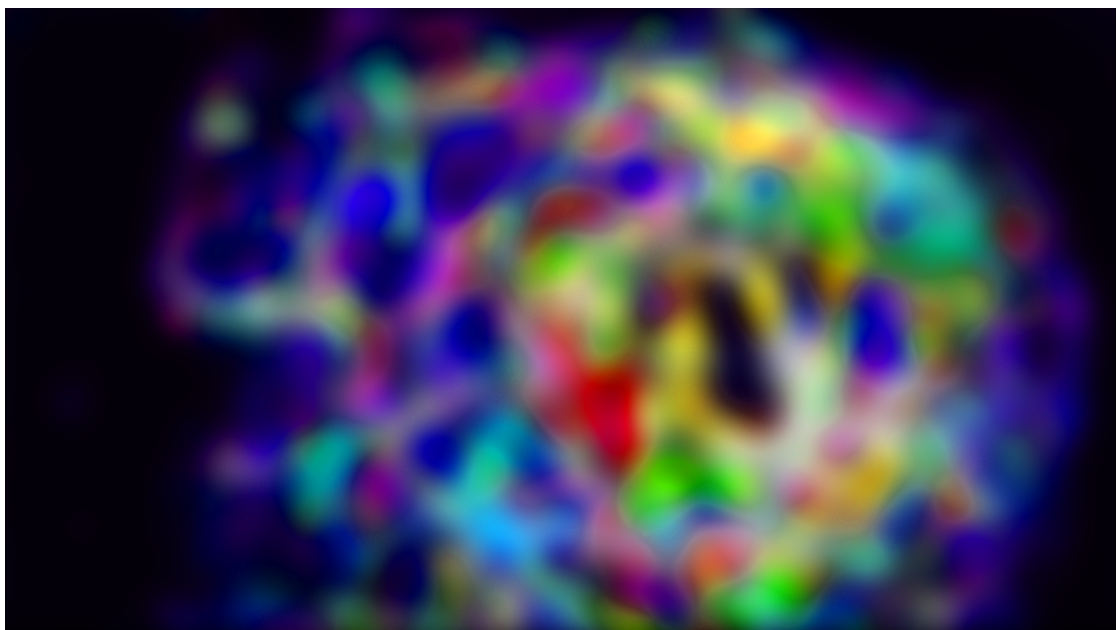
<sup>204</sup> Whilst resonant interference distribution is a physical fact, *Resonant Topographies* are positioned as potentialities for knowing, mediums through which architecture can be understood in listening.

<sup>205</sup> Here I refer to the works by Brewster and Atmajaja that deal with interference distribution. These are mentioned in chapter 3.

<sup>206</sup> For details of these experiments, see Alex De Little, 'Oxford Place: Resonances', *Alex De Little* <<http://www.alexdelittle.com/oxford-place-resonances/>> [15/10/2017].

### *Resonant Topographies Installation*

Sabine drew the above diagram (Figure 8) of the resonant interference distribution at head level at Jefferson Physical Laboratory, Harvard University. As Sabine describes, 'to an observer moving about in the room, it was quite as striking a phenomenon as the diagram suggests. At the points in the room indicated as high maxima of intensity in the diagram, the sound was so loud as to be disagreeable, at other points so low as to be scarcely audible.'<sup>207</sup> The first academic account of resonant interference distribution, this image was a product of careful, moving-listening; a visual crystallisation of embodied sonic knowing. It is an image that represents a fragment of the discoveries that Sabine made that later formed the basis for remedial acoustics. This work tracks back to Sabine's investigation and recreates this moment, not as a way of demonstrating a physical fact, but rather as a means of creating the kinds of sonic-spatial knowledges that enabled Sabine to create the diagram.



*Figure 9: Visualisation from Resonant Topographies Installation, courtesy Stuart Mellor*

In this installation, through moving-listening, visitors create visual representations of resonant topographies in real time.<sup>208</sup> It is jointly conceived and realised with Stuart Mellor.<sup>209</sup> An app accessible through each audience member's smartphone reveals the resonant environment by converting frequency to colour and loudness to

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<sup>207</sup> Sabine, pp.234-235.

<sup>208</sup> See video appendices 5 and 6. Appendix 5 is an interview with Stuart and I. Appendix 6 conveys some audience responses to the installation.

<sup>209</sup> This installation was conceived and developed jointly. Stuart was responsible for the development of the mobile app and Max/MSP patch. I was responsible for the sound element, the production and documentation, including an audience text score, which can be found in appendix 10. I include this work in the thesis with Stuart's permission.

brightness. A suspended wide-angle camera captures the colour and light values from visitors' interactions with the topography and these are projected onto one of the walls in the space as developing colour trails. As visitors populate the installation, the topography is revealed through colour and light. The acoustic signature of the space is rendered as a dynamic digital artwork that expresses the topography as a product of visitors' explorations in listening (see Figure 9). In this situation, subjects gain resonant knowledges of architectural space through cycles of reconciliation between movement, listening and looking in relation to sonic experience of resonant topographies, combined with their cumulatively manifesting visual representations. The installation was realised at Stage@Leeds as part of *Light Night* on 6 October 2017.

Unlike Sabine's experiment, which used only a single pitch, this installation used six compound resonant topographies, each consisting of two to four resonant frequencies layered on top of each other. These 'chords' were comprised of the space's strongest resonant frequencies, calculated by means of a series of impulse responses taken at different locations within the space.<sup>210</sup> The six compound topographies afforded the potential for multiple resonant understandings of the Stage@Leeds space. Each of the six resonant 'chords' manifested as complex distributions of frequencies that might be heard singly, or in any combination as one moved through the space. There were also areas of almost complete silence. Topographies were presented on a loop in sequence, each lasting for around five minutes. This relatively short length of time was intended to ensure that each visitor would experience multiple topographies, and therefore multiple acoustic framings of the space. Transitions between topographies were interspersed with white noise, which acted as a kind of auditory pallet cleanser. The sound system consisted of two Genelec 1238a speaker tops and two Genelec 7370a subwoofers placed in the centre of the space. This ensured the necessary amount of sound power to excite the large space as well as making free movement possible.

In this installation, compound resonant topographies are the mediums through which space comes to be sonically known.<sup>211</sup> As with an impulse topography, moving through a resonant topography produces sonic feedback, which in turn focuses listening attention. This process is the awakening of a listener's sonic body: as a subject moves through the space, the resonant topography implores them to listen, to think through sound, in approach of the architecture.<sup>212</sup> In this instance, movement becomes the language of listening. Moving through these topographies affects a multitude of varying levels of physical pressure. These combine with sonic experiences of pitch or multiple pitches, transitions from ear-listening to body-listening, iterative cycles of tension and release, where the body is vibrated —

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<sup>210</sup> Due to interference distribution, a microphone does not capture all of the sonic information of a space from one position: every position in space has a unique resonant profile. Taking multiple impulse responses, therefore, afforded a more holistic sense of the space's resonant profile.

<sup>211</sup> This might be seen as a resonant parallel to impulse topographies (as discussed in chapter 5).

<sup>212</sup> Here I follow Henriques's paradigm of 'thinking through sound'. See Henriques, p.xviii.

modulated — by different attributes of the architecture in different parts of the space, and where the distribution of resonant areas refers to the size and configuration of physical surfaces. As Michael Brewster posits in relation to his own resonant sound sculptures, ‘in these acoustic spaces we can hear only here, from in here. The scope of our attention implodes. The where of the experience happens here instead of there’.<sup>213</sup> Here, in the darkness of the installation, ocular conceptions of physical space as containing and separate fall away. Physical space is not an enclosure or a set of perspectives, but a configuration of sensations and thresholds. Size, shape, and volume are not seen but heard and felt. This way of knowing exists in the immediate, it is predicated on attention to sensations in every present moment. One is immersed in a sonic timespace, though not a timespace of ephemeral, disappearing sounds, but one of steady sonic structures that may be playfully explored: whose shapes, dimensions, and depths may be discovered. Sonic knowledge of resonant topographies is entirely embodied. The body is that which the sound space is compared against through movement. Every unique body experiences these sonic stimuli differently and varying sonic experiences play out as different listening dynamics.

Whilst resonant topographies themselves are the focus of this installation — the medium for sonic knowing — the visual element was intended to make a transient and ephemeral sonic experience explicit by translating the aural into visual. As an individual moves-listens through the space, in addition to sonic and somatic feedback, they experience the changing colour of their device’s screen. A subject also perceives themselves in relation to other moving subjects in the space, whose devices are responding according to their movement, as well as in relation to their trace on the projected screen; as a part of an amassing whole, which over time begins to reflect the distribution of sound in the space through audience interaction. As one audience member mentioned:

[...] I come [sic] to the installation with a certain knowledge already, that is a bridge to cross. And I think the other elements of the installation cross that bridge. You know, a child can come into that and enjoy seeing their trace and so on and so forth, and then slowly these other things are revealed [...]<sup>214</sup>

The visual element seizes on ocular tendencies in order to create situations of listening. Visual feedback is inserted into the reflexive experience of moving and listening, allowing listening to be led by, or to occur in terms of, the visual. The act of listening ceases to be ‘straining in approach of’, and becomes something that is confirmed and documented by a color and light value. Present, ‘here’ experience of sound in each moment is frozen in the projection as a ‘there’ value of light that cumulatively manifests as a totalising representation of the topography. LaBelle’s emergent public loses its sense of doubt and fallibility here, becoming instead

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<sup>213</sup> Brewster, ‘Where, There or Here?’ in *Site of Sound: of Architecture and the Ear* ed. by LaBelle and Roden, pp.102-106 (p.103).

<sup>214</sup> Transcription from video appendix 6.

represented and explicit.<sup>215</sup> The screens of others act as dynamic listening way-markers for possible sonic exploration, ways of showing common relations with regards to the acoustic whole. Whilst this visualisation was intended as a way-in to sound and a way to open up sonic exploration, a number of visitors commented that they found the visual element of the experience distracting, preferring instead a pure experience of the sound:

Just as you turn off the lights [...] you kind of notice those frequencies more and because they're such low frequencies as well, you do notice how they impinge on your body [...] I think you notice that far more when you give yourself to the sound, you listen onto the sound.<sup>216</sup>

Whilst on one hand, the visual element might provide a way into listening by making the exploration of resonant topographies accessible, on the other it might be seen to detract from a direct sonic experience. One might argue that the totalising image of a topography undermines the act of listening: its flat simplicity detracts from the present, complex and embodied spectrum of aural and somatic sensations. The objective 'truth' of an image brushes aside a sense of doubt, which is crucial for — as Voegelin has it — the act of listening.<sup>217</sup>

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<sup>215</sup> See Brandon LaBelle, 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Corbussen, Meelberg and Truax, pp.275-285.

<sup>216</sup> Transcription from video appendix 6.

<sup>217</sup> Voegelin, p.xi.

## *Resonant Topographies: Listening-led Movement*



Figure 10: Tora Hed and Hannah Buckley performing *Resonant Topographies: Listening-led Movement* at the Calder, The Hepworth Wakefield, July 2017

*Resonant Topographies: Listening-led Movement* follows Henriques's assertion that, 'you should be able to dance philosophy'.<sup>218</sup> In this piece, two dancers and an audience form sonic knowledges of an architectural space by moving-listening in relation to resonant topographies (see Figure 10).<sup>219</sup> The piece lasts for thirty minutes and consists of three sections, each lasting ten minutes and featuring a different compound topography.<sup>220</sup> In the first section, the audience is seated and the dancers explore the topography autonomously with their eyes closed, unaware of each other. Each dancer allows themselves to be moved by the topography, gradually establishing patterns of movement — choreographies — in relation to it. In the second section, the audience remain seated. The dancers open their eyes and begin to move and listen in relation to the second topography, in terms of each other. Listening-led approaches to choreography developed independently in the first section are shared in terms of a new topography as dialogue and negotiation. In the final section, the audience — via a text score handed out before the performance — is invited to experience the final topography. This engagement occurs in terms of their experience of observing the dancers during the first two sections. This piece is site-generic; it enables any enclosed space where free movement is possible to be explored through resonant topographies.

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<sup>218</sup> Julian Henriques, 'Thinking through Sound', in *ON LISTENING #1: THINKING THROUGH THE EAR*, *Radio Web Macba* <<https://www.macba.cat/en/rwm-on-listening-1>> [03/12/2018] (starting at 1:08:40).

<sup>219</sup> See video appendix 7. This performance took place at the Calder, The Hepworth Wakefield. See appendix 13 for the performance programme.

<sup>220</sup> See the score and Max/MSP appendices 3 and 4 for information on how these are practically configured.

As they move-listen in relation to resonant topographies, dancers form choreographies. Choreographies are concerted presentations of moving-listening: they are externalisations of sonic-knowing. In Alvin Lucier's *Still and Moving Lines of Silence in Families of Hyperbola* (1973-1974), dancers are moving markers; proof of the manifestation of quiet points in interference distribution. The composer states that 'any number of dancers discover troughs of quiet sound along axes of pairs of loudspeakers which they may follow, changing directions if they wish, at intersections.'<sup>221</sup> In this piece, the task for the dancers is broader; they think through resonant topographies in all their complexity. Movement is not limited or composed, but treated as a language of listening that opens out through the body to communicate sonic knowing. Dancers' bodies compose and transmit their aural experience:

[...] for me there was something about the enjoyment of shifting between spaces [...] so when you get between two points, there's something enjoyable about shifting back and forth which is what leads to that movement, when you find that curve or whatever. But flicking between those two points is kind of satisfying.<sup>222</sup>

Isn't it something with a rhythm, because sometimes I feel it's quite not so much rhythm in the sounds, but when I do this [moves head back and forth], there is a rhythm, right? It's like, sound, sound, sound, sound. So it could also be that the body is trying to find rhythm.<sup>223</sup>

Here Hannah Buckley and Tora Hed describe instances of choreography emerging from moving-listening interactions with the topography. They both describe aurally and physically registering a resonant threshold, either between two frequencies, or between a node and an antinode. A realisation about a topographical feature gives rise to a movement that in some way reflects that feature; a movement that is an externalization of the feature imbued with the specific dancer's perception of it. Unlike the exploratory movements of attendees to the installation, these choreographies are performed and presented. This scenario might be viewed through the prism of Feld's acoustemology as 'a way to enquire into knowing in and through sounding, with particular care to the reflexive feedback of sounding and listening'.<sup>224</sup> Movement here is tantamount to sounding: reflexive feedback between body and sound is what creates choreographies, which are here posed as form of sonic knowing. To create modes of movement in relation to a specific feature of a

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<sup>221</sup> Alvin Lucier and Douglas Simon, *Chambers: Scores by Alvin Lucier* (Middletown, CT: Wesleyan University Press, 1980), p.128. Incidentally, Lucier admits in a later chapter that stepping back from the act of composing produces some interesting results: '[...] I'm tossing away a lot of scientific ideas I had and depending a lot more on a player's response. [...] When we were practicing in the Merce Cunningham Studio in Westbeth, I gave her [Joan La Barbara] one oscillator sound coming from the four loudspeakers, and one of the first things she did was just to move around the space a little bit with her eyes closed and her ears really open.', p.136. This is the situation that my piece tries to capture and use as its basis.

<sup>222</sup> Hannah Buckley. From interview with Tora and Hannah. Appendix 1

<sup>223</sup> Ibid.

<sup>224</sup> Feld, 'Acoustemology', in *Keywords in Sound*, ed. by Novak and Sakakeeny, pp.12-21 (p.14).



topography is to decide on its qualities and how they play on the body. It is to *know* an aspect of the topography. Choreographies emerge from resonant topographies in relation to the attributes that physically register with a given dancer. What registers is defined by the unique body of each dancer, their listening awareness, and the space which gives rise to the resonant topographies. These three elements are caught in a triangulation, a dynamic, in which they mutually define and resolve one another.<sup>225</sup> A space gives rise to resonant topographies: elements of these register in different ways with dancers and choreographies emerge. These choreographies in turn define the body of the dancers, they bring dancers into their bodies by impinging on them, defining their limits, their innate resonances and their motility. Each choreography — any given movement response to a topography — is defined by listening attention and scope. Both Tora and Hannah's choreographies were at times free, open to the whole space, perhaps indicating a broad scope of listening, more led by overall sense than specificity.<sup>226</sup> At times choreographies were focused, repetitive and specific. These suggested a mode of deep listening, which approached the quality of specific parts of the topography, as if independent phenomena described to the dancers the exact type of movement that was required. In this situation, the size of a movement might be relational to the size of wavelength, reflecting the location of the phenomenon, even the intensity.<sup>227</sup> Choreographies in this work are a product of a reflexive relationship between movement and topography triangulated with listening attention. They are sonic knowing on the level of the body, a sonic knowing that emerges from a constant dynamic state of 'responding to' discreet elements of a resonant whole, a perpetual state of listening, a presence.

Whilst choreographies are necessarily emergent, this work structures the relationalities between dancers, and between dancers and audience as a way to direct the formulation and transmission of sonic knowledges. The piece's structure follows the natural progression of exploratory instincts in relation to the topography:

Today obviously this is the first time that we've done it so we have been quite deeply in our own investigations, but then there was a point where I could imagine also trying to build in the relation- like having more awareness of each other and the impact of that on the sound.<sup>228</sup>

In workshops for the piece, Hannah mentioned that she was initially naturally inclined to engage with the topography at first in her own terms, before seeking to explore it in relation to Tora. The structure of the piece emulates this process of discovery. It uses the dancers' development of choreographies as sonic knowing as a way to bring an audience into listening engagement with the topography. In the first section, each dancer builds choreographies entirely in terms of their isolated subjective response to a topography and in relation to their own body. In the second section,

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<sup>225</sup> This echoes with Henriques's notion of triangulation. See, Henriques, p.265.

<sup>226</sup> See video appendix 7 from around 5'45".

<sup>227</sup> See the beginning of video appendix 7.

<sup>228</sup> Hannah Buckley. From interview with Tora and Hannah. Appendix 1.

choreographies are generated through dialogue, sonic knowledges are shaped by a negotiation.<sup>229</sup> During this time, an audience is observing dancers' choreographies — their sonic knowing — as a performance. When they come to experience the topography in the third section, they do so with the experience of having seen the dancers' engagement. Choreographies function pedagogically, suggesting to the audience potential ways of moving-listening. The ocular here plays to the aural: in the first sections choreographies build a sense of anticipation in the audience, a desire to explore what drives the movement of the dancers; they pull the audience into listening. This piece allows numerous radically different subjectivities to be articulated against a topography, to engage with it, and eventually each other through it: listening breaches the barrier between performer and audience.

These two works constellate situations of moving-listening in dialogue with resonant topographies. Space is known in relation to the shape, size and changing orientation of the body as frequency, physical force and threshold. Space is created sonically for each subject entirely in relation to their autonomous processes of movement. What is known is not 'the' physical architecture, but sonic strata of that architecture. The installation tracks back to Sabine's discovery, allowing subjects — led by their ears and eyes — to visually uncover resonant topographies. In *Listening-led Movement*, resonant topographies are positioned as sonic milieux through which space comes to be known by dancers by means of the development of choreographies. This work is structured as a pedagogy of listening; dancers develop their own listening in relation to a topography and communicate it to each other and an audience.

The works in this chapter have investigated architectural space in resonance, both in sounding and situated listening, and in moving-listening. To know a space in resonance is to be resounded according to it and to be modulated by it. Sonic knowledges of architectural space might be characterised in terms of threshold, physical force, frequency, scale, or distribution. These works are not their realisations; they are potentialities that allow many spaces to be known in and through resonance: they are resonant meditations that exist in the present moment. *Deep Sea* takes a looser approach to resonance as knowing. Developed with Tora Hed for the Hull Choreography prize, it used the resonant stimulation of the performance space, combined field recordings made by Tora as the basis for a choreography that responds to both present and remembered auditory experience.<sup>230</sup>

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<sup>229</sup> Hannah Buckley articulates this sentiment in appendix 1. See p.96 of this document.

<sup>230</sup> See video appendix 8. See also Alex De Little 'Deep Sea // Tora Hed // Hull City of Culture Choreography Competition, 2017', *Alex De Little* <<http://www.alexdelittle.com/deep-sea-tora-hed-hull-city-of-culture-choreography-competition-2017/>> [15/10/2018].

## 7 *Spatial Listening*



Figure 11: *Moving Singing*, Odrathek Festival, London, March 2017

### Introduction

*Spatial Listening* was the last element of practice to be developed as part of this research project. It may be contextualised by these reflections from Alvin Lucier on a coincidental realisation of *Vespers*:

After the program was over, we packed up all our equipment and went into the town. It was early spring in Finland, that period of time when the sun finally comes out after a long period of darkness, and as we walked through the streets of Helsinki, we could hear people, singly, or in groups of two or three, playing their "crickets." It was beautiful. Perhaps they got the point of the piece more after the concert than they did during it.<sup>231</sup>

Here, Lucier describes the events that occurred after having conducted a participatory performance of *Vespers*. During the performance, he mentions that people began to play 'banal' rhythmic figures rather than turn their attention toward sonic reflections.<sup>232</sup> Later, when the group was free of the concert environment, they began to start listening to space as a matter of genuine curiosity. In July 2017, I conducted a workshop version of *Vespers* in a public square in rural Poland, which intended to reflect this sentiment. Before we performed the piece, we spent time walking the streets, listening openly, free of instruction. The works discussed thus far represent my own practice, but it struck me that what was effective about this workshop was that participants were free to listen as a matter of their own practice.

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<sup>231</sup> Lucier, *Reflections*, p.76.

<sup>232</sup> *Ibid.*

To significantly listen to architectural space cannot be something which only occurs in works, it must come from within: it must be part of a more profound ontological shift. *Spatial Listening* has been concerned with the development of instructions for a practice. It is a recent workshop and performance practice, recorded for this submission in a series of text scores and activations, in which participants explore their relationship to, and understanding of, architectural acoustic space through the creation and audition of sound.<sup>233</sup> The idea for a *Spatial Listening* workshop practice grew out of the workshops given as part of the *Listening Devices* project. Whilst the realisation of these scores can take place in multiple contexts, fundamentally, they are human algorithms in which people play with and through ubiquitous acoustic phenomena of resonance, echo and reverberation in any spaces in which they may be heard.<sup>234</sup> In these scores, participants excite spaces either with the voice or using handheld percussion instruments to create impulses.<sup>235</sup> The dynamic and embodied sounding and listening developed in the spatial drone pieces — which places subjects in resonant dialogue with architecture — forms the basis for almost every score in the collection: after or during each excitation of a given space, participants are asked to listen closely for particular acoustic events or qualities, such as a returning echo, the end of a reverberation tail, or the modal resonance of a room. The nature of what is perceived aurally in a given situation informs the further process of sound creation.<sup>236</sup> In this sense, *Spatial Listening* resonates with Michael Gendreau's sense-conceptual framework.<sup>237</sup>

Recalling the prolegomenon, *Spatial Listening* can be seen as an extension of the moment in which somebody shouts to hear their voice resound. This an act of auditory presencing: instinctive and meditative. In it a person hears themselves in this space and in this moment. *Spatial Listening* reconceives of this often-singular act as evolving cycles of sounding and listening, in which knowing-in-action and thinking-through-sound can begin to open up. Four categories of scores deal with impulse, reverberation, echo and resonance. Each category allows knowing-in-action to open through the prism of a given phenomenon. The collection calls on the modes of situated listening and moving-listening that were developed in earlier works to modulate the possibilities for this knowing-in-action even further. It does so by specifying different physical relationalities between participants, and between participants and acoustic space. Some scores place a focus on the relationality

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<sup>233</sup> For a sense of a *Spatial Listening* workshop, see video appendix 9. The submitted collection of text scores is also published as a *Spatial Listening* workbook by Wild Pansy Press. See Wild Pansy Press, 'Spatial Listening', *Wild Pansy Press* <<http://wildpansypress.com/spatial-listening>> [18/12/2018].

<sup>234</sup> This definition of compositions as 'human algorithms' comes from Pauline Oliveros's commentary on her *Deep Listening* scores. See, Oliveros, *Text Scores Anthology*, p.v.

<sup>235</sup> Depending on the acoustic phenomenon in question.

<sup>236</sup> The only instance for which this is not the case is in the three scores that relate to impulse.

<sup>237</sup> See Gendreau, 'Concerted Structures' in *Site of Sound #2: of Architecture and the Ear*, ed. by Martinho and LaBelle, pp.33-42 (p.33).

between an individual and an acoustic space, whilst others explore the relationalities between groups of participants within an acoustic space. In the context of a single score, a relationality may be fixed, or there may be movement instructions that are carried out in response to the cyclical process of sounding and listening. In this way, processes of thinking-through-sound in relation to the architectural environment open up in individual participants, but also as a product of dynamic social relations.

As Pauline Oliveros expresses in her work, the choice to listen is a political one.<sup>238</sup> *Spatial Listening* exists in order to enable people to engage a sonic mode of being in space, as a way of challenging normative modalities. *Spatial Listening* reverse-engineers Feld's acoustemology. Rather than using it to unpack cultures of sounding and listening to understand the ways in which they know, it produces them. Deploying workshops in public space calls back notions of Henri Lefebvre's body revolt: *Spatial Listening* requires bodies to gather in spaces. In these moments of coming together, occupied spaces — if only for moments at a time — are claimed as spaces of sounding and listening. Emergent listening publics propagate sound, implicating all within earshot in the hearing of them.<sup>239</sup>



Figure 12: Activations at Den Frie Centre for Contemporary Art, Copenhagen, February 2018

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<sup>238</sup> Oliveros, *Deep Listening*, p.xv. I should also note that this practice was inspired by Augusto Boal's 'Games for Actors and Non-Actors'. See Augusto Boal, *Games for Actors and Non-Actors*, trans. by Adrian Jackson, 2<sup>nd</sup> edn. (London: Routledge, 1991).

<sup>239</sup> For a brief sense of a *Spatial Listening* Workshop, see video appendix 9.

## Activations

The collection of activations falls into three categories.<sup>240</sup> Body activations intend to bring participants into a sense of their bodies by increasing blood circulation, activating a series of joints and stretching various muscle groups.<sup>241</sup> Breath exercises function to centre participants in order to support various modes of listening.<sup>242</sup> Group activations follow body activations and breath work. They intend to bring a group of disparate people together as a functioning organism. They are intended for group engagement with spatial listening and form the beginnings of workshops or performances.<sup>243</sup> Whilst it does not engage directly with acoustic phenomena, *Moving Singing* is halfway between a score and an activation. It encourages the development of auditory spatial awareness.<sup>244</sup>

### 7.1 Impulse

Whilst *Reflection // Position* is the creation of a work, a piece of hardware that creates impulse topographies in spaces, the three impulse pieces in *Spatial Listening* are practices of movement and impulse-creation.<sup>245</sup> Unlike the pieces in the echo and reverberation collections that follow, they do not involve playing ‘with’ a phenomenon. Rather, they are systems — both contingent and non-contingent — for the repetitive expression of architecture through impulses that unfold inside, outside, or anywhere in between, from the perspectives of multiple subjects over

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<sup>240</sup> The activations displayed in the collection are those that have worked most successfully in practice. Individual exercises were collected in various workshops in which I participated. These include most notably *Deep Listening* workshops with Ione, workshops with the vocalist Melanie Pappenheim, workshops with Ali Campbell, a student of Augusto Boal, workshops with Suzi Willson of Clod Ensemble, and Ben Hadley on the techniques of Jaques Lecoq, and workshops with James Taylor on the Dru system of Yoga and meditation.

<sup>241</sup> These are adapted from the Dru Yoga tradition. The extreme slow walk originates in Buddhist traditions, though it is used in Pauline Oliveros’s *Deep Listening* practice, see Oliveros, *Deep Listening*, p.20. The slow movement of walking acts as an anchor for a focus on other senses. It is useful in the context of this practice as it requires little experience from participants but is an effective way of focussing listening attention.

<sup>242</sup> Grounded breath, from the Dru yoga practice, works to bring a sense of vertical alignment and focuses participants well for situated pieces. Jumping breath is energising and fosters a sense of alertness. Voiced breath is useful for activating the voice in preparation for the resonance scores.

<sup>243</sup> Walking at Different Speeds adapted from LeCoq’s practice requires dynamic decision making and spatial awareness, thereby forming a basis for those pieces in this collection that involve movement. *Moving, Touching* is excellent for bringing a group together and it forms the basis for *Moving, Singing*. I picked up *Moving, Touching* in a workshop with Ali Campbell. Circle Singing was taught to me by Melanie Pappenheim and is a satisfying, group-centric way of warming up the voice.

<sup>244</sup> Listen to audio appendices 14, 15 and 16.

<sup>245</sup> These pieces were developed as part of my ‘Listening to Architecture’ residency at LEGROOM in Manchester.

time and through space. They are ways of claiming space and knowing spatial environments through sounding and listening.<sup>246</sup>



Figure 13: Workshopping *Impulse Pieces* in Manchester as part of a residency at LEGROOM, November 2017

### ***Dispersed Impulses: Fixed, Dispersed Impulses: Moving, Circle Moving Outward***

In *Dispersed Impulses: Fixed*, subjects begin by individually moving, sounding and listening through a chosen space in order to find acoustic areas that produce impulse responses that grasp their attention. As each subject finds a captivating impulse response, they settle where they are best placed to excite it and begin to regularly sound their instrument to an internal count. When a given subject is satisfied with their excitation of an acoustic area, they resume the process of scanning the space in order to find an alternate impulse response. In a situation where many individuals undertake this process as a group, a constellation of impulses is created that repetitively excites a space or series of architectural spaces. As subjects move from one area of acoustic interest to the next, this impulse constellation gradually morphs and changes in accordance with the intuition and attention of individuals as they are drawn to different areas of acoustic interest.

In this piece, the process of scanning the space and listening is led by intuition; players are 'pushed around' by the acoustic tensions and characteristics, pausing when they find areas that resonate with them.<sup>247</sup> Sonic knowledges are constituted for each player-listener in relation to their own process of sounding and listening: an iterative uncovering of acoustic areas, perceived through impulse-signatures, which are heard again and again as associated with a series of corresponding visual perspectives. Players also perceive space in relation to the sounding-listening processes of other subjects as part of a sounding group: they simultaneously experience the part and the whole. For members of an audience or public, the space

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<sup>246</sup> See video appendices 11 and 12. Appendix 11 contains clips of *Dispersed Impulses*, *Moving*, and *Circle Moving Outward*: 2:09, and 3:07 respectively.

<sup>247</sup> This is an expression of Lucier's. See, Lucier, *Reflections*, p.80.



is claimed and constituted in sound, expressed by a gradually morphing constellation of impulses that are a product of the sum of individual processes of playing-listening.

In *Dispersed Impulses: Moving*, subjects walk consistently, slowly and evenly, through space(s). As each subject moves, they regularly sound their instrument on a count of between seven and twelve steps (counts are decided privately). A perpetually morphing constellation of impulses is created, an ever-changing sound space that continuously (re)constitutes and (re)defines the architecture in which it exists. Two key differences set this aside from its sister piece. First, the process of sounding and listening that takes place is inspired by the extreme slow walk. It is undirected, passive, and meditative. Listening attention is not biased by particular acoustic phenomenon, but flat and even. Space is known sonically from the perspective of each individual as a series of unique impulses, each capturing a positionality, a space and a moment in which each hearing of impulse is combined with the effort of movement and visual perspective. Second, the space is heard in constant flux, as a product of changing relations between an individual subject and their architectural environment, and between sounding subjects, publics and audiences. This piece moves through streets, across cities, under bridges. Players congregate and disperse. The piece claims each space it moves through for as long as it exists there, for a fleeting moment, or for much longer.

*Circle Moving Outwards* is a group choreography for the systematic spatialisation of impulses. A group of players assemble in a circle in the middle of an outdoor architectural space. An impulse is passed around the circle from player to player until a temporal regularity is established. When this has been achieved, each time a player makes an impulse, they take one step away from the circle out into the space. The circle gradually expands as impulses are created, until there is no more room to expand. *Circle Moving Outwards* initiates a contingent, systematic mode of moving and sounding as a group. It engages a mode of listening that creates knowledges of space for player-listeners through a reconciliation between changing positions in space and corresponding impulses. Unlike the relatively open modes of sounding and listening used in the other two pieces in this collection — which produce a milieu of impulses — this piece produces a temporally regular sequence of unique impulses: a series of unique understandings of a space, each of which relates to a given subject's position in a given moment. This manner of sonic knowing is process-driven and iterative.

These pieces take the impulse as a unit of spatio-sonic knowledge. The *en masse* creation of impulses in outdoor spaces captures them as sonic and implicates all who occupy them in the hearing of them. The pieces are different modes of sounding and listening, which through the way that they structure the production of impulses, produce different ways of knowing spaces. Sonic knowing through impulse in these pieces is inherently audio-visual; it involves a reconciliation between physical location, visual perspective, and acoustic signature.



## 7.2 Reverberation



Figure 14: *A Song Composed of a Number of People's Lives*, Den Frie Centre for Contemporary Art, Copenhagen, February 2018

Speaker 1: When you think of composing [...] anything, like making structures, it was really interesting because when you're making sound, people, like randomly, like enjoy resonance [claps]. It could be a song. But there [...] was no patterns. That was constructed by people's will and then...

Speaker 2: Yeah I wonder though, I mean there's certain things that people associate with the sounds that they try and automatically turn them into harmonies or musical compositions.

Speaker 1: That's what I mean, but where it comes from though [...] it comes from the life. So that's what I thought interesting you know. It's a song, composed of like, ten people's lives.<sup>248</sup>

The improvisational practices of Pauline Oliveros' *Deep Listening Band* use the temporal and timbral properties of reverberation as stimuli for musical improvisation. Cycles of sounding and listening are governed by the accumulation, blending and decay of sounds across a fixed reverberant temporality.<sup>249</sup> The pieces in this collection involve 'playing reverberations'; they are meditations on the reverberant qualities of spaces. Eschewing overt notions of musicality, these scores call for

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<sup>248</sup> Transcription from *Points of Listening* workshop recording. For full recording, see Alex De Little, 'PoL Workshop Insights', *Soundcloud* <<https://soundcloud.com/alex-de-little/pol-workshop-insights>> [28/12/2018].

<sup>249</sup> Pauline Oliveros, Stuart Dempster, Panaoitis, *Deep Listening* (San Francisco, CA: New Albion Records, 1989) [on cd].

sounding only in order to listen. The scores may occur in any enclosed space with a perceptible reverberation, creating situations where people are organised around reverberation, both in sounding and listening. They engage the mode of machine listening and sounding conceived for the proto-installation *RT60*, deploying it in a manner that is entirely embodied.

***A Song Composed of a Single Person's Life, A Song Composed of a Single Person's Life — Moving, and A Song Composed of a Number of People's Lives***

In *A Song Composed of a Single Person's Life*, a single subject with one or more wood or plastic struck percussion instruments situates themselves within an enclosed space. They begin the piece by striking an instrument with sufficient force to produce reverberation. From this moment onwards, the player makes each following sound at the exact moment that they perceive a reverberation tail to have completely died away. The piece continues in this manner until the subject is satisfied. At this point they might either finish, or move to another location within the same space, or different space altogether, before beginning again.

The manner of sounding and listening that occurs in this piece — as well as its two sister pieces — might be known as 'playing' reverberation. To play reverberation is to be in resonance with it, both in the sense of being resounded by it, and in the etymological sense of striving towards an 'agreement' with it. To agree with reverberation in this sense is to perfectly match its temporality, however, perfect agreement is never possible, owing to human inaccuracies and the interruption of ambient sounds. What playing reverberation affords is a reflexive mode of listening-sounding that perpetually focuses a subject's awareness on the temporality and characteristics of a given reverberation tail. This mode of listening-sounding causes a subject 'always to be on the edge of meaning, or in an edgy meaning of extremity', a state which, for Nancy, constitutes listening, and for Feld is the means by which sonic knowledges come about.<sup>250</sup> In playing a reverberation, sounding occurs in order to initiate this state, and this state is maintained in order to time the next impulse. As cycles of listening-sounding unfold, a subject listens through the contour, timbre and temporality of reverberation (as perceived), towards — and in approach of — the ways in which these sounds describe the acoustic space, as well as a subject's place within it. The body establishes its own temporality, the ear stretches to the contour of the space; a subject comes to know a space sonically, whilst simultaneously articulating their own auditory existence within it.

The sonic knowledges produced by playing reverberation are situational and relative: they are determined by a subject's positionality and the instrument(s) used. A subject's position within a space determines the manner in which created sounds will propagate through it and return to their ears as reverberation. Given this, the qualities and temporalities of reverberations may vary considerably, despite the fact

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<sup>250</sup> Nancy, p.7. I refer here to the notion of reflexive feedback between sounding and listening. See Feld, 'Acoustemology', in *Keywords in Sound*, ed. by Novak and Sakakeeny, pp.12-21 (p.14).

that they are all a product of a single space.<sup>251</sup> Whilst the sounding means in these three pieces is limited, instruments with different sound radiation patterns and timbres stand to interact variously with the resonant properties of a space (thereby producing reverberations of different lengths and timbres), and propagate differently through the space. The size and nature of a space produces its reverberation: the act of playing a reverberation is transformed in its nature from space to space. In *A Song Composed of a Single Person's Life*, a subject comes to know a space from a fixed position through the sounding potentials of one or several different instruments. This mode of playing reverberation affords depth of understanding through repeated cycles of sounding and listening. A space comes to be known in many repeated hearings of a reverberation, through the intimate knowledge of its temporality, contour and timbre in relation to the effort and action of sounding.

In *A Song Composed of a Single Person's Life — Moving*, a subject plays a reverberation whilst moving slowly, consistently and without direction through an enclosed space or series of spaces. A reverberation tail — something that was before perceived statically — is now perceived as a product of a subject's constantly varying relation to a space and the location where each impulse was created. Whilst the first reflections of a reverberation tail might be heard in relation to the point of origin of the impulse that created them, as a reverberation progresses, the subject moves across, through and against the milieu of sonic reflections that constitute it, perceiving them in an ever-changing relationality to the space. Sonic knowing in this piece is holistic, formed by a listening attention that continuously maps the propagation of reverberation across time and through spaces. It exists in the perception of the variations of the character of a reverberation across timespace.



Figure 15: *A Song Composed of a Single Person's Life — Moving*, British Pavilion, Venice Architecture Biennale, August 2018

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<sup>251</sup> See Augoyard and Torgue, p.111.

In *A Song Composed of a Number of People's Lives*, a group of subjects equipped with wood or plastic struck percussion instruments distribute themselves through a space or series of spaces, put on blindfolds and begin to play a reverberation.<sup>252</sup> Whilst the piece is in motion, players change their locations in the space and resume playing and listening at any time. In this situation, sonic knowing is produced by, and produces, a group dynamic; a sociality of listening. Reverberation is articulated from multiple positions in space (or from multiple spaces), through multiple subjectivities, and possibly with different sounding means. Any given subject forms sonic knowledges of the space through their own process of sounding and listening, but this process is subject to continual interruptions by other members of the group: the temporality of reverberation is in constant dispute, perceived by different subjects, with different listening attention and from different locations in the space. The dynamic afforded by this human algorithm acknowledges that there is no single sonic essence or knowledge of a given space, but rather that sonic knowing is dynamic, constituting what is perceived from a given location, by a given person, in a given moment in time. In this piece, listening is a 'putting out there', an act which is externalized by sounding, where each instance of sounding in turn affects every individual's perceiving and knowing of the space, as well as their further process of sounding. Through this sociality of listening, a space comes to be known as the product of all subjectivities interacting with it, but also as a means by which a mode of social interaction may come about.

In playing reverberation, spaces may become known through the repeated audition of reverberation tails in approach of their temporalities and qualities. Reverberant knowledges of space might be characterised in terms of temporality, contour and timbre, in relation to established bodily rhythms of sounding. In *A Song Composed of a Single Person's Life*, sonic knowing is situated, meditative and intimate. In *A Song Composed of a Single Person's Life - Moving*, it might be characterised as holistic and fluctuating. In *A Song Composed of a Number of People's Lives*, space is known in reverberation as, and through, a social dynamic.

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<sup>252</sup> Listen to audio appendices 12 and 13. These versions respond to entirely different acoustics. Audio appendix 12 was recorded in the vast, reverberant acoustic of the British Pavillion at the Venice Biennale. Audio appendix 13 was recorded at the Calder at the Hepworth Wakefield, a brick-built warehouse space.

### 7.3 Echo

The manner of sounding and listening in relation to reverberation in the previous pieces is developed here in relation to the phenomenon of echo. An echo is reflection, a sonic trace that testifies to a passage. As Casey O’Callahan posits, ‘the apparent echo is the original or primary sound perceived with the distortion of place, time and qualities.’<sup>253</sup> Sounding and listening through echo is explored in Alvin Lucier’s *Vespers*, in which subjects echolocate through the disembodied emission of sounds through sondols,<sup>254</sup> and Michael Parsons’s *Echo Piece at Muddusjarvi*, which choreographs the production of echo through an explicit set of instructions.<sup>255</sup> Whilst these pieces engage listening subjects with echoes, in neither of them does both sounding and listening explicitly occur in relation to the echo itself. Lucier’s impulses are a means to echolocation, whilst Parson’s work leans more towards choreographing movement in relation to sounding than the experience of echoes. These pieces create a number of situations that place subjects in temporal resonance with echoes through sounding and listening.

#### *Playing an Echo, Playing an Echo (Moving), Reflective Polyrhythms, Daisy Chain*

*Playing an Echo* asks a single subject equipped with a woodblock to move through outdoor space, testing it by sounding and listening, in pursuit of a clearly defined echo. Upon the discovery of an echo, the subject situates themselves in the best location to excite it and begins to play it by striking their instrument at the exact moment — and every time — its sonic reflection or reflections have died away. As they play an echo, the subject gradually varies timbre and dynamic. Over the course of this sonic variation, the perceived temporality of the echo may change. If and when this is the case, the subject begins to play the newly perceived echo, varying timbre and dynamic over time. Each time the temporality of an echo is perceived to have changed, playing is adapted to follow it. When the subject is satisfied with their exploration of a particular echo, they begin to scan for another before restarting the process.

To play an echo is to be in resonance with it, to resound with it and to be in the pursuit of an agreement with it. Whilst this manner of sounding and listening is similar to playing reverberation, the phenomenon through which it occurs is different. In reverberation, space is heard as a changing contour, but in echo it is heard as a single discreet reflection or series of discreet reflections. Reverberation is the product of enclosed environments that contain sonic reflections, but echo is the product of open environments where sounds are perceived to return on discrete occasions before diffusing into the aether. To play echoes, then, necessarily requires a different mode of listening to playing reverberation. It is concerned more with

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<sup>253</sup> O’Callahan, p.407.

<sup>254</sup> See Alvin Lucier, ‘Taking Slow Audio Photographs of the space’, in Lucier, *Reflections*, pp.74-85.

<sup>255</sup> See John Lely and James Saunders, *Word Events: Perspectives on Verbal Notation* (London: Continuum, 2012), pp.50-51.

sounding in relation to the implied 'rhythm' of a single returning sound — or series of discreet returning sounds — rather than sounding in relation to a duration; the decaying homogeneity of a reverberation.

In *Playing an Echo*, a subject or group of subjects play echoes in situ.<sup>256</sup> Listening through echoes, they begin to hear reflections in relation to a series of physical surfaces: the temporality and intensity of these reflections begin to pertain to their distance and orientation, and the timbre (and intensity) to their materiality. This mode of sonic knowing — as with the other phenomena — is situational and relative: through playing echoes, a subject produces their spatial environment in sound, whilst simultaneously defining their own position and presence within it. The playing of an echo in situ allows its continual audition over time and in relation to varying instrumental timbres and dynamics. This allows a spatial configuration to be intimately known in sound through the detailed hearing of each aspect of an echo. As a player varies timbre, they manipulate the sonic frequencies that propagate into the space, which, in their various propagation characteristics and energy profiles, highlight different aspects of that spatial configuration, modulating how it might be sonically known.<sup>257</sup> Dynamics also modulate listening awareness: a low dynamic, which uses the least sound required to excite an echo, stretches the ear towards that echo, whilst playing as loudly as possible fully excites the space, making the returned sound undeniably explicit. This dynamic and timbre variation might cause the temporality of an echo to be reheard, or heard differently, provoking a way of playing which is closer to the essence of that echo; a truer sonic knowledge of a spatial configuration.<sup>258</sup>

In *Playing an Echo: Moving*, a subject moves through an outdoor space whilst sounding and listening for playable echoes.<sup>259</sup> Upon the discovery of an echo, they begin to play it whilst continuing to move, adjusting their playing over time and space to accommodate the changing returning sonic reflections. When an echo is no longer playable, they resume the process of sounding and listening in order to find another playable echo. Over time, a player learns routes through a space or series of spaces that may be expressed through playing echoes. The sonic knowledges that this piece creates are the sum of many moment-by-moment descriptions of a subject's shifting position in relation to a spatial configuration as described by changing returning echoes. The mode of listening here doesn't reach as deeply into the specifics of a spatial configuration as *Playing an Echo*, but rather strains the ear towards an understanding of the changing echo situation from moment to moment.

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<sup>256</sup> Listen to audio appendices 18 and 19. I recorded these at two locations in Leeds City Centre. In each recording I use a different instrument.

<sup>257</sup> When recording audio appendices 18 and 19, the extent to which the varying of timbre and dynamic changed my perception of the echo — and thus the spatial configuration — was dramatic.

<sup>258</sup> Sometimes a loud dynamic confirms reflections which were not previously explicit.

<sup>259</sup> Playable echo means one that is recognisable, and not too fast to enter into a playing dynamic with. What constitutes a playable echo will therefore naturally vary from player to player.

In this instance, 'listening builds, trashes and connects places in time, and tracks and diverts times in space'.<sup>260</sup> A series of paths and passages come to constitute a space in echo: a space is defined by what might be played.

*Reflective Polyrythms* is an algorithm which describes the iterative redistribution of a group of subjects playing echoes over time. The piece starts with a single player moving through an outdoor space, testing it by sounding and listening, in pursuit of a clearly defined echo. Upon the discovery of an echo, the subject situates themselves in the best location to excite it and begins to play. At this point, a second player initiates this process in pursuit of a different echo to player one. The piece accumulates in this manner until all players are continuously and simultaneously playing different echoes. At this point, player one begins the cycle again, surveying the space for a new echo. This piece perpetuates a mode of knowing space through echo which is similar to *Playing an Echo*, however this occurs simultaneously to understanding the space as excited by all members of a group. Players iteratively know space through echo as parts in relation to a whole. For an audience, incidental or invited, the space is framed and reframed in echo from multiple perspectives at a time.

In *Daisy Chain*, an echo is extrapolated across a space or series of spaces. The piece begins with a single player identifying and beginning to play an echo. When this has been established, the second player locates themselves in a different location in the space where they can comfortably hear the returning sound from player one. They begin to play on every returning sound from player one, matching exactly the volume of the returning sound as they perceive it. If sounds made by player two create their own distinct echoes, then a third player locates themselves in a different location in the space to player one and two, where they can comfortably hear the returning sound from player two. They begin to play on every returning sound from player two, matching exactly the volume of that returning sound as they perceive it. This process continues until it is not possible for more players to join. In this piece, an interdependent group mode of sounding as listening is instigated where an echo is extrapolated across a space or series of spaces. Space is understood through as a product of physical relationality, and physical relationality and action is defined by echo. This system is fragile, dependent on the focused listening attention of every member of a group for it to maintain its integrity.

Playing echoes is an act that captures subjects in dialogue with echo, such that they may be listened to and through, in pursuit of the ways in which they simultaneously, sonically create a space as well as a subject's presence within it. *Playing an Echo* situates a dialogue in which subjects may listen deeply into an echo, probing its timbre, temporality and spatiality in approach of its essence. *Playing an Echo – Moving* situates a dialogue in which a subject creates a space in sound through a series of sonic track points, iterative documentations of a changing relationship. *Reflective Polyrythms* is the creation of a dynamic between echo-players, an algorithmic redistribution which affords a systematic reframing of space, and enables

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<sup>260</sup> Voegelin, p.125.

players to hear their own spatio-sonic articulations in the context of those of others. *Daisy Chain* is a way of tracking the propagation of echoes through space, using humans as sonic way markers, beacons of sounding and listening, which in turn propagate their own knowledges. Unlike Lucier's *Vespers*, this practice isn't about humans becoming bats; taking away the visual to emphasise and explore the world as sonic. It is about sound in relation to the sensory whole. By implicating situations of physical and visual relationality as sonic, these pieces recalibrate the normative sensory modality by feeding sound and listening into them.



#### 7.4 Voice and Modal Resonance

The following pieces adapt for the voice the mode of sounding and listening through resonance that was developed for the *Spatial Drone* pieces. *For Someone Who Has Never Performed a Resonance* and *For a Group of People Who Have Never Performed a Resonance* build from an acknowledgement that architectural spaces shape the sounds of voices, returning them to their emitters imbued with their properties. These scores are processes of listening and vocal-sounding in which subjects tune their voices towards spaces, in order that they may be known in resonance: they turn a usually implicit relationality between voice and space into an active interrogation. This pursuit calls to mind ancient vocal practices of sounding and listening evoked by Igor Reznikoff in his archaeoacoustic research.<sup>261</sup> More technically explicit than Oliveros' *For Phil Wilson*, and unlike the pre-composed works in Oliver Beer's *Resonance Project*, this practice is perpetuated by subjects for themselves in order to produce sonic knowledges of space through vocal-sounding and listening.<sup>262</sup>



Figure 16: Lore Lixenberg demonstrating *For Someone Who Has Never Performed a Resonance*, Field Studies: 'Listening After Pauline Oliveros', Leeds, October 2017

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<sup>261</sup> See Reznikoff.

<sup>262</sup> See, Oliveros, *Anthology of Text Scores*, p.53. See also Oliver Beer, 'The Resonance Project' *Oliver Beer* <<https://www.oliverbeer.co.uk/the-resonance-project>> [25/10/2018]. Beer's resonance project was discovered after the commencement of these pieces.

### *For Someone Who Has Never Performed a Resonance*

*For Someone Who Has Never Performed a Resonance* instructs a subject to select an architectural space, position themselves within it, and use a combination of two vocal processes to uncover and explore the resonant properties of that space with their voice.<sup>263</sup> The first process asks the subject to use their voice in a similar manner to an ESS (exponential sine sweep) — what might be used to measure an impulse response — by conducting slow pitch sweeps, whilst listening intently for the space to ‘speak’. The second process guides a subject in the exploration of each individual resonant area discovered in the first process, first by asking them to find its threshold through pitch bending, second, by prompting them to change the aperture of the mouth to affect the production of vocal formants, third by varying dynamics, and fourth by experimenting with the duration of sung pitches.<sup>264</sup> For each resonant area discovered, these techniques are explored in combination in order to find the point at which their voice produces the strongest excitation of the space. Like *Spatial Drone II*, the piece is structured around the breath as a unit of thought: breaths between phases of sound production are moments to digest and absorb what has just been experienced, in order to shape the next phase of sound production.

In this piece, what is sonically knowable through resonance is determined by the relationship between the acoustic properties of a space, a subject’s position within it and the sounding affordance of their voice. Every enclosed architectural space exhibits resonant modal behaviour in accordance with its shape, size and material properties.<sup>265</sup> The voice — beyond language — is a sonic essence of a person;<sup>266</sup> it consists of a timbral profile, varying over a given range, which is entirely unique, dependent on the relationship between vocal folds and the architectures of the vocal tract and mouth. A subject’s position within a space, in combination with the sounding affordance of their voice, determines which resonant modal behaviour is perceptible, due to the interference distribution that occurs when standing waves manifest in combination with the radiation pattern of the voice.<sup>267</sup> The resonant behaviour that is knowable in this piece is determined by the nexus of architectural space, a subject’s position within it, and a subject’s vocal sounding affordance.

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<sup>263</sup> See video appendix 13, and audio appendices 9 and 10. Appendices 9 and 10 were recorded in the same acoustic space by two different voices.

<sup>264</sup> I use the wording ‘resonant area’ rather than ‘resonant mode’ because due to the timbral complexity of a voice, a single mode might be articulated by multiple sung pitches in a subject’s range (maybe in one instance by an overtone, whilst in another instance, by the actual sung pitch).

<sup>265</sup> See. Heller, p.533.

<sup>266</sup> See, for example, Lisa Blackman *Hearing Voices: Embodiment and Experience* (London: Free Association, 2001).

<sup>267</sup> Augoyard and Torgue comment that, ‘Standing waves produce a non-uniform acoustic field since the difference between antinodes and nodes may be in the range of 60 dB.’ Augoyard and Torgue, p.103. In a given position in space, a subject will be located in nodes of some resonant frequencies, whilst in antinodes of others.

The two interrelated processes constitute methods for identifying and exploring the resonant nexuses between the timbral profile and range of a voice and the resonant profile of (a given part of) an architectural space. They are a pedagogy for sounding and listening through resonance, a methodology for forming sonic knowledges of a space which are constituted in relation to, and as a product of, self. In the first process, a subject learns the resonant profile of a space. Sustained vocal pitch sweeps strain listening attention towards the anticipation of moments where emitted pitch is unmistakably shaped by the space.<sup>268</sup> In process two, methodical instances of shaping the voice towards resonant areas uncovered in the first process transform what is recognised or understood into what is known. Each resonant area expresses a space differently. It is a basis for investigation, a medium through which to know a space. A subject, through trial and error, breath by breath, sounds and listens towards the purest articulation of a resonant area that is possible with their voice, by using a series of techniques that variously articulate it. Changing the aperture of the mouth varies formant content, which may have the effect of attenuating or amplifying given aspects of a resonant area. Sounding volume directs attention towards the strength of a resonance. Pitch bending around a resonance determines its threshold, its contour. In these processes, a subject listens through a resonant area in pursuit of its essence in relation to their voice.

*For Someone Who Has Never Performed a Resonance* initiates a mode of sounding and listening where sonic knowledges are produced as a series of auditory and somatic sensations inextricably tied to a series of physical exertions; a constant, contingent presencing of subject and space in tandem. A subject produces the space that they occupy 'in sound', and in turn, the space produces the subject's sense of themselves. This model resounds with Nancy's conception of Listening:

To be listening is to be at the same time outside and inside, to be open from without and within, hence from one to the other and from one in the other.<sup>269</sup>

Listening and vocal-sounding through resonance produces a means of relating to and knowing space that might be defined by a mutual calibration, in which space resolves subject and subject resolves space from each moment to the next; '[acoustic] spatiality opens up in me as well as around me, and from me as well as toward me'.<sup>270</sup> This piece is to be in resonance with a space; to resonate a space and to be resounded by it.

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<sup>268</sup> Where these moments fall vary significantly for different subjects and from space to space. Listen to audio appendix 9 in comparison to audio appendix 10. The male singer uncovers resonance in very different parts of his vocal range to the female singer.

<sup>269</sup> Nancy, p.14.

<sup>270</sup> LaBelle, 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Corbussen, Meelberg and Truax, pp.275-285 (p.283).

### *For a Group of People Who Have Never Performed a Resonance*



Figure 17: *For a Group of People Who Have Never Performed a Resonance*, *Field Studies: 'Listening After Pauline Oliveros'*, Leeds, October 2017

*For a Group of People Who Have Never Performed a Resonance* takes place in a group context, where multiple people conduct vocal-sounding and listening through resonance in the same space or series of spaces. Whilst the content of the score remains largely identical to its sister piece, a critical difference is that subjects are instructed to spend more time listening to each other than producing sound. This piece sets a system into motion where the resonant properties of a space are uncovered as a product of a group dynamic. Subjects conduct processes of listening and vocal-sounding, both in terms of, and by contributing to, a sounding milieu. Each individual develops sonic knowledges in relation to this milieu, 'through an ongoing cumulative and interactive process of participation and reflection'.<sup>271</sup> When the piece was practiced as part of *Field Studies*, at any given moment the sounding whole was marked by varying levels of dominance, of performativity, different methods for approaching resonance, different levels of listening attention, different breath lengths, and different voices.<sup>272</sup> For as long as the piece is performed, this milieu provides each subject with a variety of understandings, of ways in which they might approach the excitation of the space with their voices: a crowd-sourced sonic knowledge of the space that stands to enrich the sounding and listening approach of each individual. In addition to this, each subject perceives a multitude of voices according with the space — in resonance — in terms of their unique sounding affordances: each individual experiences multiple resonant locations in a space, each articulated in its own way, by a unique voice.

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<sup>271</sup> Feld, 'On Post-Ethnomusicology Alternatives: Acoustemology', in *Perspectives on a 21<sup>st</sup> Century Comparative Musicology: Ethnomusicology or Transcultural Musicology*, ed. by Giuriati and Giannattasio, pp.82-99 (p.86).

<sup>272</sup> See video appendix 10.

This dynamic, over time, organises a group around the resonant profile of a space. Sound acts as an agent, which forms the groundwork for an agreed social knowledge of space in resonance, as LaBelle posits:

Acoustic spatiality may be embraced as a social structure tuned to the global movements of contemporary life. Is not global culture marked by an intensity of overhearing? By presences that demand and distract, and which define my own sense of being, without my knowing?<sup>273</sup>

As the exposition of each subject's trialling of the processes in the score contributes to the sounding milieu, each instance of resonance is perceived by others and stands to find its way into the sounding and listening repertoire of each individual, eventually becoming part of a group sounding lexicon: sound acts as an agent that cross-pollinates individual subjects' processes of uncovering the space through sounding and listening.

In *For Someone Who has Never Performed a Resonance*, resonant sonic knowledges of architectural space are produced in the calibration between subject and space. In *For a Group of People Who have Never Performed a Resonance*, however, these knowledges are produced for each subject in calibration with both the architecture and the sounding group. Through the mode of vocal sounding and listening in both of these pieces, spaces may be known as intensities, frequencies, and in terms of muscular effort and internal and external vibratory sensations. This act makes emergent in subjects the kind of primordial spatio-sonic instincts to which Reznikoff alludes. Through it, subjects are brought out of established modes of being and doing, and into a meditation on space and self. It is an act that is ubiquitously achievable, and which engages a sense of 'wonder vis-à-vis the world'.<sup>274</sup> In listening to these processes of sounding and listening, one hears a kind of music.

### ***Spatial Listening Conclusions***

*Spatial Listening* is a practice in which sonic knowledges of spaces are produced alone or in coming together, in tandem with a making present of self, and as part of an emergent public. The situations of methodical sounding and listening that open up through acoustic phenomena position those who engage with it as 'designers of [their] own environment.' As a practice, it 'challenges, augments and expands what we see, without presenting a negative illusion, by producing the reality of lived experience.'<sup>275</sup> Over time and with practice, subjects produce sonic knowledges, which are always 'situated', relational, and may be characterised in terms of both sounding and listening.<sup>276</sup> Resonant knowing, in relation to vocal sounding, may be

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<sup>273</sup> LaBelle, 'Restless Acoustics, Emergent Publics', in *The Routledge Companion to Sounding Art*, ed. by Corbussen, Meelberg and Truax, pp.275-285 (p.284).

<sup>274</sup> Langer, p.163.

<sup>275</sup> Voegelin, p.12-13.

<sup>276</sup> Here I refer to Annie Goh's notion of situated sonic knowledges. See Goh, 283-304, (p.289).

spoken of as intensities, locations, frequencies, muscular effort, and internal and external vibratory sensations. Knowledges formed through playing reverberation might be described in terms of temporality, location, contour and timbre in relation to established bodily rhythms of sounding. Knowledges formed through playing echo might be described in terms of temporality, location, spatiality and timbre, relation to established bodily rhythms of sounding and visual perspective. Finally, impulse-knowledges might be articulated in terms of location, reflection, temporality, relationality, and movement. *Spatial Listening* constellates a variety of situations of listening that differently engage acoustic phenomena: situated sounding and listening is present in *For Someone Who Has Never Performed a Resonance, A Song Composed of a Single Person's Life and Playing Echoes*. It allows a subject to intimately engage with acoustic space, producing their environment in sounding and listening from a fixed position. Moving-listening is present in *A Song Composed of a Number of People's Lives – Moving, Playing an Echo – Moving, and Dispersed Impulses –Moving*. It involves auditory presencing across and through space, articulating a concrete environment as a series of acoustic relationalities. Finally, in group sounding and listening, present in *For a Group of People Who have Never Performed a Resonance, A Song Composed of a Number of People's Lives, and Daisy Chain*, space is articulated through different subjectivities, as an emergent public.

*Spatial Listening* stands aside from the rest of the practice in this portfolio. Uninhibited by the constraints of the performance setting or gallery space, and the requirement of significant hardware or technology, it can be deployed in a multitude of environments with diverse groups, from highly experienced musicians to members of the general public. The scores are deliberately simple, centred on ubiquitous phenomena that contain within them worlds of complexity. What is fascinating about the act of *Spatial Listening*, is the ways of being that it seems to open up and the extent to which these contrast the accounts of ocularcentricism and disembodiment articulated in the introduction: the practice affords a slowing down, a becoming present and an opening up to the world and to others. It affords situations in which people listen intently to each other, and the spaces in which they find themselves. *Spatial Listening* has afforded the development of a way of working, a practice where listening is the starting point, the source from which these scores emerged. It is a way of working that emerges from the subjectivities of those who engage with it, and will provide fertile ground for future practice.

## 8 Conclusions and Further Research

This research has involved the creation of works that engage subjects in spatial listening. Based on a phenomenological model of listening, practice places the bodies of subjects at the centre of the experiential question. Works constellate situations that engage subjects in methodical modes of sounding and listening to and through acoustic phenomena, in approach of sonically knowing the spaces in which they may be heard. Acoustic phenomena dissolve an ocular separation between humans and space. Omnipresent and recognizable, they provide a familiar, site-generic language that affords an intelligible route in to the complex entanglement between the sonic and the spatial. The portfolio positions each of the three acoustic phenomena of reverberation, resonance, and echo as mediums through which the built environment may be known.

*Reflection // Position* creates impulse topographies through which subjects move-listen, coming to know space as changing impulse signature, whether perceived as a field of reverberant intensities, or discrete patterns of echoes. *RT60* organises sound around the temporality of reverberation in a given space, expressing and recording reverberation from multiple perspectives. Always listening, the system demands the attention of subjects by contextualising the sounds that they make within a reverberant temporality. *Spatial Drone* engages a player in using a synthesiser to probe the resonant properties of a space. The player comes to know their material environment in resonance through sounding processes that are dictated by the ways in which resonant sensations play on ear and body. Whilst *Spatial Drone II* is similar to its sister piece, the medium of the tuba allows a critically more embodied dialogue with resonance, due to the increased audibility of the player. The *Resonant Topographies* works are moving-listening engagements with resonance. In the installation, a mobile application provides an ocularly-informed listening experience by allowing subjects to visually render a resonant topography through their listening engagement with it. *Resonant Topographies: Listening-led Movement*, poses choreography as a vessel of sonic experience, an externalization of sonic knowing. It is deployed as a pedagogical tool for bringing an audience into moving-listening with a topography. *Ear Pieces* prepare subjects for the modes of listening that these works engage, both by implicating the body in sound and by providing subjects with a refreshed sense of their normative auditory modality. They also provide ground to return to: an opportunity to listen beyond what the explicitly phenomenon-based portfolio works afford. *Spatial Listening* builds on the embodied mode of sounding and listening espoused by *Spatial Drone II*. Metaphorically and literally extending the act of shouting to hear an echo into a series of dialogues, it is entirely embodied, realised by subjects for themselves and each other. *Spatial Listening* is a practice which, even if for moments at a time, claims spaces as spaces of sounding and listening.

The practice within this PhD does not levitate the ear above all other senses as any kind of permanent solution, but rather brings the aural to the forefront to examine what spatial listening might contribute to the sensory whole. Broadly speaking, the experiences of space afforded by the practice are non-totalising, immediate, unquestionably attached to the present moment, and located in *this* space. They are

inherently subject-laden, experienced as a 'here, now', rather than the detached 'there' of the visual. The knowledges that these works formulate are contingent, relational, transient, ephemeral, and explicitly connected to the body with regards to both the perception and emission of sounds.

The ways of knowing space afforded by the works in this project can be characterised by the combination of the phenomenon in question and the mode of listening, or sounding and listening that engages with it. To know architecture in resonance is to be modulated by it. It is a knowledge associated with pitch, intensity, physical force, threshold and positionality. Knowledges of space formed through impulse are characterised by acoustic reflections, either discreet as in echo, or as a homogenous contour as in reverberation. Situated listening renders space in sound from a given perspective. It affords deep, qualitative attention to the natures of the sounds that may be experienced from a given position. Moving-listening affords breadth rather than depth: sonic knowledges of space pertain to the changing nature of acoustic phenomena as articulated by a subject's autonomous movement. Solo sounding and listening captures a subject in dialogues with space in which they intimately constitute themselves and the space from either a fixed position, or through a changing relationality. Group sounding and listening adds others to this dialogue: individual sonic conceptions of space are weighed in on by other subjectivities. In this setting, sonic knowledges form through negotiation; they are the product of an emergent acoustic public.

This project acknowledges cultures for whom sound has played, or plays, an integral role in creating sense of space and place. Inspired by these, the practice put forward in these commentaries has intended to materialise micro-cultures of listening within architectural spaces as a response to the ocularly-dominated sensory dispositions that are prevalent in contemporary society. The practice tracks space according to its sonic properties, unlocking an alternative manner of approaching architecture: through the lens of *Spatial Listening*, for example, visually or socially unimportant spaces become playgrounds for auditory exploration. The works make possible alternate ways of conceiving and relating to space: they seize on Henri Lefebvre's conception of a revolt against abstract space, seeking to claim spaces as sites of sounding and listening in order — in their own small way — to influence the cycle of spatial production. The practice brings subjects into their bodies and into the present moment. It is the intention that its engagement with acoustic phenomena creates a sense of 'wonder vis-à-vis the world'<sup>277</sup> that might enduringly manifest in the psyches of those who experience it. This might foster a residual sonic-spatial awareness that could influence further perception of the concrete environment, perhaps giving rise to a certain auditory-spatial playfulness. Finally, this practice makes possible alternate modes of social relations. It fosters situations in which people relate sonically, and come together through, and in, listening.

*Spatial Listening* is both an end and a beginning. This project ends with the formulation of an itinerant practice for exploring and knowing spaces through

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<sup>277</sup> Langer, p.163.



sounding and listening, but it is yet to be fully tested. The key direction for further research is to open up the practice to a multitude of subjectivities. I propose to develop and expand it according to the experiences gained from its deployment in diverse settings.<sup>278</sup> Another fruitful further research endeavour might be to further theorise the concept of acoustic knowing.<sup>279</sup> There is also potential to theoretically conceive of resonance, echo and reverberation as modes of social interaction akin to Annie Goh's figuration of echo, and in relation to Brandon LaBelle's recent text, *The Sonic Agent*.<sup>280</sup> In response to Ouzonian and Lappin's call for a practice of listening, I plan to direct this work towards architects and planners as a way of informing their existing practices.<sup>281</sup> More broadly, I am keen to continue to creatively explore the potential of listening as a mode of relations, a way of coming together and a basis for knowing.

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<sup>278</sup> A recent workshop saw some interesting feedback. One person mentioned the idea of allowing individuals to rewrite scores in relation to their individual experiences of the pieces.

<sup>279</sup> At the end of this research, I became aware of the following article on 'acoustic knowing': Carsten Stabenow, 'Acoustic Knowing — Formats of Mediation between City and Sound', *Volume. 02 The Statement! Sound-Installation*, ed. by Ulrich Eller and Christoph Metzger (Berlin: Kerher Verlag, 2015) [page range not known].

<sup>280</sup> See Brandon LaBelle, *The Sonic Agent* (London: Goldsmiths Press, 2018). This text is an extension of the 'Restless Acoustics, Emergent Publics' article which has been discussed in this document.

<sup>281</sup> In the coming months, I will be giving *Spatial Listening* workshops for the architecture department at the Royal Academy of Arts.

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———, 'Oxford Place: Resonances', *Alex De Little* <<http://www.alexdelittle.com/oxford-place-resonances/>> [15/10/2018]

———, 'Peter Ablinger — Places Leeds', *Alex De Little* <<http://www.alexdelittle.com/peter-ablinger-orte/>> [15/10/2018]

———, 'Points of Listening #33 // Shoreditch Church // Listening Devices', *Alex De Little* <<http://www.alexdelittle.com/points-of-listening-33-shoreditch-church-listening-devices/>> [15/10/2018]

———, 'Sensing Space through Sound at East St Arts' Patrick Studios', *Alex De Little* <<http://www.alexdelittle.com/sensing-space-through-sound-at-east-st-arts-patrick-studios/>> [15/10/2018]

———, 'Space: on Sound and Architecture // The Calder - Hepworth Wakefield', *Alex De Little* <<http://www.alexdelittle.com/space-on-sound-and-architecture/>> [15/10/2018]

———, 'Spatial Drone // LEGROOM Manchester', *Alex De Little* <<http://www.alexdelittle.com/spatial-drone-legroom-manchester/>> [15/10/2018]

———, 'Spatial Drone 3 // with James Seabrook // LEGROOM Manchester', *Alex De Little* <<http://www.alexdelittle.com/spatial-drone/>> [15/10/2018]

———, 'Tate Lates // Listening Devices // Trevor Cox', *Alex De Little* <<http://www.alexdelittle.com/tate-lates-listening-devices-trevor-cox/>> [15/10/2018]

———, 'Thoughts on Resonance', *Alex De Little* <<http://www.alexdelittle.com/thoughts-on-resonance/>> [15/10/2018]

## **10 Appendices**

**97-107** Interviews

**108 -119** Diagrams and Sketches

**120-124** Event Documentation

## Interviews

### Appendix 1: *Resonant Topographies: Listening-led Movement*

#### Interview with Tora Hed and Hannah Buckley<sup>282</sup>

This conversation was recorded during workshops with Tora Hed and Hannah Buckley at the Clothworkers Centenary Concert Hall, University of Leeds, School of Music in April, 2017. These workshops gave rise to *Resonant Topographies: Listening-led Movement*.

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Hannah Buckley: I don't think it really needs a structure. You can just use the sound.

Tora Hed: Also, it's something about coming with repetition of movements; repetition of the shape that I was doing. Almost like a trance.

HB: And I think for me there was something about the enjoyment of shifting between spaces appearing [...] so when you get between two points, there's something enjoyable about shifting back and forth which is what leads to that movement, when you find that curve or whatever. But flicking between those two points is kind of satisfying.

Alex De Little: The only thing that I can think of which is comparable is reacting to an actual building, for example stepping through a threshold or around a corner: architecture as a prompt for movement. There's no other way that you can get a stimulus to prompt a movement. Which is why I think that everything in this piece should come out of what you're hearing.

TH: Isn't it something with a rhythm, because sometime I feel it's quite not so much rhythm in the sounds, but when I do this [moves head back and forth], there is a rhythm, right? It's like, sound, sound, sound, sound. So it could also be that the body is trying to find rhythm.

HB: My ears are not trained at all. I am not a musical person. I don't listen to music in a musical way. So I feel like I miss a lot of things.

ADL: I spent my whole time listening to this, so if I were to come up with a piece it would be based on my own observations. You two read something totally different into what's going on which is way more interesting. Even between the two of you, you read different things into it.

HB: Today obviously this is the first time that we've done it so we have been quite deeply in our own investigations, but then there was a point where I could imagine

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<sup>282</sup> This interview was recorded after the piece was first workshopped in the Clothworkers Centenary Concert hall in June 2017. It is reproduced here with the permission of Tora and Hannah.

also trying to build in the relation- like having more awareness of each other and the impact of that on the sound. There was a point where I was like, 'I'm going to go and stand behind Tora and see if it makes any difference'.

TH: Yeah I really felt I wanted to do that, I was really seeking for bodies at some points.

HB: The relationship between whoever's in the space is an interesting aspect of this.

ADL: I wonder whether there's a way for you to manipulate each other.

HB: Well it happens naturally if you put more than one body in the space, like when I was here and you were there and we were kind of doing similar [moves].. these things; it begins to happen anyway.

Tora: I think it's because this is how we're trained to think about the space and relationships between each other, but I felt that when you were moving from one point to another I felt a need to move to a different place or change because something happened in the space and I felt that changing my way of moving in the space. It becomes an affection of movement [sic].

ADL: I think what's cool that's coming out of this is that rather than the rules that I made up, this should be about where your awareness is. So if your awareness is on yourself then you come up with your own things. The main rule is that everything you do has to relate to something sonic- it's coming out of that. Perhaps to start with it's more directly related and as the piece goes on, it becomes more abstract, more about feeling. So there are bits where you are just aware of yourself, but there are bits where you become aware of each other and it becomes a collective awareness, even though you're not necessarily doing the same things. But that collective awareness then directs how you respond.

HB: Yeah, I mean I think it'll be interesting to keep doing it and see how it grows.

ADL: I think that this is exactly how it should be: coming out of doing rather than thinking.

HB: yeah exactly, because the sound is so powerful. They [sic] do actually drive movement- even if you weren't dancing you'd still want to move because they have a physical effect on you. They shift when you move, so even if you were only asking the audience to move around, I think it would have a physical impact. It's unavoidable- you can't avoid the sound.

ADL: In the first year of my PhD, two years ago I made a piece using the same concept as this [Modes of Resonance], but the only thing that interested me was how the audience responded. The music didn't particularly interest me. And that is the site of where things are happening; that moment when you're being led by sound.

HB: Yeah, and I think also where the audience are is really important in this. I could imagine them just walking around without necessarily having to be stationary [...]

TH: There's something very intriguing for me as a performer to have people around, and also then I can't really come back to the sound as the same because then there will be interruptions. It would be a next step right?

ADL: Ok, so maybe there's some kind of structure where [starts drawing] you guys start here and you go all the way through, but at one point the audience are allowed to start moving in the space. There's a bit here where it's sort of introductory: you kind of get prepped for listening. I was thinking today that the Lucier piece is interesting and demonstrates a concept, but this is all about listening. It tries to take the whole thing a step further, but what I want to do to take it even further is have a dialogue between you guys and the audience which allows the audience to come into your way of exploring the space. Not because you're telling them anything, but because you've shown them somehow. I find that really fascinating, because they go from someone who's just walking into an event to someone whose exploring this phenomenon without anyone having said anything.

TH: Yeah, I guess it's a big challenge sometimes to do that—

HB: —to make the audience feel comfortable. Because an audience is really keen to form an audience. And they will do whatever they can do to avoid being in the piece. [...] You have to be really clear with direction otherwise they go to the edges.

ADL: There's a text score. There's a tiny little text score and you just give it to all of them and you say sit for five minutes or something and after five minutes you can walk around.

TH: It would also be interesting to start as an audience member and then the performance comes from the audience.

ADL: But then it's edges again. I like the idea that you bring them into the space. A space that's prepared already for listening.

## Appendix 2: *Reflection // Position*

### Discussion with Scott McLaughlin<sup>283</sup>

This conversation was recorded during a demo of *Reflection // Position* on the University of Leeds campus.

—

Alex De Little: With this one if you just walk in a straight line, at some points it sounds like the wall is the sound source.

Scott McLaughlin: There was one there where it sounded like that little corner was the sound source. Quite spectacular really, this is wonderful.

ADL: That one quaver rest is so important.

SMcL: I just keep thinking I hear telephones ringing.

ADL: Yeah, yeah it is a bit like that this one.

SMcL: But I think there's a source thing there as you said. Because I hear that as the source and then I hear a source impinging from somewhere else.

ADL: That's it.

SMcL: And it must be a different thing. You should have psychologists up here.

ADL: There is so much depth to the sound field because there's always a haze going on which is slightly imperceptible. So it's about levels of perception — what's the most prominent rhythmic pattern that you hear in any given situation. There's no given way to recognise set rhythmic relationships. When I first came up with the idea, I thought 'oh well you'll hear a polyrhythm here, here and here, based on the distance from these walls, but there's no point thinking on that level, because it's just--

SMcL: I have to admit that I don't think of it like that at all. I hear it as a single object that's refracted so that I hear multiple objects sometimes.

ADL: Yes. There's also a textural depth; you're hearing the space texturally.

SMcL: Imagine looking at a single picture of a telephone that suddenly splits in two and two. That's that depth. It occurs to me that you could potentially do a fancy spectral geometry thing where you'd find a bunch of intervals which are potentially

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<sup>283</sup> This interview was recorded whilst testing *Reflection // Position* on 9 July 2018. It is reproduced here with the permission of Scott McLaughlin.

formants of a lower fundamental and at certain angles, in theory, they might form spectra. You probably need a bigger speaker range than that though. But you could start hearing false fundamentals as you move around.

ADL: The last one was the same sound source being peaked at different points whereas this one is literally different notes on a synthesiser. [plays example] I think actually because they're all of the same fundamental these sounds they all sound the same, you spectrally eq the sounds at different points, but when you stack them on top of each other you just basically get the original

SMcL: Yeah the separate pitches are much more effective up here.

ADL: I want to see how slow I can get it for it still to be effective. Because there's a temporal resonance to the space. At what point does the pattern going into the space get matched with its reflection rhythmically?

SMcL: Yeah do a slow one. This is just as effective to me in terms of separation. The rhythmic thing is there, I'm just not listening to it that way. Though, partly, that's because this is a short motif. If this was, say, a randomly generated, continuously changing string, I wouldn't be hearing it the same way. because what I'm hearing is a canon. But if it were just randomly generated durations--

ADL: But I don't think that that would be as effective because here you're hearing something in terms of itself. And it should be short because you should be able to go—The reflected signal should be very apparently a different version of the direct signal.

SMcL: That's what I mean, that why I'm hearing it as a canon. Or kind of a fugue.

ADL: A spatial fugue...

[...]

ADL: I like how you have not only phase relationships as you move, but also intensity relationships. So, as you move further towards this space this sound becomes more intense and this one fades. And so on and so forth. So, every position in the space, whether you hear a different rhythm or not, you hear different intensity relationships. So, every spot in the space is sonically unique

SMcL: Again, I resolve that as different images. So right now, I'm hearing [sings], and over here, I'm hearing [sings]. It's a grace note apart.

## Appendix 3: Spatial Drone Workshops

### Conversation with James Seabrook

This conversation was recorded when James Seabrook and I were workshopping ideas for the performance of Spatial Drone III at LEGROOM. See audio appendix 8 for a recording of the performance.

—

James Seabrook: [...] Yeah, I could feel it in the middle of my torso [...]

Alex De Little: And did you feel the sound moving across you at all?

JS: A little bit, not a lot. There were certain frequencies that got your ears. Um, just a feeling in your ear like pressure. — Yeah there were some weird pressure moments actually; feeling like when you're driving up a long hill and your ears pop. There were similar kinds of feelings where the pressure just changed really quickly, it was really interesting.

ADL: And did you kind of [...] feel like it linked you to the space; did you feel the space being excited, or was it just the sound? Or you even care or think about it? It doesn't matter if you didn't. It's not a trick question.

JS: I don't think that I thought about it consciously, it was just as though I was connected to the space in that [...] Yeah I'd say so, although I wasn't consciously thinking about it.

ADL: I mean you objectively were being connected to the space, you know, by the fact that you know, the space was in resonance.

JS: Yeah, but I wasn't really thinking so analytically about it, just experiencing it. I was very aware that I was in the space. Um. And there were certain frequencies that excited it, yeah.

ADL: It [making the space resonate using the synthesizer in the first performance] was quite a random process, like shining a torch around and seeing what gets illuminated. And [as the process unfolds] you kind of forget what you shone it on before, you shine it on something else, and then you go back to an idea in a different way, and then you go somewhere else. And all in the frame of like trying to do this certain thing. Which is why I think it's interesting that we're doing this session off the back of you having heard it [the first performance of Spatial drone]. I think it makes it much easier for you to understand what the piece is trying to do [...] Because I haven't had that experience that you've had with it.

JS: And if you were to, you would be thinking about it in a different way because you've done it.

[emission]



ADL: But I think on reflection, let's keep it closeish [sic] to that [points at the sketched structure in notebook]. I think the free thing is good, but I don't want us to finish the performance and think, 'oh we should have evoked that [idea] more clearly, or this more clearly'. The only thing that I didn't include in that [sketch] is the idea of these cutoff sweeps that I was doing so I think that that should go into the structure somewhere. These things [plays a cutoff sweep]. The kind of automation of it. Which is quite interesting from a musical point of view because it created a framework for you to work around.

JS: Yeah

ADL: I can vary the quality of it. [plays]. I want to avoid making it ever sound too 'synthy'.

JS: Yeah I get that. Because it takes you away from the idea

ADL: Yeah because then you're hearing a synth and not the space.

JS: Because then you think synthesizer, you think Brian Eno.

ADL: And it's like that with the Tuba, you don't ever want to hear a tuba, you just want to hear the space. All we're doing. There are two things we're doing. The first is [...] all the loudspeakers do — and the reason they point away from the audience — is they set the space into vibration, different states of resonant vibration. Secondly, these states of vibration affect the audience. They target the audience. But, you stop becoming a tuba player and start becoming an exciter of the room. And that's the mind frame isn't it. Which is a different mind frame.

JS: It's cool. I like it. What's this word that you put in here [points at the sketch], steady?

ADL: Steady state. So the idea that you start, with an exploratory [...] so you're introducing the [resonant] frequencies to the audience one by one, bending in and out is really important I think. It would be as interesting in some ways if you found very resonant notes to start with. Like what's the least resonant note you can find. And then play a really resonant one and compare them.

JS: Yeah, ok.

ADL: And then bend in and out. Increase dynamic envelope, decrease dynamic envelope. Change overtones. Use a mute, don't use a mute. All these kinds of ideas. These are just a guide. Within that do what the hell you want. And then I'll come in and slowly establish a resonance. I've only been using G because I think G is the strongest.

JS: Yeah I was sometimes using C because I thought it was fairly G but then I was like, 'okay it's not really doing anything'.

ADL: The C has Gs in it, right [due to the overtone series present in the synth and the waveforms used by the synthesiser]? So the fundamental of the C I think is too low for your instrument to evoke. But if I play you the C [plays fundamental of C]. That's the fundamental of the C and that's, [...] that's there isn't it.

JS: Yeah

ADL: But that's not as strong as the fundamental of the G which is this [plays the G fundamental frequency and it's much, much louder]. I didn't do anything to the volume there. That's all resonance.

JS: So cool, yeah.

ADL: So I'll establish that in a very steady way and I think I'll just stay on the G. Because it's using the strongest resonance. I don't want to get in the way of you, I want to come in underneath you and start subtly. I like the idea that the resonance gets stronger and stronger, then it's established, then after it's established, we mess with its state, so the harmonic things is I suppose making comparison between the sensations of different resonant frequencies, so like you might be down in the bottom and I might be going like kind of [plays through a range of high frequencies].

JS: Yeah there were time when I was playing in my middle register and I was still getting some effect against you, but then it's not as strong as down at the bottom.

ADL: I think you should generally stick there. I think that simplifies what you do. I want this to be something that is distinctly different to what I did last night, and so this [using the tuba to cover the fundamental whilst I play against it] is not that. I see you as taking the role of what I was doing last night and now this [synth] doing extra. So one is the harmonic thing, so essentially you're playing your introductory section again, but with stuff over the top. Then, I think there's this idea of me re-establishing this low resonance and you creating beating patterns with it, which is what I was doing last night but just between the two oscillators on the synthesiser. So we do the beatings. Then that could be an opportunity to move into the idea of using this, [plays with cutoff modulation]. I need to spend some more time with that. Then I think that's quite a nice opportunity for us to segway back into [...] I'm just going with [...] we did a process of improvisation and what was effective about it, for me it was the beatings, the harmonies, and then the cutoff modulation which is nice because it's a repetitive gestural thing, it kind of adds a periodicity to it, and you can kind of sink in with that and I'll change it very subtly and slowly. I'll then reduce the modulation to a steady tone and then fade out, and leave you—

JS: —just to do what I was doing at the beginning. Sounds cool. Um. I was trying to [...] trying not to come in too strong, but that can be really hard. Do you mind occasional strong entries?

ADL: No, I mean I think that's... I think you're limited by what your instrument can do and if it's telling you strong entries, then do strong entries. You're not a synthesizer. I think the other thing about this piece that I think is cool is the humanness of what

you're doing versus the really fixed-ness of this. And whilst this can target, like, target the frequencies exactly and create envelope exactly and partials and waveforms and modulation and all of that stuff. [with the tuba], there's a humanness to the fact that there's a breath that runs out [...] and that's why I don't want to get in the way and also there should be some windows in the thing where I just come out and show you on your own. I think there should be sections where you are underpinned by me and sections where you are on your own. [...] Because you've got no choice but to sound like a tuba. And there's a certain thing that that brings. But I mean obviously I have eq'ed you loads. And you're quite compressed as well. The compression means that you don't overblow. You maintain quite a consistent dynamic level.

[...]

JS It's fun to jump octaves.

ADL: the change in octaves on the tuba is just an emphasis on a different partial of a same waveform. You begin to think of the tuba in terms of acoustics rather than notes.

#### Appendix 4: Listening Devices Tate Lates Transcription

The quotes that follow are transcribed from audio appendix 1. This recording was made at a listening devices workshop conducted at the Tate Modern with Trevor Cox in January, 2017. The devices were displayed on a table, and people were free to try them as they pleased. During the session, I walked around and asked people open questions about their experiences:

—

[...] I can tell you it was nice to have the environment change so suddenly quickly [sic]. You do have to try quite hard to focus on your hearing these days, I feel. I think people are quite -especially living here [London], they're quite used to filtering out noise, and so maybe people that aren't good at that don't live in cities maybe, or maybe people who live in cities that aren't good at that have a harder time [...] It's nuts if you're neuro-typical what your brain can tune out, that can be quite amazing. And I like the ones that had the skins on the end of the cones, mainly because that made the background talking into a mushy note, and then, when you looked at things you could hear them, you know, If you focused on someone talking you were able to hear what they were saying, but otherwise, made it a mushy note.[...]

[...] We were all saying you could tune into other people's conversations [...]

[...] He was saying that, I can't hear myself [...]

I don't feel present in the same way [...] I prefer to be present.

It blurs together, like nothing stands out, nothing stands out. It sounds like waves, like water [...] I thought it would make it more specific but it makes it all washes together you know [...]

I've never experienced something like this before so I can't really describe it [...]

It kinda sounds like everything is sped up but I can't tell why [...]

My own voice sounds different and I'm not sure whether I'm talking louder than usual [...] I think it's very easy to get lost in what's going on [...] Everything's so muffled, I think you have to make more of an effort to concentrate on what is close to you, what you think you're supposed to hear. And I know I'm not supposed to hear what's going on over there, but usually I'd probably just hear it, ignore it and focus on other things [...] I'm more aware of what's going on in front of me than behind, but, If I heard something I'd care —if it was behind, but now 'cos I can't hear it, erm, I've kind of forgotten about it because I'm more fixated on what's, like, in front [sic].

So if I close my eyes, it sounds like, say I was in an empty room, with a hole in it and someone talking to me from another room, through a tube, that the sound came in through that hole. It's a bit weird, but it's kinda cool as well.

I think I'm kind of going to another universe, but all the sounds are still in this planet, but just my hearing is going to another universe [...]

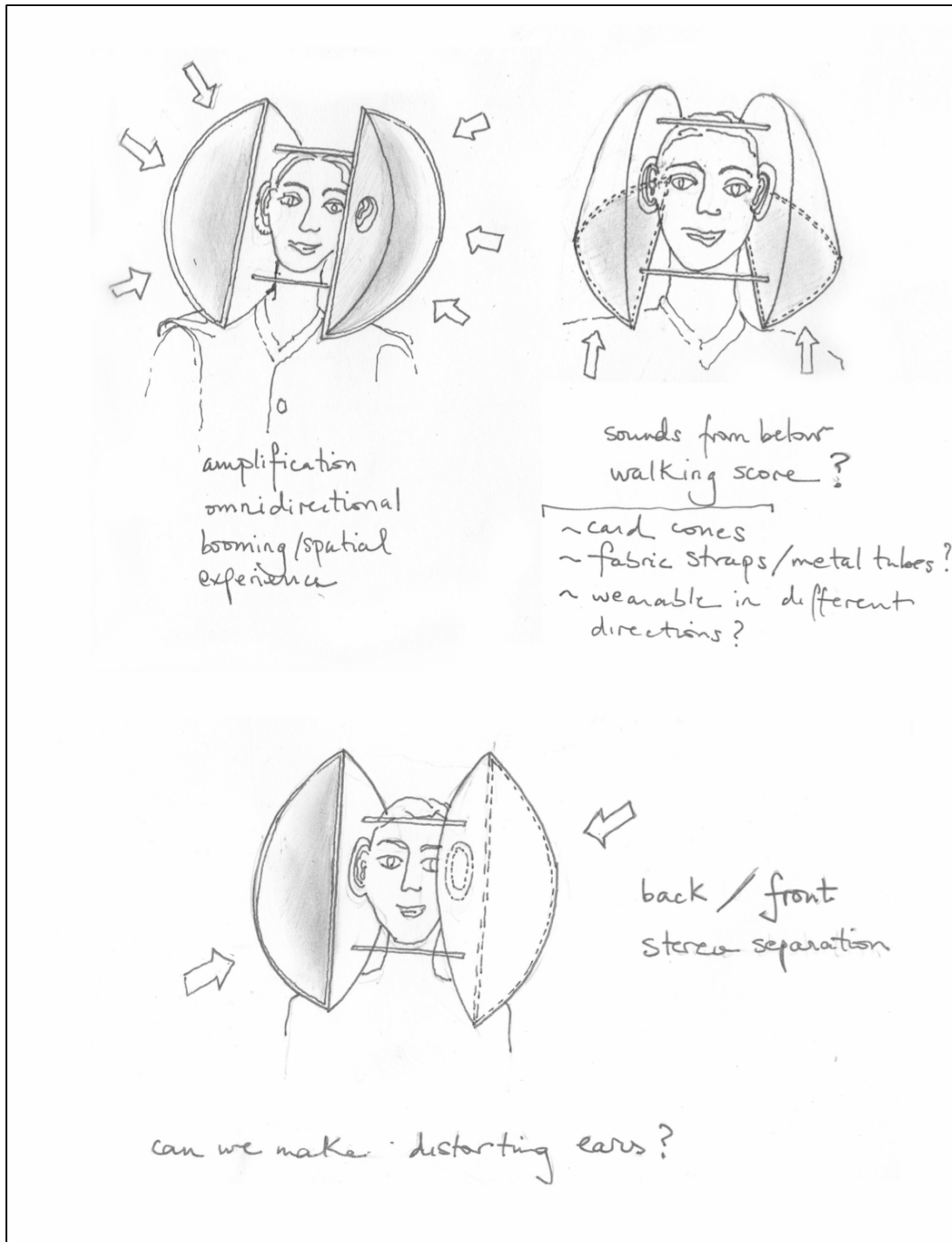
It feels like the sound's coming from another, like it's almost coming from above in a way. Like it's coming from another room. You're surrounded by people, but you're surrounded by sound coming from a different space to where the people are.

There is a melody. The noise becomes a sort of tune and all the people are singing together. There is a rhythm! Really! It's a mantra, it's like a mantra [...]

More engaged [with the environment] in a way, because you're more focused on the sound. By obstructing the sounds actually, you're more focused on it. You don't need to, like cut all of the other senses off, you just need that, a little tweak.

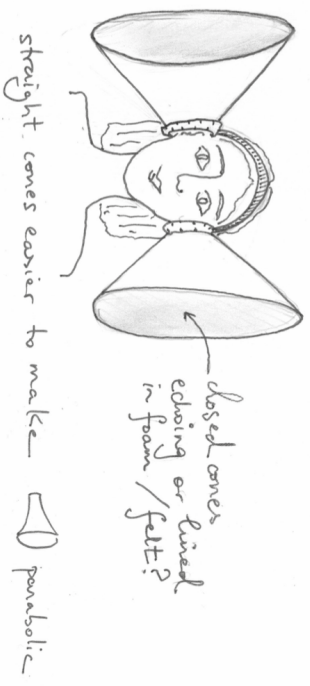
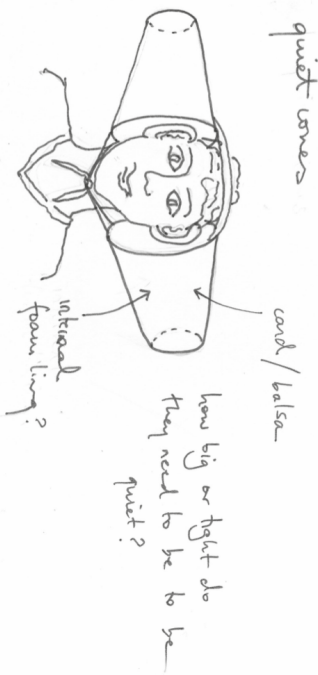
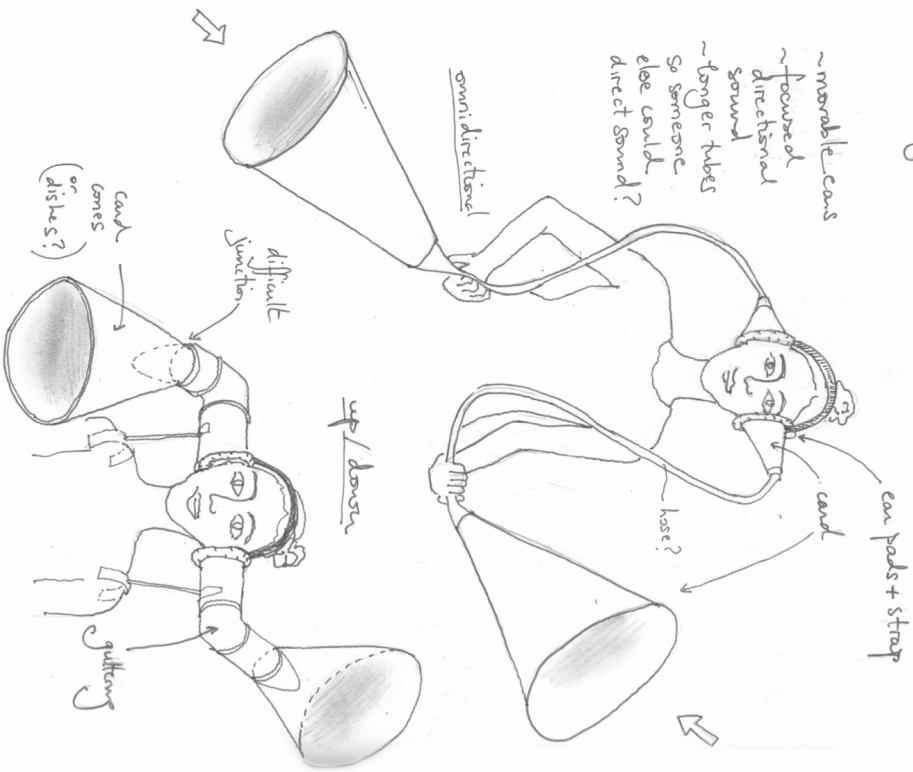
Sketches and Diagrams

Appendix 5: *Listening Devices* Preliminary Sketches by Lara Karady<sup>284</sup>



<sup>284</sup> Reproduced here with Lara's permission

~ mobile sound mirrors?  
 ~ up down / back front / tubular structure that's flexible  
 ~ dampening cones or chamber



Appendix 6: *Listening Devices*, Science Gallery 'Biorhythm' Exhibition, Health Museum, Houston, Texas: Installation View<sup>285</sup>

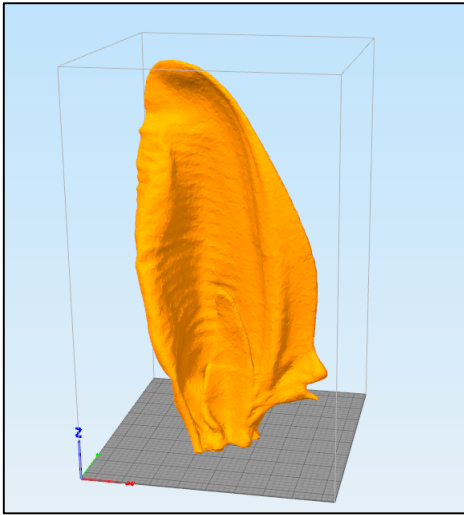
These Listening Devices were installed as part of 'Biorhythm' between January and August, 2018.



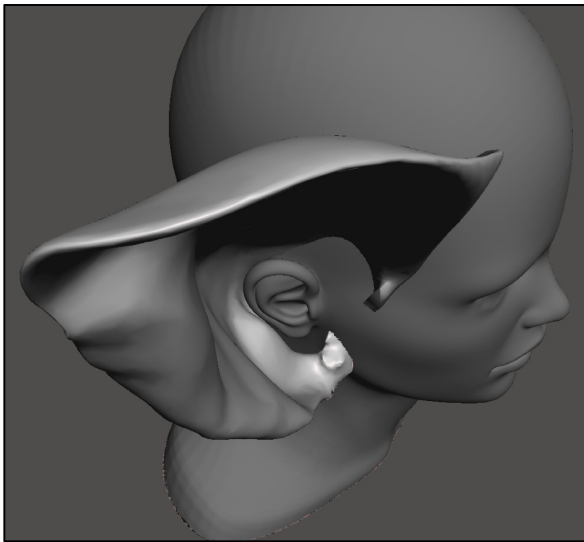
<sup>285</sup> These devices were all designed and made by the author.



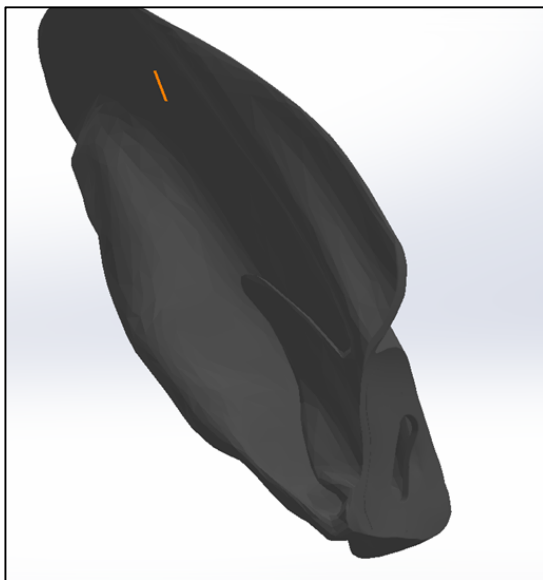
## Appendix 7: Listening Devices Bat Ear Design Process<sup>286</sup>



**Image 1:** 3d scan of the *Plecotus Auritis* bat ear.  
Courtesy Robert Mueller and  
Smithsonian Museum  
Washington, D.C.

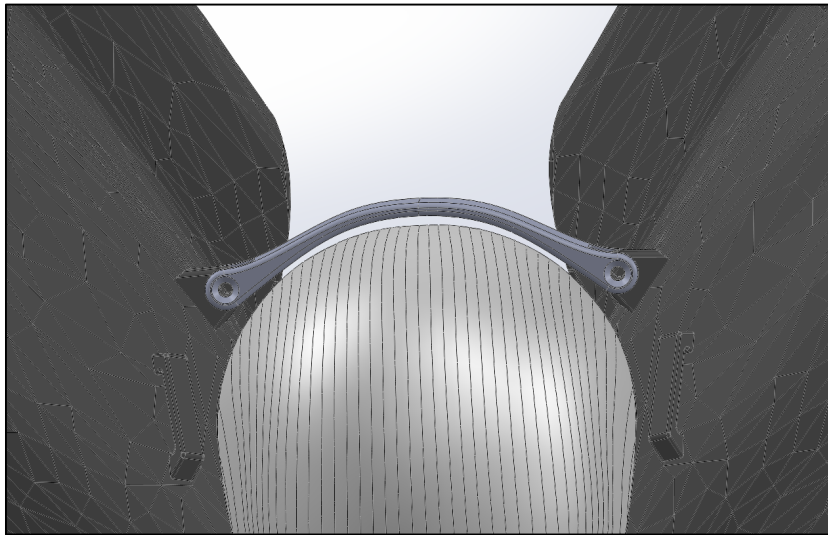


**Image 2:** The scan is smoothed and modelled around the ear. This design was abandoned as the acoustic transfer function is minimal with the human pinna exposed.

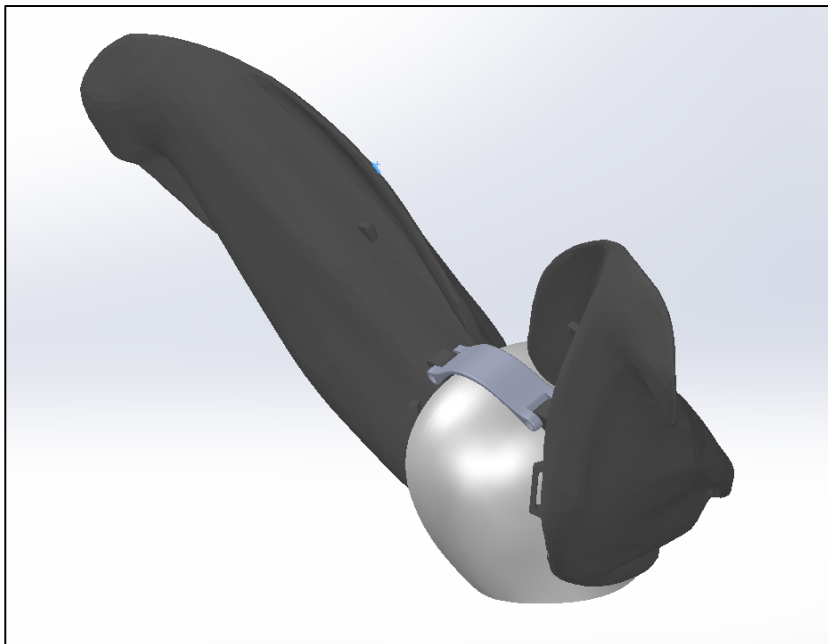


**Image 3:** The original scan is cut around a median human head shape. An opening is created at the acoustic focal point of the shape. The human pinna presses flat against the opening and sound passes directly into the ear canal. The lengthy opening accommodates the majority of head sizes.

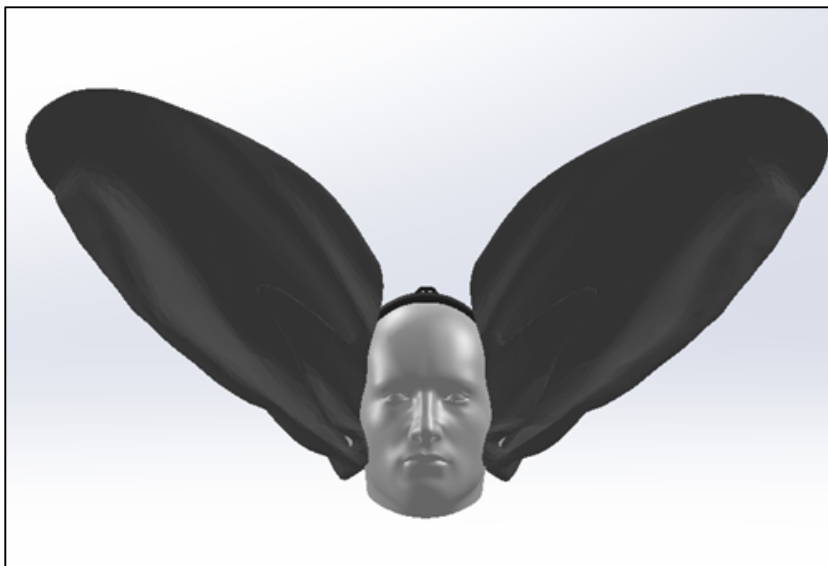
<sup>286</sup> Courtesy Nick Fry and Rolf Mueller. Reproduced with permission.



**Image 3:** Mounts are created and a band is added based on the median human head size.



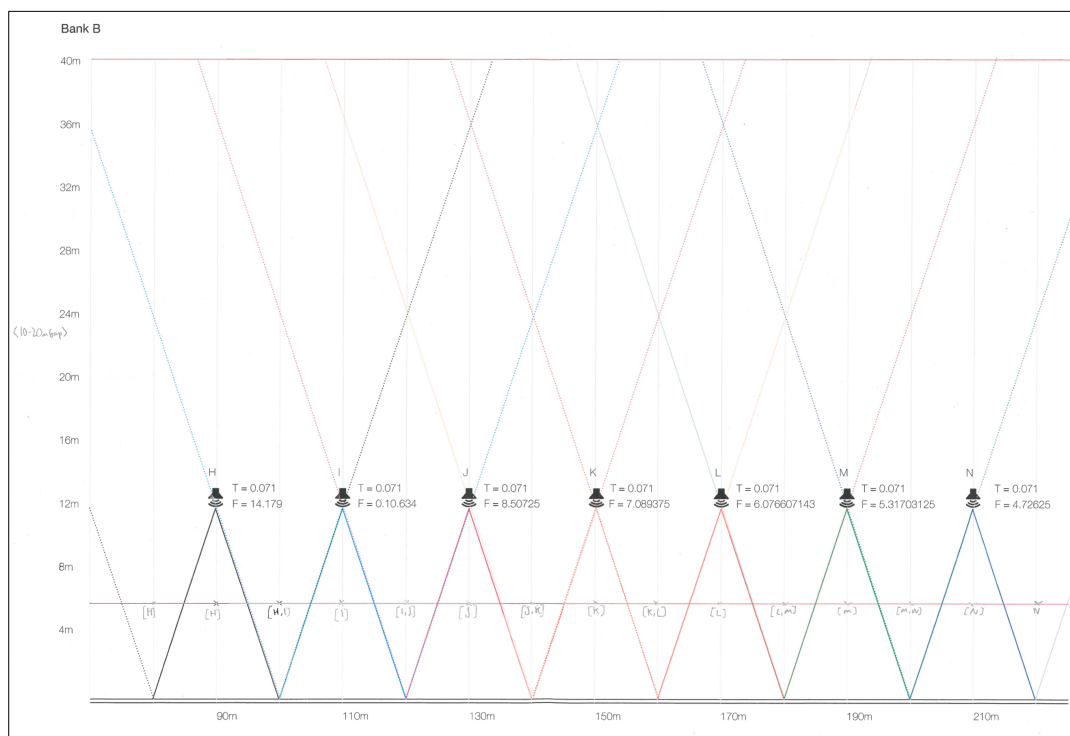
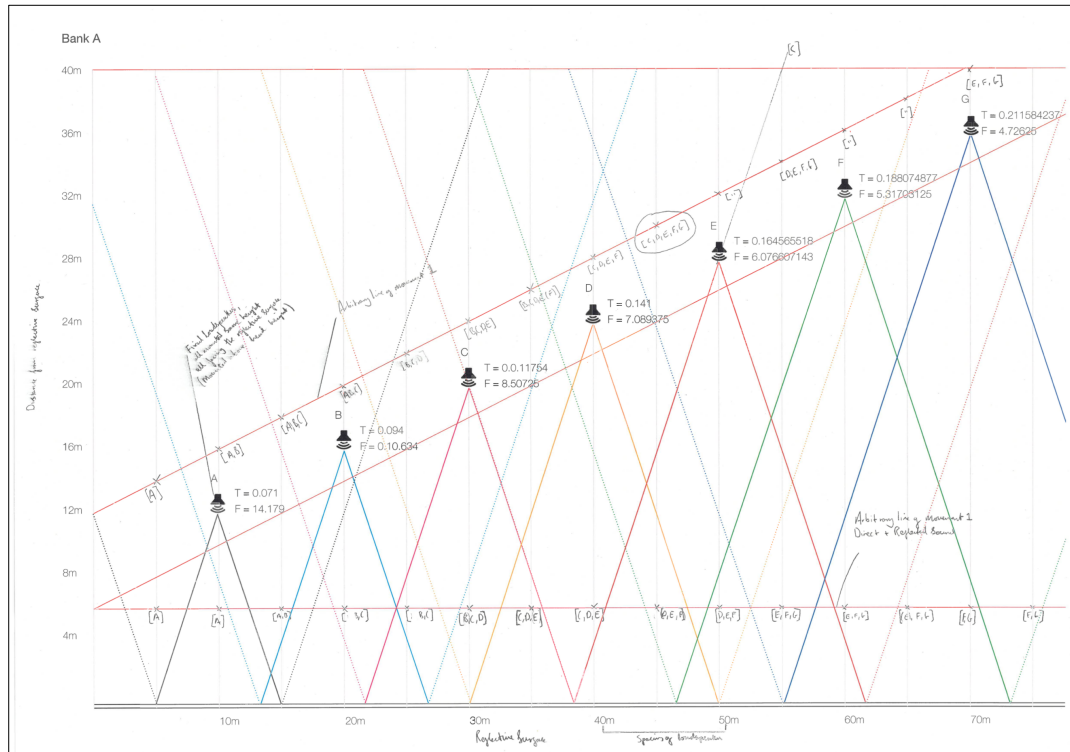
**Image 4:** Final design back view.



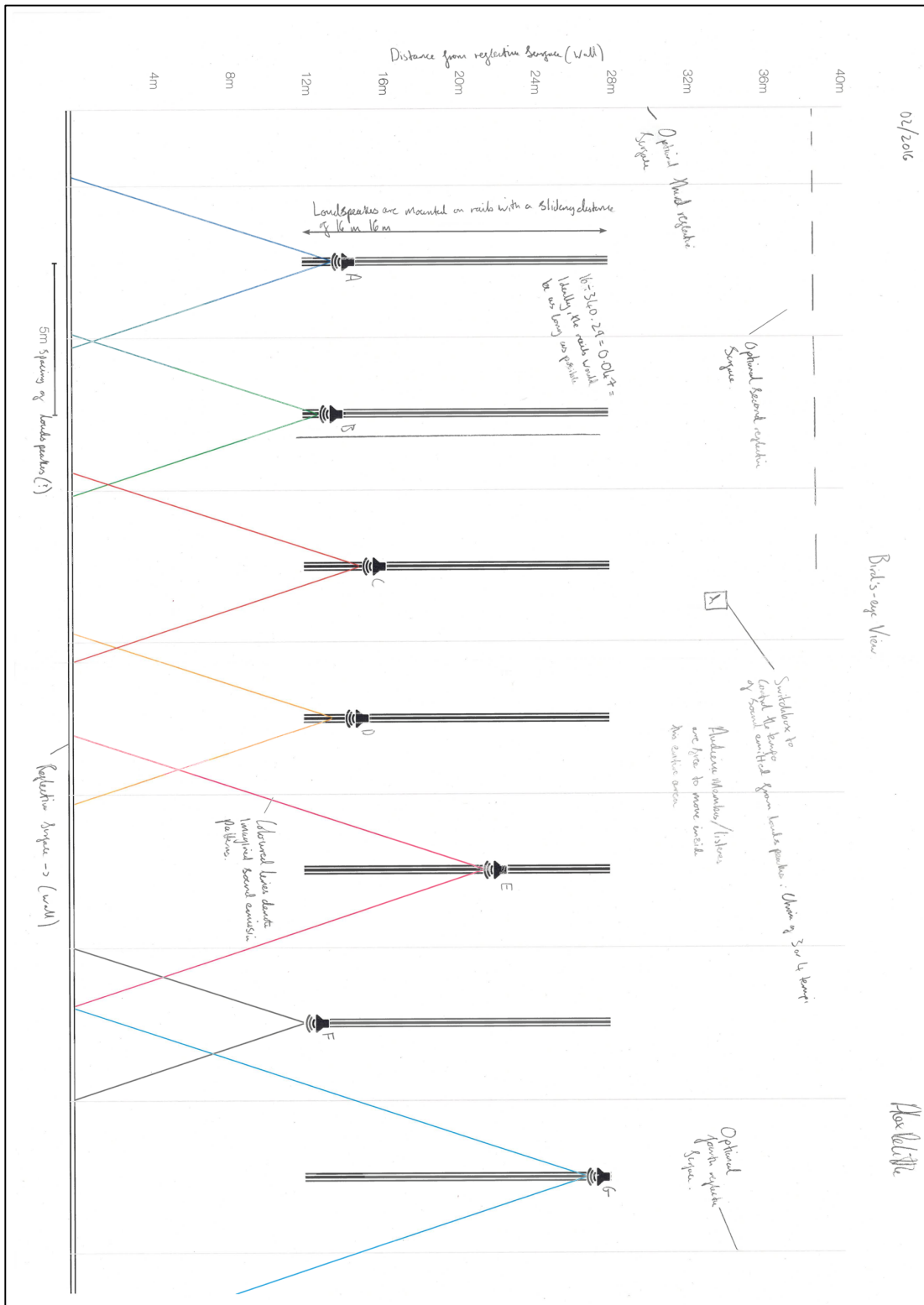
**Image 5:** Final design front view.

## Appendix 8: Reframing a Reflection Sketch

This early installation sketch conceived of two banks of loudspeakers, each bank arranged in front of a reflective surface. Bank A is arranged at varying distances from the reflective surface, and loudspeakers emit constant impulses at the same rate (defined by the time it takes sound to return to the furthest loudspeaker). Speakers in the second bank are arranged parallel to the wall. There are emitted at time intervals which correspond to the distances of the first set of speakers.



In this version, loudspeakers are on rails and may be pushed closer to or further away from a reflective surface. All speakers emit impulse-based sounds at the same rate.

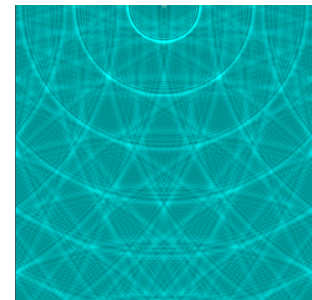
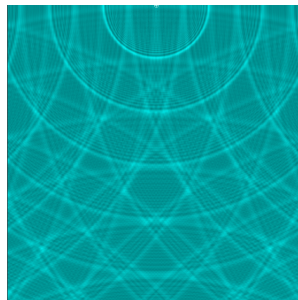


## Appendix 9: Reflection // Position Sketches

Diagrams on the following two pages simulate the propagation patterns of constantly emitted pulses in a perfectly square space. The last diagrams in each series show an established impulse topography.

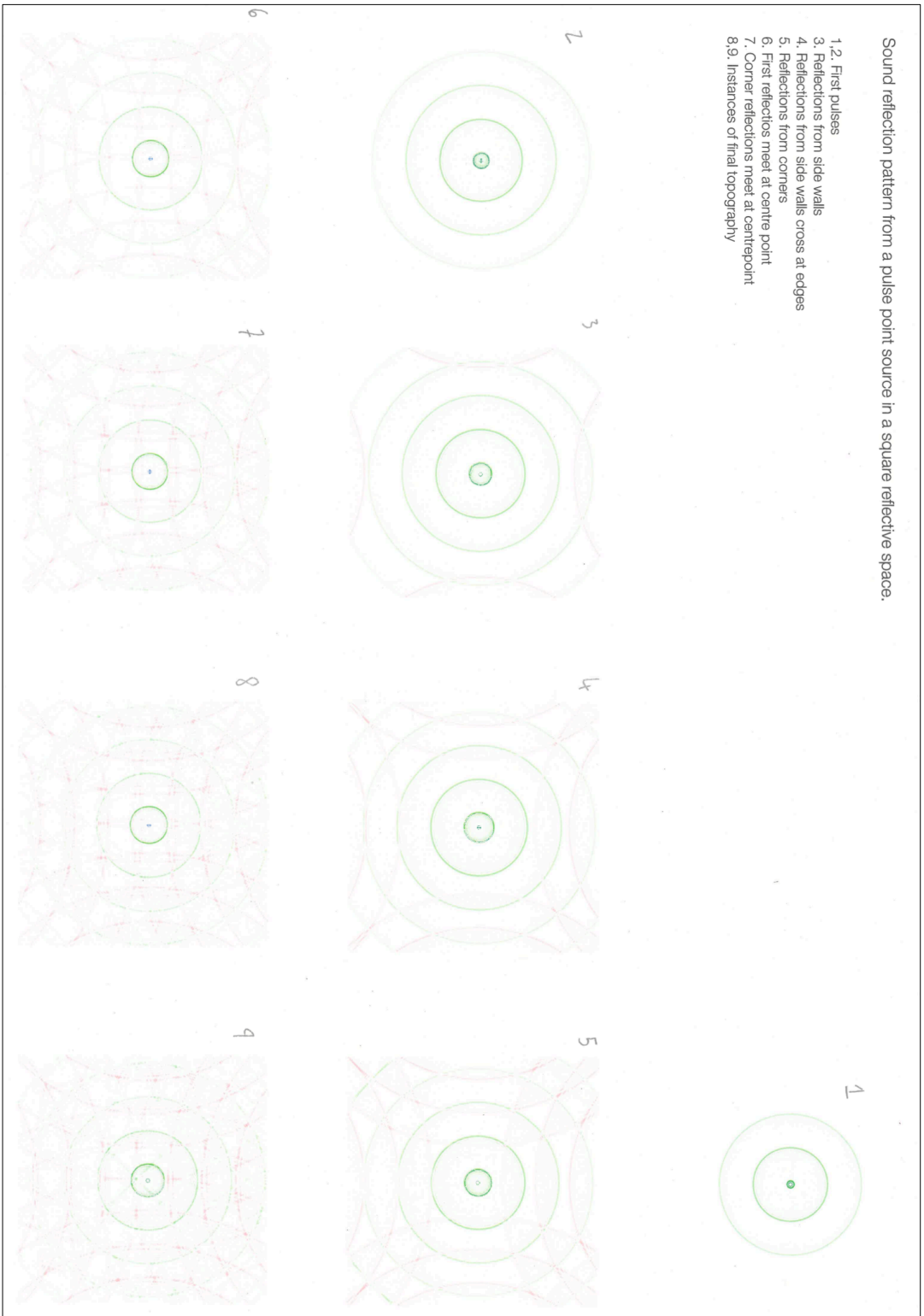
Sound reflection pattern from a single loudspeaker in a square, reflective space.

1. First pulses
2. Reflections from side walls
3. Reflections from opposite wall corners
4. Diagonal reflections from opposite wall
5. Second reflections from side walls
6. Reflection from opposite wall reaches original point of emission.
7. All reflections

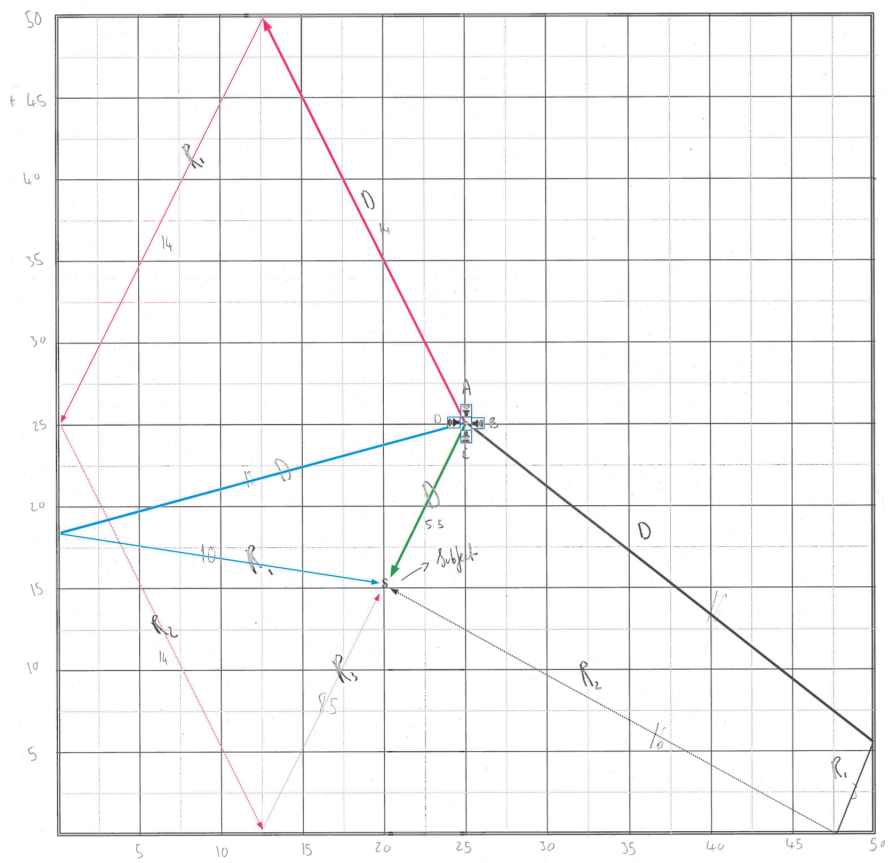
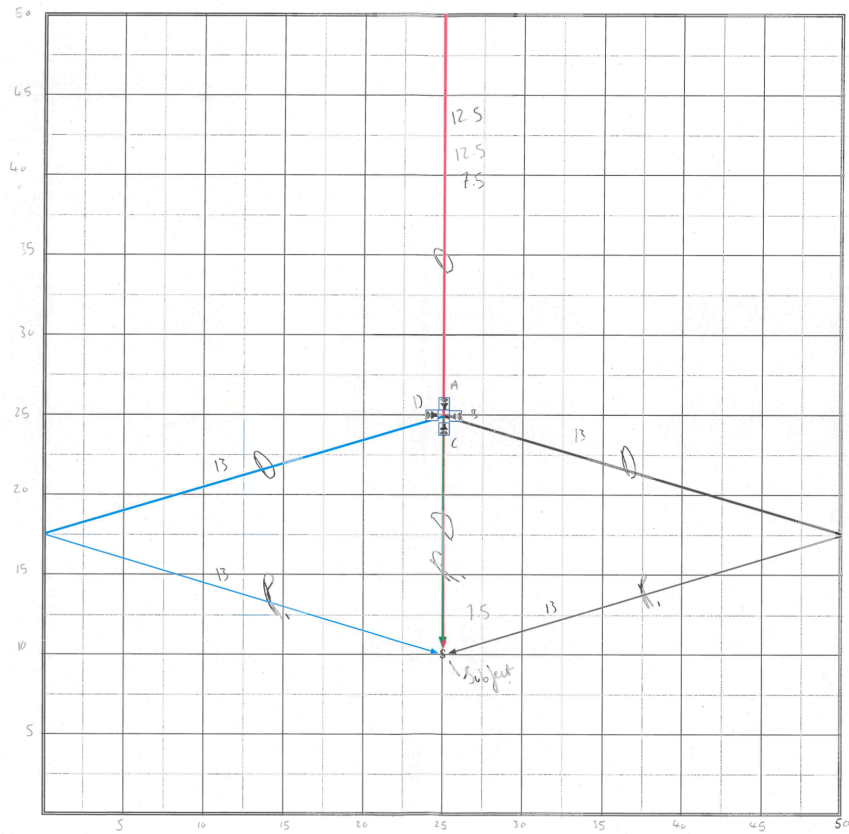


Sound reflection pattern from a pulse point source in a square reflective space.

- 1,2: First pulses
- 3: Reflections from side walls
- 4: Reflections from side walls cross at edges
- 5: Reflections from corners
- 6: First reflections meet at centre point
- 7: Corner reflections meet at centrepoint
- 8,9: Instances of final topography



These two simple ray tracing diagrams describe the manner in which impulse signatures arise as a result of the sound radiation and reflection patterns from four loudspeakers.





## Appendix 10: *Resonant Topographies* Installation Text Score

**Resonant Topologies**

**Leeds Light Night**

**6/10/2017**

Every site has its own harmonic language; resonant frequencies are acoustic phenomena whose wavelengths are directly related to a given set of spatial configurations and dimensions – a site's breath – borne directly from shape and material construction. They energetically reinforce themselves and are perceived as significantly louder than a non-resonant frequency.

They embody the physical space, and relate it to the soft bodies who intersect it.

This installation reveals the unique acoustic signature of Stage@Leeds; its resonant frequencies are calculated and played back into it in different combinations, creating a series of Resonant Topologies - three dimensional lattices of harmonic material, loud and null spots. These patterns are a direct product of the architecture of the space.

This aural exploration of a site is visually revealed and made explicit through light: An app (or webpage), accessible through your smart phone will reflect the auditory environment by converting frequency to colour, and loudness to brightness.

An inward and implicit spatial listening experience is made outward and explicit by reflecting what is aurally perceived in colour and light values. This allows patterns to emerge and connections to be made:

In the space, consider the link between:

sound and architecture

what you hear and what you feel

what you hear and the colour on your device

the colour on your device and the colours on the devices of others

all of the above in relation to what is projected onto the back wall of the space

Every five minutes, a new resonant topology will be heard: the space is reframed.

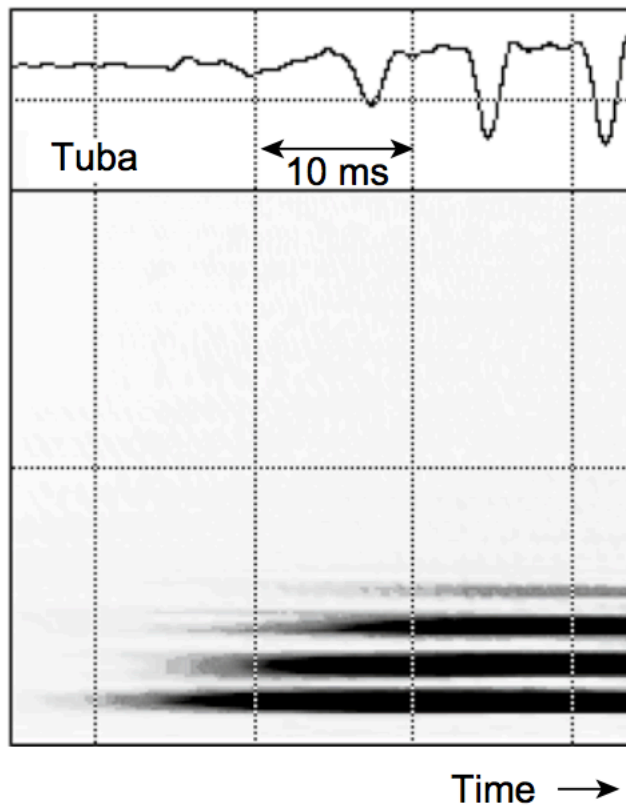
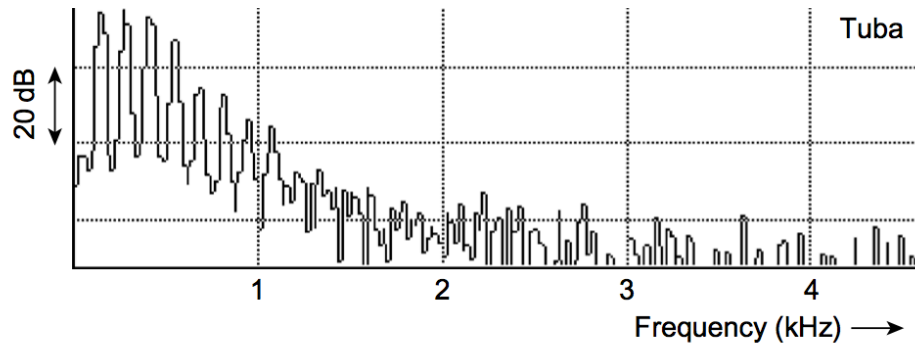
Stuart Mellor

Alex De Little



## Appendix 11: Timbral profile of the Tuba

These diagrams show the spectral energy of the tuba focused around the second, third, fourth, and fifth partials. Diagrams both from Howard and Angus, p.208 and p.238 respectively.



# Sound; Space; Play

*'Sound is not something merely projected into a space. Space is not merely sound's container. To the contrary, sound has the potential to define space, to create metaphorical walls. Sound "happens" in space; its waves traverse a distance from source to ear.'* Shannon Mattern

**Interdisciplinary, Practice-led Research Symposium**

**Saturday 30 May, 09:30-20:30**

**School of Music, University of Leeds**



**Keynote**

Peter Ablinger

**Talks**

Linda O'Keefe  
Ben Nigel Potts  
Rob Mackay

**Performances / Installations**

Peter Ablinger  
Alvin Lucier  
Alex De Little

**Workshop**

Steven Chase

**Register**

[soundspaceplay.wordpress.com](http://soundspaceplay.wordpress.com)



**CePRA**

## Appendix 13: 'On Sound and Architecture' Event Programme

### Space: On Sound and Architecture

#### The Calder, The Hepworth Wakefield

26/07/2017

In association with the Hepworth Wakefield, the University of Leeds *Centre for Audio Visual Exploration* presents an afternoon and evening of performances and workshops that examine listening in the context of the spatial environment.

14:00–16:00 ☞ Alex De Little - Listening Devices Workshop

//

16:30–17.15 ☞ Stuart Mellor – *Resonant Propagation*

17.30–18:00 ☞ Alvin Lucier - *Vespers*

18:15–18:45 ☞ Alex De Little with Tora Hed and Hannah Buckley - *Resonant Topologies: Listening Led Movement*

19:00–19:30 ☞ Alvin Lucier - *I am Sitting in a Room*

#### **Alex De Little - Listening Devices Workshop**

The Listening Devices designed by architect Lara Karady and sound artist / composer Alex De Little modulate sound according to specific aspects of our auditory sense, such as the ability to sense direction, the ability to perceive frequency, the ability to hear the distance of an object, or the ability to hear at all. Devices resonate, channel sound, block sound, and amplify sound in certain ways. They are activated by users' movement and interaction, and each device provides an opportunity for a particular approach to listening. This workshop explores the Listening Devices in the context of a series of games, which use the devices to explore our engagement with listening through movement and singing. In these games everybody is a listener, but each listener is also participant, performer and audience member. In this context, a series of individuals morph into an interdependent group whose characteristics are constantly morphing and contingent on the interrelationships between each and every listener.

#### **Stuart Mellor - *Resonant Propagation* (2017)**

*Resonant Propagation* presents an opportunity to explore the microscopic time spans of frequency and the dimensional qualities of sound pressure waves. The piece is organised as a series of sections, which “zoom in” and bring the minute rhythmical structures at play into a perceivable domain. Four speakers have been placed at four exact positions that relate to four frequencies which have been discovered in the Calder. These resonant frequencies are sound pressure waves with wavelengths that are directly proportional to the dimensional properties of the space.

#### **Alvin Lucier – *Vespers* (1968)**

*Vespers* is based on the principle of echolocation and takes inspiration from the navigational capabilities of bats. Four blindfolded listener-players navigate their way around a large space through the use of pulsed sounds emitted from sondols— megaphone-like handheld loudspeakers. The pulses emitted by the sondols reflected by the space create an acoustic signature whose complexity is gradually revealed as participants scan the space. Lucier describes this process as like, ‘taking slow audio photographs of the space’.

*Vespers* is performed by Charlotte Sadd, Tora Hed, Hannah Buckley, and Stuart Mellor.

#### **Alex De Little with Tora Hed and Hannah Buckley - *Resonant Topologies: Listening Led Movement* (2017)**

Every site has its own harmonic language; resonant frequencies are acoustic phenomena whose wavelengths are directly related to a given set of spatial configurations and dimensions –a site's breath– born directly from shape and material construction. They energetically reinforce themselves and are perceived as both louder and less directional than a non-resonant frequency. When resonant frequencies are played into a space, they create interference patterns, a landscape of areas of high and low sound pressure. Dancers Tora Hed and Hannah Buckley improvise around these topologies, creating choreographies in direct response to them. Movements and actions correspond to the physical distribution of sound in the space. The structure of the piece is defined by shifts in the awareness of the dancers, the evolving composition of the physical sonic topology and the physical presence of the audience.

#### **Alvin Lucier – *I am Sitting in a Room* (1970)**

*I am Sitting in a Room* subjects speech to an iterative process of recording and playback in a given space such that it gradually reveals the resonant frequencies in that space. Initially, speech is read live into a room whilst being recorded, and through a pair of tape recorders it is iteratively and simultaneously recorded and played back into the space. With each iteration, the recording accumulates acoustic colourations from the room, until the climax of the piece when the speech becomes unrecognizable: information conveyed through speech turns to expression of the space conveyed through ‘music’.

The original text for *I am Sitting in a Room* is read live by Scott McLaughlin

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## Appendix 14: Legroom Residency Programmes

### Resonance, Tactility and Movement

Alex De Little // Tora Hed // Hannah Buckley

Listening to Architecture Residency, LEGROOM

Sound;Space;Play

Sound;Space;Play

22/11/2017

In collaboration with dancers Tora Hed and Hannah Buckley, the first event in the Listening to Architecture series explores the resonant frequencies of the Legroom space through tactility and movement.

20:15–20:45 🗨️ Alex De Little with Tora Hed and Hannah Buckley - *Resonant Topologies: Listening Led Movement*

21:00–21:20 🗨️ Alex De Little - *Spatial Drone*

#### Alex De Little with Tora Hed and Hannah Buckley - *Resonant Topologies: Listening Led Movement* (2017)

Every site has its own harmonic language; resonant frequencies are acoustic phenomena whose wavelengths are directly related to a given set of spatial configurations and dimensions – a site's breath – born directly from shape and material construction. They energetically reinforce themselves and are perceived as both louder and less directional than a non-resonant frequency. When resonant frequencies are played into a space, they create interference patterns, a landscape of areas of high and low sound pressure. Dancers Tora Hed and Hannah Buckley improvise around these topologies, creating choreographies in direct response to them. Movements and actions correspond to the physical distribution of sound in the space. The structure of the piece is defined by shifts in the awareness of the dancers, the evolving composition of the physical sonic topology and the physical presence of the audience.

#### Alex De Little – *Spatial Drone*

*Spatial Drone* is a synthesizer improvisation which excites the resonant frequencies of the Legroom space. This is an improvisation which aims to subject a stationary audience to a range of body-listening experiences by putting the room into contrasting resonant vibratory states. During this experience, the audience becomes explicitly bound to the space through vibration. The audience both hears and feels the materiality of the space.

\*

#### Alex De Little

Alex De Little is a researcher, sound artist and composer with bases in Leeds and London. His work and collaborations have been featured at the London Contemporary Music Festival, the Tate Modern, Palais de Tokyo, East Street Arts' Patrick Studios, The National Media Museum, the Stanley and Audrey Burton Gallery, and the Hepworth Wakefield. He is completing a practice-based PhD with Scott McLaughlin and Martin Iddon at the University of Leeds. Alex's practice is concerned with how we listen and perceive our spatial environment through sound. He is interested in sound as a medium through which we can understand the world and aims to work between disciplines to create practice which engages people with space and place sonically through play. <alexdelittle.com>

#### Hannah Buckley

Hannah Buckley is a performer and maker based in the North of England (graduating from the Northern School of Contemporary Dance in 2010 she obtained a BPA in Contemporary Dance). She makes work about human experience from a personal perspective. She is interested in the complexity of human co-existence - questioning the way we live and creating space to imagine new realities. Her work has been supported by organisations including Yorkshire Dance, The Place, Dance4, Greenwich Dance and Arts Council England, and shown at venues such as The Whitworth, Baltic39 and Live Art Bistro. Hannah has an ongoing collaboration with her twin sister, a photographer based in NYC, which began (artistically) in 2009. She is also part of Accumulations, a collective of four artists working primarily in movement, dance and performance. <hannah-buckley.com>

#### Tora Hed

Tora Hed is an independent choreographer and dancer from Sweden, based in Leeds since 2012. She trained in contemporary dance and ballet at the Northern School of contemporary dance and specialized in improvisation. During her undergraduate degree at NSCD, Tora worked with choreographers including Dam Van Huyg, Angus McLean Balbernie and Carlos Pons Guerra, as well as winning the Carolyn Woolridge Outstanding Performance Award. Tora has made works from solo to extended pieces and collaborated with other dance, music and filmmakers across the UK and Europe.



  
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Sound;Space;Play

**Space as Time, Space as Frequency**  
**Alex De Little // Stuart Mellor // James Seabrook**  
**Listening to Architecture Residency, LEGROOM**

**26/11/2017**

This selection of performances marks the culmination in Alex De Little's artist residency at LEGROOM. These performances use the language of the physical properties of sound to frame (and reframe) space through games and techniques which are always determined by listening to the acoustic response(s) of the space. Through this practice, listening becomes the method through which audiences and participants begin to *know*, and engage with, space. The works in this event use two broad approaches to 'framing' space. First, space as frequency, and second, space as time. The first approach aims to create understandings of spaces through exciting and listening to their resonant frequencies. The second creates understandings of spaces through making sounds and listening to resulting temporal responses – echo, reverb, reflection.

**LISTENING TO ARCHITECTURE** is Alex De Little's artist residency at LEGROOM, from 20 to 26 November, 2017. The public event programme features collaborations with dancers Hannah Buckley and Tora Hed as well as musicians from the Royal Northern College of Music, and work by composer and technologist Stuart Mellor.

**16:45** 🎧 **Alvin Lucier – *I am Sitting in a Room (We are Sitting in LEGROOM)***

**17:15** 🎧 **Alex De Little with Nicole Prior, Amy Lawrence, Chloé du Bateau, David Birchall and Giorgos Stenos Frantzios – *After Vespers: Architectural Sound Walk***

**18:00** 🎧 **Stuart Mellor – *Partial Decay***

**18:20** 🎧 **Alex De Little with James Seabrook – *After Vespers: Architectural Sound Walk***

**Alvin Lucier – *I am Sitting in a Room (1970)***

*I am Sitting in a Room* subjects speech to an iterative process of recording and playback in a given space such that it gradually reveals the resonant frequencies in that space. Initially, speech is read live into a room whilst being recorded, and through a pair of tape recorders it is iteratively and simultaneously recorded and played back into the space. With each iteration, the recording accumulates acoustic colourations from the room, until the climax of the piece when the speech becomes unrecognizable: information conveyed through speech turns to expression of the space conveyed through 'music'.

The original text for *I am Sitting in a Room* is read live by Juliet Davis and Amy Lawrence

**Alex De Little with Nicole Prior, Amy Lawrence, Chloé du Bateau, David Birchall and Giorgos Stenos Frantzios – *After Vespers: Architectural Sound Walk***

In this performance, the audience is lead round a series of architectural sites in central Manchester, which are sonically activated in various ways by a group of percussionists. The audience hear the spaces through which they are lead framed and reframed in relation to sounds that are emitted and patterns of movement which take place. This performance was created in a participatory workshop on 24 November as part of the *Listening to Architecture* residency.

**Stuart Mellor – *Partial Decay***

The propagation of sound through space, following an initial sonic impulse, is a journey that tells of contortion, disruption and diffusion. As sound permeates the physical configuration and texture of space, an imprint describing the very features of interaction are infused in the audible quality of the sound that remains. Tracing these minute fluctuations across the frequency spectrum and through time creates an opportunity to identify sonic patterns that ultimately represent the way in which we perceive the acoustic character of space. *Partial decay* is a composition that explores the nuances of spatial acoustics and deconstructs the changing quality of sound into vignettes of sonic texture and colour. This piece is based entirely on acoustic analyses of LEGROOM, which were conducted on 20 November as part of the *Listening to Architecture* residency.

**Alex De Little with James Seabrook – *Spatial Drone 2***

*Spatial Drone 2* is a synthesizer and Tuba improvisation which excites the resonant frequencies of the Legroom space. This is an improvisation which aims to subject a stationary audience to a range of body-listening experiences by putting the room into contrasting resonant vibratory states. During this experience, the audience becomes explicitly bound to the space through vibration. The audience both hears and feels the materiality of the space. This piece was developed as part of the *Listening to Architecture* Residency. *Spatial Drone 2* is a development of an earlier version, performed on 22 November in LEGROOM.



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Appendix 15: RA Alternate Languages Programme, Venice Biennale of  
Architecture 2018

[Included loose with submission]