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Making COVID dis-connections: designing intra-active and transdisciplinary sound-based narratives for phenomenal new material worlds

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ABSTRACT

In this article, we reflect on the design and implementation of an interactive transhistorical and transmedial web-based digital narrative audio experience, PATTER(n)INGS: Apt 3B, 2020 that we developed in 2020. This work is an immersive audio-only application, and it focuses on the complex, material living conditions during the COVID-19 pandemic. Drawing inspiration from PATTER(n)INGS and its complex, material audio and narrative design, we propose a model for creating the content and delivery for similar sound-based interactive digital narratives. Our proposed model focuses primarily on the creative process for designing such sound-based work.   To construct our analytical model, the New Material/Spectral Morphology Design Model (or NM/SM Design Model), we draw on theoretical influences from critical posthumanism, feminist new materialism and non-human narrative that critique notions of stable subjectivity as sites for power and authority over semiotic meaning-making. We combine these views with foundational theoretical research in electroacoustic musical composition notation, and audio experimentation that complicate notions of sound, sound making, spatial perception, psychoacoustic phenomena, and listening practices. Together, this theoretical/compositional framework provides a unique method to consider how one can sustain and maximize sonic agents as core phenomena to create anti-cognitive worlds and stories.

The notion of gesture as a forming principle is concerned with propelling time forwards, with moving away from one goal towards the next goal in the structure—the energy of motion expressed through spectral and morphological change. Gestural music, then, is governed by a sense of forward motion, of linearity, of narrativity. The energy—motion trajectory of gesture is therefore not only the history of an individual event, but can also be an approach to the psychology of time. (Smalley, 1997, p. 6)

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Affect, at its most anthropomorphic, is the name we give to those forces-visceral forces beneath, alongside, or generally other than conscious knowing, vital forces insisting beyond emotion-that can serve to drive us toward movement, toward thought and extension, that can likewise suspend us (as if in neutral) across a barely registering accretion of force-relations, or that can even leave us overwhelmed by the world's apparent intractability. Indeed, affect is persistent proof of a body's never less than ongoing immersion in and among the world's obstinacies and rhythms, its refusals as much as its invitations. (Gregg & Seigworth, 2010, p. 1)

1. Introduction: theoretical overview

In this article, we reflect on the design and implementation of an interactive digital narrative audio experience *PATTER(n)INGS: Apt 3B, 2020* (or *PATTER(n)INGS*), a web-based audio-only interactive digital narrative we developed (with Programmer Gustav Johanssen) and evaluated in 2020 during the start of the COVID-19 global pandemic (Holloway-Attaway & Fawcus, 2020). The aim of the work is to represent and reflect on the complex material living conditions of the pandemic through experimentation with interactive sound-based narratives, electroacoustic music composition, and transhistorical and transmedial influences. We use this work as a basis to illustrate our proposed conceptual framework to support the creation of *other* interactive digital narratives (IDNs) that may feature related material, acoustic phenomena as the primary agents for delivering story content. Although out focus in on illustrating a model that can be used as a creative design tool, we propose with further refinement and validation, it could be further extended to serve as a form of analysis for other works (in combination with user studies for example) or even for other transmedia works (such as immersive audio/video).

Our proposed model, the *New Material/Spectral Morphology Design Model* (or *NM/SM Design Model*) draws theoretical influences from critical posthumanism, new materialism and non-human narratives that critique notions of stable subjectivity as sites for power and authority over semiotic meaning-making and/or storytelling. These narrative forms as we define them promote material, rather than abstract semiotic states and as such are grounded in the lived experiences of the world and in the worldly experiences that express them; they are affective and felt, rather than cognitively decoded, organised and rationally understood. We combine these views with foundational theoretical research in electroacoustic music composition and audio experimentation that complicate notions of sound, sound making, spatial perception, psychoacoustic phenomena, and listening practices. In particular, we highlight Denis Smalley's influential work on dynamic aural spectra or spectromorphology (Smalley, 1997), and we adapt it to include more specific contemporary references to new material philosophies focused on emergent phenomenal objects, drawing heavily on Karen Barad's theories of Agential Realism (Barad, 2007).

Together, this theoretical/compositional framework provides a design method to consider how one can sustain and maximise sonic agents in a series related apparatuses as the core phenomena to create anti-cognitive, intra-active narrative worlds. Drawing on Smalley's notion of spectromorphology and gestural music (the ways in which sound spectra are shaped over time and propelled *forward* by sending agents in search of receivers), we refer instead to *spectral morphologies*. These even more *ghostly* sound shapes, agents, and linguistic processes recall Smalley's model based on their emergent properties that come into perception only through specific *un-natural* encounters with senders and receivers. As such, they offer *gestures toward meanings*, opportunities for sense-making, but with no clear end goal for meaning as a teleological promise, despite their (seemingly) linear projections from senders to receivers (or writers to readers). They also specifically recall the kind of boundary-marking phenomena (or agential cuts) that Karen Barad (2007) identifies in her theory of Agential Realism. These phenomena are central to a complex mode of material-discursive intra-activities, assemblages (or more specifically apparatuses) in a world-space that generate meanings and performatively tell and express sites and states of existence. These kinds of *other* material phenomenal agents and agencies *haunt* the traditional concepts of linear narrative and musical fixity, found within, for example, traditional literary texts and musical scores. Instead, these material phenomenal conditions, the possibilities/impossibilities for meaning, the assembling of the apparatuses in temporary states of alliance, favour more allusive, affective, and abstract bodies of expression: these are clusters of operational relata with specific operational functions to encourage engagement and interpretation; these "apparatuses are the material conditions of possibility and impossibility of mattering; they enact what matters and what is excluded from mattering" (Barad, 2007, p. 148). In this sense, they can tell *other* stories of disruption, of discomfort, and they offer counter resistance to false narratives of resolution and to simplistic closure and security as told by expert senders and receivers in organised and controlled/controlling narrative systems. Instead, our vision for material and gestural audio-based IDNs circulate audio spectra and phenomena in functional clusters, apparatuses, that strategically *gesture* towards reception, but never fully engage with pure, stable, linear systems of organisation.

In the following introductory sections, we further discuss the theoretical foundations that underlie the narrative and audio design of *PATTER(n)INGS* and offer more background for the design of the work (Section 1.2.) and the critical posthumanist, feminist new materialist, non-human narratives that inform our design structures and content (Section 1.3). We also outline our influences from Electroacoustic Music composition (EAM) and audio experimentation, particularly from Smalley's Spectromorphology model that extends the theoretical principles and which formulates the basis for our own *NM/SM Design Model* (Section 1.4). The introduction is followed by our

Methods section where we more formally outline the *NM/SM Design Model* we propose based on our explication of select sections of the narrative and audio compositions from *PATTER(n)INGS* to illustrate its compositional strategies and capabilities. In our concluding discussion, we suggest how we believe our model could be extended and used for future development and potentially even for analysis of other related IDN works that align with the foundational principles of new materials, non-human narratives and that foreground qualities of disruption, dis-connections, and resistance to traditional linear narrative composition.

1.1. Creating a phenomenal material COVID audio experience

PATTER(n)INGS is an interactive audio-only experience created in the game engine Unity (Unity, 2018) meant to simulate the state of pandemic lockdown within the walls of an apartment as overheard by a single eavesdropper. The work explores fragmented and disordered personal states of being derived from the human/nonhuman/and inhumane experiences of people suspended in the emerging *new normal* spaces, patterns and troubled times of mid-2020, early COVID-19 existence (Holloway-Attaway & Fawcus, 2020). But it also draws on many transhistorical and transmedial influences and contemporary theoretical perspectives that complicate perceptions of fixed, linear histories, complete narratives, and traditional representations and semiotics for world-building and meaning-making in storytelling contexts (Holloway-Attaway, 2018; Knoller, 2019; Koenitz, 2015; Murray, 2017; Murray, 2018; Rouse & Koenitz, 2018). The pandemic world(s) we evoke are deliberately contradictory in nature, defying traditional ideas of history-telling and spatial orientation. Like the pandemic, they are disconcerting, disorienting and resistant to simple interpretation through the hyper use of fragmentation and (aural) media confusion.

Such confusion in *PATTER(n)INGS* is highlighted as it is designed primarily as an audio-only experience. It is constructed as a web-based interface with no identifiable graphics, other than some opening textual instructions, and then a full-screen black square when it is in playable mode. (See Figures 1 and 2.) A user (or "eavesdropper") ideally wears headphones to play the piece, both to emphasise the focus on the audio content and the sound design, but also to isolate the ears as the primary sensory receiving source. In this way, eavesdroppers are limited in their interactive affordances, as well as their sensory input, and their primary mode of physical interaction is only to move a computer mouse blindly across the flat surface of a desk in front of a blackened computer monitor, discovering hidden sound files that comprise the eight *rooms* (listening spaces) of Apartment 3B. The rooms are metaphorical and do not correspond to actual living spaces (kitchens, living rooms, etc.). Rather they are deliberately ambiguous and serve mainly as clusters of related sound groupings

Figure 1. Opening screen of *PATTER(n)INGS*.
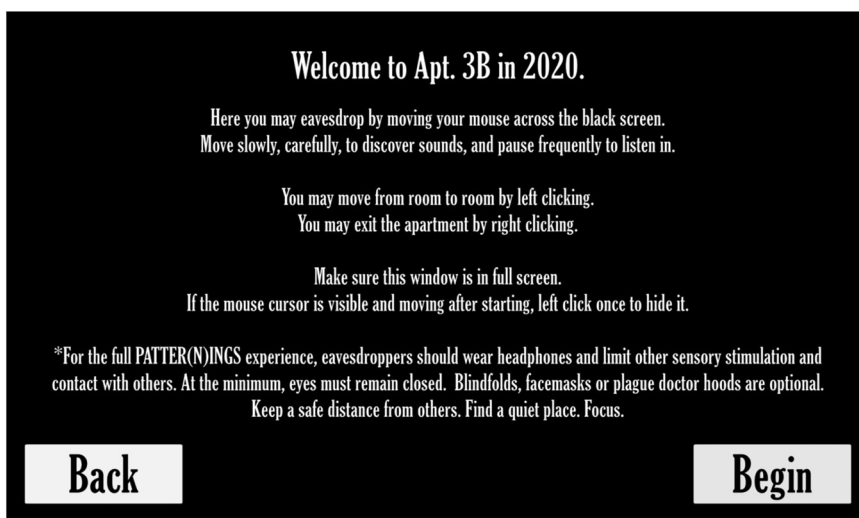
Figure 2. Instructions for eavesdroppers in *PATTER(n)INGS* on second screen before beginning the experience and entering the apartment.

as a way to serve as destinations through the application defined by the creaking sound of an opening or closing door. The eavesdropper repeats the mouse movements until they have explored all the rooms of Apartment 3B. Collectively the sound fragments in the rooms, as discovered randomly by the eavesdropper, narrate the simulated experience of subjects (human and otherwise) inside the apartment during the COVID lockdown. The audio content is disordered and non-linear (eavesdroppers can discover sound files in any order), as well as diverse.

Although each room is thematically connected, the connections are not always obvious to the eavesdropper, and the ability to discern if one has found all of the sounds or completed the room, is unclear. The sound files are layered, and they overlap to create an illusion of both a specific location (a room within an apartment) but also a timeless and multiplicitous space, disorienting both spatially and historically with its use of disruptive and fragmented sounds, binaural audio, and contemporary and older literary sources. (In our Methods section (section 2), we review the audio room design in more detail.) Constructed similarly to combinatory poetics works or hypertext fictions, that make use of chance and procedurality as an authoring/un-authoring form of composition (Rettberg, 2019), but also to the indeterminate, generative and aleatory music of composers like John Cage and Brian Eno, who distribute authorship to human and non-human forces, the audio composition is layered to hide the sound source (the senders) of the composing sonic agents (both narrative/audio). In this way, within *PATTER(n)INGS* and its rooms, we reflect on the difficulty of processing both temporal and spatial existence, a familiar reality for many during the suspended state of the pandemic lockdown of 2020, and beyond, when we are hyper-focused on discovering what exactly is going on in the almost familiar, yet disordered world.

The narrative content includes voiced/whispered text, isolated environmental sounds, both familiar and difficult to discern (crying, creaking doors and chairs, cat purring, bird calls, paper rustling, for example), and snippets of contemporary (2020) pandemic news stories. Other material comes from historical literary sources, voiced and read aloud, including first-person excerpts from personal accounts of plague and disease narratives—from Boccaccio's *Decameron* (1995), Pepys' Diary of Samuel Pepys (1932), and Gilman's *The Yellow Wallpaper* (2006), for example. To emphasise the complicated realities of domestic space during the pandemic, we also include some reflections on home and storytelling from Ursula K. Le Guin (1985), combined with other original texts and recordings based on/inspired by contemporary (2020) news reporting and obituaries focused on personal loss and threats of viral global destruction (Grippe, 2020). Such a mix allows us to consider the pandemic as both uniquely disruptive, as a novel 2020 phenomena, but also widespread and uncontrollable, historically anticipated, and therefore timeless, human and inhumane.

The work is a challenge to traditional concepts of space and time. As such it is located (here and now) but also speculative and historically layered and imprecise (from the past, suggestive of a present, but also forward-thinking, projecting forward). We understand and represent the COVID-19 pandemic as a world-changing cultural, social political cross-sectorial disaster, one that challenges our sense of domestic/public space, of normalcy and personal safety, as well as foregrounding our distrust of media narratives, authoritative governmental institutions, and familial order. *PATTER(n)INGS* is constructed

as a generative world-space to explore non-traditional expressions and narrative possibilities, particularly through disruptive semiotic systems. Collectively the mixed texts/audio sources we use aim to destabilise fixed subject identities, histories and rational cognitive states in favour of affective, ontological, material ones to support narrative delivery for an uncertain listener.

1.2. New material reflections and influences

The disruptions and disorientations, central to our narrative and audio content and design in *PATTER(n)INGS* are reflected in the theoretical influences that inspire us. We are highly influenced by the philosophical perspectives of critical posthumanism (Alaimo, 2010; Alaimo, 2017; Braidotti, 2013; Grosz, 1994; Hayles, 1997; Wolfe, 2010), non-human narratives (Bennett, 2010; Haraway, 2016; Parikka, 2010) and feminist new materialism (Alaimo & Hekman, 2008; Barad, 2007). Collectively these theorists offer critiques of the notion of stable human subjectivity as a place of power and authority, and thus also as a reliable site for narrative coherence and of immutable identity formation and the oppression it. These foundations from which we drew inspiration, allow us to experiment with a form of IDN based on non-centralised power and meaning-making with an aim towards shared experience and affective relationship among the story-telling agents and the recipients of the narrative content. Combining these theoretical views with other influential research in EAM composition and audio experimentation focused on practices to distribute sound across sending and receiving/listening bodies (outlined in more detail in Section 1.4) we further complicate notions of our acousmatic phenomena as coming from "somewhere" specific and recognisable. Instead, the distribution of content across multiple bodies and sources serves as a form of resistance to linear and controlled narratives and storytelling modes.

Drawing on these mixed frameworks of influence (from philosophical and theoretical perspectives to audio-based composition models) offers a robust foundation to consider *more-than-human* creative making, making beyond human-centered composition, as well as present a critique of the simplicity of perception and reception in narrative contexts. Furthermore, we can become fully engaged in a more radical material revolution and consideration of IDNs while re-thinking traditional discourse and representation. Collectively these philosophical re-imaginings question the alleged stability of the individual liberal human subject and the institutions and agencies of power associated with human exceptionalism and capitalism. They instead advocate for new ways to identify and engage with more distributed power dynamics and material realities to offer ethical and responsible approaches to their multiple interconnected networks of exploitation and oppression.

Entangling a variety of domains for interaction within our works (social, historical, virtual, physical, human and other) sound/audio IDNs like ours in

PATTER(n)INGS are also differently spatialised and their temporal dimensions collapse past-present-future distinctions in ways that may be oppressive and universalising, but are also open to radical remaking. We find these worlds are also deeply embodied and massively distributed in the network relations they sustain. Such interconnectedness and reconfigurations among material elements, embrace affective and embodied registers for meaning-production and critique beyond linguistic and purely cognitive forms. Gregg and Seigworth (2010) remind us that affective relations are co-constitutive, and they embrace rhythmic, intense relations among agents on the move:

> Affect is found in those intensities that pass body to body (human, nonhuman, part-body, and otherwise), in those resonances that circulate about, between, and sometimes stick to bodies and worlds, and in the very passages or variations between these intensities and resonances themselves. (p. 1)

These affective worlds are configured to embrace sonic, musical registers, resonating among senders and receivers. They also orient an interactor towards political and ethical responsiveness and direct actions to challenge the objectivity of texts and traditional semiotic meaning-making and storytelling. This form of telling is one Donna Haraway likens to the practice of radical *SF* storytelling. For her, *SF* stories encompass many elements and assume many names: "SF is a sign for science fiction, speculative feminism, science fantasy, speculative fabulation, science fact, and also, string figures" (Haraway, 2016, p. 10). The intra-active stories she promotes are not only a form of resistance to traditional narrative, they are more like games, and they are, then, played, not read:

> Playing games of string figures is about giving and receiving patterns, dropping threads and failing but sometimes finding something that works … of relaying connections that matter … String figures require holding still in order to receive and pass on. String figures can be played by many, on all sorts of limbs, as long as the rhythm of accepting and giving is sustained. (Haraway, 2016, p. 10)

Again, the reference to rhythmic senders and receivers, passing on and among, is a fruitful foundation for considering the audio designs we promote. This call to embrace dispersed material (sonic) agents, to de-stabilise representation and to make it resonate instead, offers us a compelling framework to consider intra-active narrative forces in our audio IDN storyworlds.

1.3. Electroacoustic music and spectromorphology

In our audio design for *PATTER(n)INGS*, we purposefully complicate our content-delivery method and incorporate different kinds of sonic agents to flood the narrative space. These include voice narration, psychoacoustic

phenomena, such as auditory brainwave entrainment, binaural beats, and fragmentation/granulation of sound materials that de-centralise and deconstruct the worlds and bodies we make. From the standpoint of genre, collectively, we also move across and blur multiple intra-disciplinary boundaries, moving between musical performance, field recording, sound art, sound assembly and live performance. All the states require a listener (an eavesdropper or other) to intervene, listen, watch, and attempt to interpret the experiences that are deliberately designed to resist clarity and coherence.

In *PATTER(n)INGS*, we aim to explore transdisciplinary theoretical concepts and practices around narrative systems, decentred narrative, space, perspective, isolation and the passage of time through creative practice. Experimental audio work like ours, often starts with creative processes that appear conventionally unplanned and non-linear. In fact, the creative process itself could be argued to be more energetic and efficient when unconstrained by rigid, linear planning or compositional approaches. However, we suggest there is value in experimenting with analytical creative models that allow for a messy creative process, and even enhance or contribute to it. In this context, Dennis Smalley's spectromorphology system becomes interesting to us as it is open for describing the multidimensional process or *activity* of listening, as well as the dynamic movements/shapes (morphologies) and interrelationships of sound material in the act of sending/receiving audio phenomena (Smalley, 1997). Using a model like Smalley's shifts focus from the categorisations and sources of the material (which can often conceptually freeze and immobilise them) focusing instead on their dynamic performative life, movement, development and interaction within a given aural environment.

Smalley also offers a specific reflection on EAM, recognising *technical* interventions into musical composition are differently constructed by nature. With the advent of electronic sound recording, editing, splicing, recombination, synthesis and re-synthesis, the existing methods of music notation and analysis soon became insufficient to examine and explore the breadth and complexity of sound relationships made possible in electronic music/sound design. In instrumental music, many composers had already experimented with abstract, pictorial or graphical approaches to the representation or composing of music and sound. Karlheinz Stockhausen's fixed media work "Kontakte" (1958–60) for example is meticulously designed and described in a document of over 700 pages, including technical instructions for audio engineers and graphical layout of structures and movements (Stockhausen, 1958–60). This approach was necessary both in order for the composer to realise and execute the work, and to be able to recreate the work from scratch at a later date. Stockhausen notated and described every element of the piece in the score/document, and also analysed/described of the inter-relationships of sounds and structure verbally. "Kontakte", and a number of his other works, were extensions of the compositional approach of "total serialism" developed earlier by composers

such as Arnold Schoenberg and Alban Berg an approach in which Stockhausen and others attempt to systematise and control every aspect of the musical production, not just the notated instructions to musicians. Iannis Xenakis used diagrams, graphs, mathematical formula and graphical representations as methods to explore architectural, stochastic and statistical ideas in music (Xenakis, 1992) leading him to develop software—UPIC—that could translate graphical images into sound directly. Other composers have explored the visual representation of sound and musical structures, both as methods to compose original material, break from conventions and established methods of composition, and to analyse and reflect on audio works in a manner less bound to traditional musical practice. Many other examples of graphical scores and analysis can be found in a myriad of places, either created and employed by the composers themselves or merely implemented by interested listeners in order to explore or better appreciate the sound work.

Smalley's spectromorphology is not entirely unique, and his model builds on the work of Pierre Schaeffer in his "Traite des objets musicaux" (1966), together with Michel Chion's *Guide to Sound Objects* (2009) (which acts as a kind of guide and handbook to Schaeffer's original text) where he works to analyse, categorise, examine and define both sound "objects" and their morphology, and interaction, both on a technological and compositional level, but also on a philosophical and perceptual level. A different approach, concentrating on notational typologies, has also been explored by Lasse Thoresen (Thoresen, 2007). However, we find Thoreson's model is better suited to the analysis of linear acousmatic music rather than inter/transmedia arts like Smalley. According to Smalley, his spectromorphology model is a *collection of tools* for describing sound shapes, structures, and relationships, based on aural perception, not on semiotic notation of pre-existing, recognisable spectra. In essence, Smalley's model is a complex and layered system of listening, arranging and understanding EAM sound and can function independently of any traditional musical analysis born of the western tonal musical traditions. Significantly, he claims directly that spectromorphology is not intended to be prescriptive analytical or (music) compositional system. Rather it is a flexible tool for "speculating and imagining" not to be organised into a single analytical or compositional action (Smalley, 1997, 92). There is an appeal also within its verbal structures (Smalley's intensive technical vocabulary) that invites experimentation and exploration outside the initial boundaries of EAM analysis.

While spectromorphology has been examined and expanded by others, primarily within the electroacoustic world (Blackburn, 2011; Patton, 2007 and many more), its use in more transdisciplinary works is less well documented. We believe Smalley's investigations and subsequent linguistic system could provide a bridging model between conceptual ideas, objects, processes and interpretations. Further, if we consider Smalley's tool in light of some of the new material critical theories we have outlined, we believe we can begin to

understand both how to compose complex audio IDNs with non-representational and non-traditional material and affective narrative agents meant to engage listener's and their highly attentive, interpretative capabilities. With further development of our model, we believe this foundation might also be expanded as mode of analysis and critique, although it is currently beyond the scope of our research. We outline the creative process for the model in our Methods section more precisely where we look more carefully at select elements from *PATTER(n)INGS* and connect them to Smalley's tool and to new material theories. Our aim is to illustrate how one can bring the theoretical perspectives into alignment by considering key elements in both Smalley and the new material theorists we identify. Revealing this process through our model offers a way to understand the complex design of our audio IDN that foregrounds ontological disorientation, fixed identities, and resists traditional orders and rules, including traditional linear, narrative forms. Revealing these formulations may be able to serve as inspiration for future creative works, or with more development and testing, the model could potentially be a basis for critical analysis of other similarly composed complex audio IDN works.

2. Method: the NM/SM design model

For the purposes of this paper, we have chosen to concentrate primarily on the concept of gesture in terms of two related features in Smalley's original paper in order to highlight key components in his spectromorphology model that coordinate well with new material properties: spectral density (See Figure 3) and the three lists of terminology specifically focused on gestural and structural functions over time: onsets/continuants/terminations (See Figure 4). Highlighting and considering these elements is particularly helpful as they directly connect to new material models and theories to offer more specificity to determine the kinds of gestures we identify and include.

Spectral Density in Smalley is a way to map the varied and changing relationships between sound agents and listeners as they occupy a kind of *spectral space*, a constructed location for listening and perceiving. For Smalley, the way a spectral space *unfolds* is key to a listener's interpretation of it, and it is measured in terms of how close, far away, occupied (and by what) or empty it seems. Smalley claims:

> the occupancy of spectral space, the impression of the space-breadth, how it unfolds, where the highs and lows are located and how they are reached, are directly related to the listener's interpretations of extrinsic factors as well as being strong formal determinants. (Smalley, 1997, p. 121)

The evocation of such spatiality through sound is foundational to our room structure in *PATTER(n)INGS* and informs our understanding of the arrangement of varied apparatuses, described in more detail below.
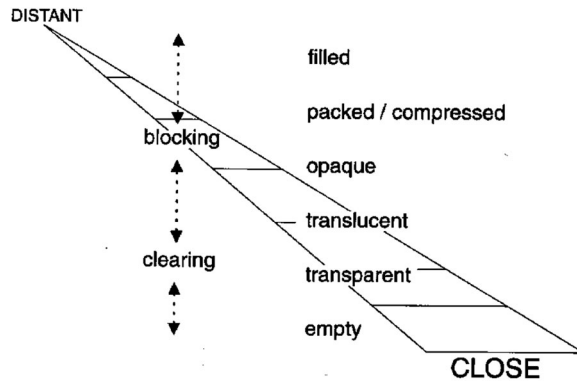
Figure 3. The concept of Spectral Density as it is outlined by Smalley. The concept of proximity and distance between sending and receiving agents in a spectral space, and the defining limitations and characteristics between them as a listener interprets them, is highlighted. Such factors are specifically relevant to our discussion of gestures as audio content circulated in an identified, composed space. As gestures are made within each of our designed spaces (our rooms, for example), the audio content is crafted to support unique agents to differentiate that particularly constructed space of listening and to place a listener in relation to it.

onsets	*continuants*	*terminations*
departure	passage	arrival
emergence	transition	disappearance
anacrusis	prolongation	closure
attack	maintenance	release
upbeat	statement	resolution
downbeat		plane

Figure 4. An outline of spectral functions as identified by Smalley that (attempt) to classify the range of *gestures* activated in the process of creating sound agents meant to be received. These kind of structural functions can be ambiguous, interchangeable, and indeterminate, and are described as a series of possibilities for *beginning, middles* and *endings* of listening activities with sonic agents that belie simple cognitive processing. They can be mapped in individual sounds, but also measured in more global capacities to consider the growth processes and other movements within a musical piece.

Other kinds of structural functions referenced in Smalley's work relevant to our own are identified in terms of how they begin, continue and end, and how the listener may discern this. Smalley claims that "expectation" is central to how electroacoustic music is perceived by a listener (1997, p. 114). Thus, it's important to compose with such listener desire in mind:

> Structural functions are concerned with expectation. Like other musics, electroa-coustic music has its expectation patterns, and I have already suggested that these are based on our wide cultural acquaintance with the perceived spectral changes of a wide variety of sounds. During listening we attempt to predict the directionality implied in spectral change. We might ask ourselves, for example, where a gesture might be leading, whether a texture is going to continue behaving in the same way, whether change is likely or not, whether change is likely to be con-cerned with gradual merging or sudden interruption, and so on. (Smalley, 1997, pp. 114–115)

As illustrated in Figure 2, Smalley suggests that there are a variety of ways to consider the emergent properties of both an individual sound as it evolves and fulfils (or resists) the culturally-based expectations of a listener. But this focus can be expanded to consider other kinds of more global movements or growth processes within the larger context of a musical structure. In some cases, ambi-guity is deliberately embedded and different cognitive processes are evoked simultaneously to maximise listening and attentiveness, even if clear under-standing is often obscure. The aim for Smalley in his compositional model is to determine how to keep a listener in process according to EAM principles, but not necessarily to deliver them concrete functional understanding of the sound spectra. In our work, we also attempt to vary many of these onsets (beginnings), continuents (middles) and terminations (ends) of each of the sounds, but also in larger gestural spectral spaces that we construct to keep meaning-making active, but elusive.

Connecting these primary concepts from Smalley to key new material con-cepts (such as agency, apparatus, phenomena, performativity) and composing within emergent material-discursive systems of meaning, spectral spaces and systems, allows us to identify more precisely how experimental audio IDNs may be designed in ways to maximise their interpretive, intra-active material and narrative dimensions. Specifically, we draw on the interpretive and expec-tant tensions of a listener trying to make sense of spectral spaces, measuring the density, opacity, transparency, directionality, and temporal ranges for local and global processes.

We call our own system the *New Material/Spectral Morphology Design Model* (*NM/SM Design Model*) to indicate our allegiance to Smalley, but also, as we have discussed, to align with more dispersed, haunting and ghostly semiotic systems of resistance common to new materialism. Important to note, that fol-lowing Smalley, at this point we see our model as primarily a compositional tool to aid design processes for experimental works like *PATTER(n)INGS*. Smalley overtly declares his spectromorphology model is not a compositional theory that may be applied and generalised universally. Rather it offers a composition aid for composers to consider the complex and varied content of EAM works. Smalley's aim is to raise the consciousness of composers for considering the selection and impact of their sound material:

> Although spectromorphology is not a compositional theory, it can influence compositional methods since once the composer becomes conscious of concepts and words to diagnose and describe, then compositional thinking can be influenced, as I am sure my own composing has been. In the confusing, wide-open sound-world composers need criteria for selecting sound materials and understanding structural relationships. So descriptive and conceptual tools which classify and relate sounds and structures can be valuable compositional aids (Smalley, 1997, p. 107)

Following Smalley, we perceive our model in its current state as a design tool to aid in the creative process.

Our *NM/SM Design Model* is a layered one that is essentially defined by differently configured and relational forms of *Apparatuses* (recalling Barad) that frame and layer affective experiences, but which may also be iteratively built on through dense description of gestural activities (recalling Smalley) to foreground and highlight different kinds of particular material, embodied and affective audio content. (See Figure 5 for an overview of primary functions). The *Interface-Apparatus* (I-A) is the primary container for the work and identifies how users will be invited to the piece, showing the gestures that entice them in and determine their formal experience (as a single-user, via a browser and mouse, or as a fixed installation museum experience, for example). Within the *I-A*, multiple other apparatuses are constructed. Each is its own *Micro-Apparatus* (or *M-A*), defined by its core spatial and temporal functions for meaning-making. Each *M-A* contains sending and receiving bodies or agents: *sa and ra*. These sonic agents create specific gestural relata among the senders and receivers, and each may be described in through a number of differing qualities to dis/locate them in varied *states* of expression and forms of engagement (sonically and materially). The on-going gestural connections are also sustained among each *M-A* and reverberated in the *I-A* overall. Each *M-A* may contain any number/type of *sa/ra* content, and they do not have to be balanced with each other. The gestures between them (indicated by the purple arrows on the figures) are also multiply/infinitely configurable. Although we only identify some of these states, selected from Smalley's highly dense model and consider them through a new material lens, we construct an initial design framework that might easily be expanded to increasingly describe and develop more or other content to structure and compose audio-based content for IDN construction. The more detailed descriptions offered in Figure 6, for example, could be outlined more fully with the actual audio content in each *sa/ra*, and the gestures between each *M-A* could also be designed and articulated. Figure 7, based on a spectral space (room 3 in our work), offers an example of how to document and describe a more specific and detailed description of compositional material. In Sections 2.1 and 2.2 below we further elaborate on our own work with reference to the model principles, giving particular details which suggest how it might be further described and designed.
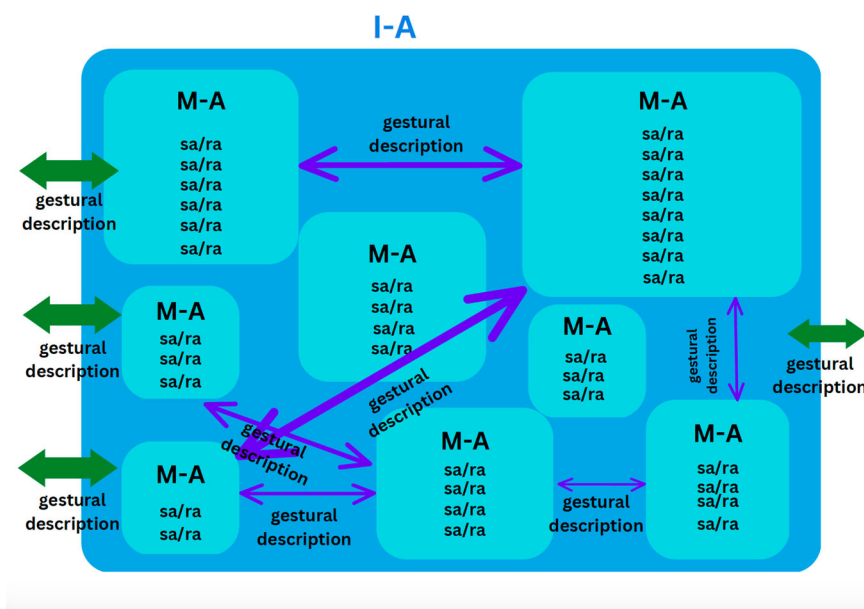
I-A

Figure 5. The general outline of the *Interface-Apparatus* (*I-A*) with the *Micro-Apparatuses* (*M-A*) and the sending and receiving agents (sa/ra). Relevant *M-As* that share common features (gestures) and that relate more directly to each other are illustrated by purple arrows. Such arrows might increase or decrease based on design. They could be described more fully in a gestural notation. Gestures from the *I-A* to define the user experience are indicated by green arrows. Each kind of gesture, between M-As and between the I-A and the user could be customised to map each experience and might be described more fully in a notation (or "gestural description"). In the case of our work *PATTER(n)INGS*, for example, the gestures from the *I-A* to the user (indicated by green arrows) would highlight our designed interaction for a single user at a computer and one could describe them beneath each arrow as "a mouse", "a chair", "a mask", "a single-user", and motivate the choice: ("a single user is required to increase concentration and isolation." Descriptions of each sa and ra could also be described. (See Figures 6 and 7 for reference of more detailed *M-A* content and notation examples.)

2.1. Extending Smalley's spectromorphology model

Smalley's system is complex and rich, and in order to explore possible cross-pollinations and new applications of the terminology, tackling a limited set of terms and concepts (apparatus and gestures) allows us to be more precise in terms of elements of our own composition, *PATTER(n)INGS*. These selections offer us a limited language set and conceptual framework that is both prescriptive and descriptive of artistic/creative concepts or processes—that is it can both decide or describe choices, groupings, processes and forms within an audio-based work. Smalley's terminology can, of course, describe the sound material itself, (as it is fundamentally intended to do) but also (which is what is of interest to us here) it can be extended and used to describe/compose the conceptual affective nature in which material/phenomena relate to each other across genre and classification boundaries. Our application of it here is an
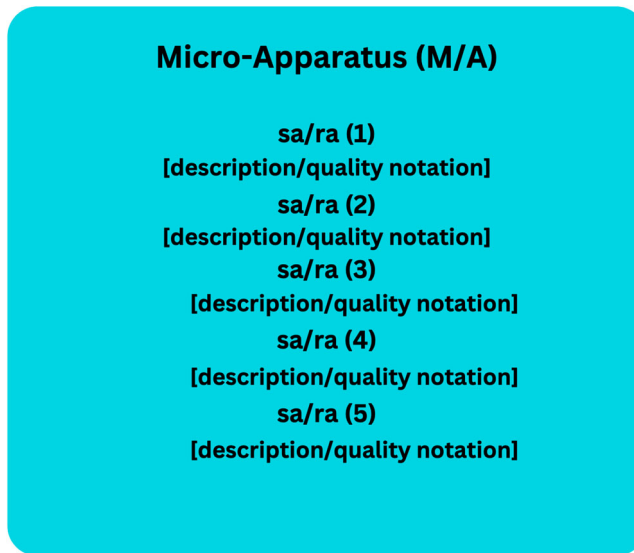
Micro-Apparatus (M/A)

sa/ra (1)
[description/quality notation]
sa/ra (2)
[description/quality notation]
sa/ra (3)
[description/quality notation]
sa/ra (4)
[description/quality notation]
sa/ra (5)
[description/quality notation]

Figure 6. Outline of detail for a generic *Micro-Apparatus* (*M-A*) construction. The description and quality of each of the sending and receiving agents (*sa/ra*) could be expanded on in more detail to offer a more fully elaborated model for each *M-A*. This would then offer a foundation to consider how each *M-A* might then be connected both to the other *M-As* through specific gestures, but also to the *I–A* as a whole as it is designed for and gestures towards a particular user interaction.

initial, tentative and explorative first process—a kind of mapping system of indeterminate material content and their gestures towards meaning-making using descriptive language of the variety of properties we use.

Our intention is to explore a possible system by which the author's creative process can be examined, analysed, planned and executed without crystallising or otherwise stabilising flows and processes into existing models or systems— for example within traditional musical terminology and analysis based around 12 tone scales and major/minor motion, linear or branching narrative forms, or existing theoretical models or interpretative approaches within conceptual art or audio-visual analysis. By using a design system based on apparatuses and gestures, along with textual descriptions and other considerations to define ephemeral concepts, interrelationships and interactions in the creative process, we make them temporarily stable and able to be manipulated in the design process. The usefulness is one of a tool to make or iteratively de-construct relata, with the understanding that any attempt to concretely define or freeze the constituent parts, without noting the multiple flows and processes, will be unhelpful and counter to our theoretical basis in non-representational material phenomena. We are interested in the possible/impossible intra-active systems we can deploy, rather than cataloguing all the possible constituent (audio) materials that anchor these relationships. Our content is, then, defined by audio morphology (emergent shapes over time) but also by
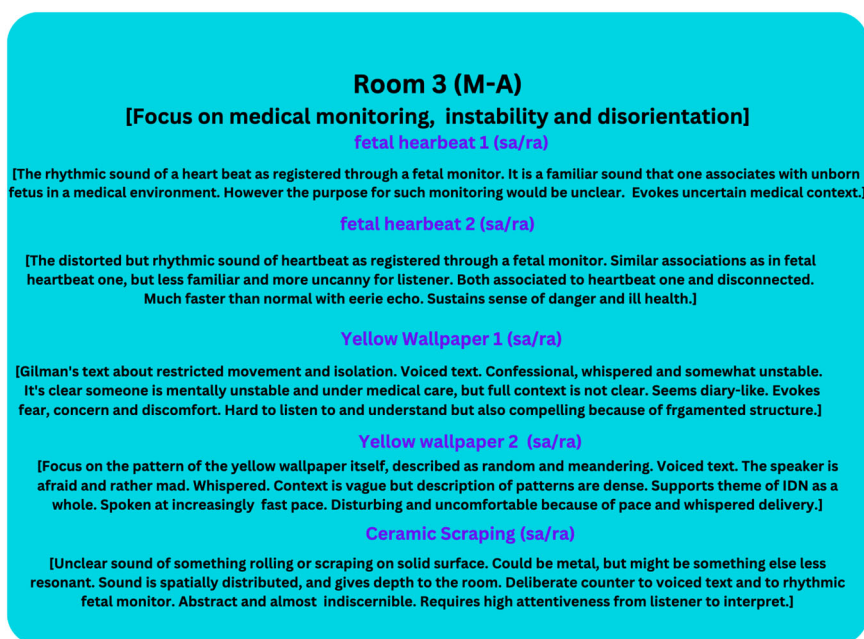
Room 3 (M-A)

[Focus on medical monitoring, instability and disorientation]

fetal hearbeat 1 (sa/ra)

[The rhythmic sound of a heart beat as registered through a fetal monitor. It is a familiar sound that one associates with unborn fetus in a medical environment. However the purpose for such monitoring would be unclear. Evokes uncertain medical context.]

fetal hearbeat 2 (sa/ra)

[The distorted but rhythmic sound of heartbeat as registered through a fetal monitor. Similar associations as in fetal heartbeat one, but less familiar and more uncanny for listener. Both associated to heartbeat one and disconnected. Much faster than normal with eerie echo. Sustains sense of danger and ill health.]

Yellow Wallpaper 1 (sa/ra)

[Gilman's text about restricted movement and isolation. Voiced text. Confessional, whispered and somewhat unstable. It's clear someone is mentally unstable and under medical care, but full context is not clear. Seems diary-like. Evokes fear, concern and discomfort. Hard to listen to and understand but also compelling because of frgamented structure.]

Yellow wallpaper 2 (sa/ra)

[Focus on the pattern of the yellow wallpaper itself, described as random and meandering. Voiced text. The speaker is afraid and rather mad. Whispered. Context is vague but description of patterns are dense. Supports theme of IDN as a whole. Spoken at increasingly fast pace. Disturbing and uncomfortable because of pace and whispered delivery.]

Ceramic Scraping (sa/ra)

[Unclear sound of something rolling or scraping on solid surface. Could be metal, but might be something else less resonant. Sound is spatially distributed, and gives depth to the room. Deliberate counter to voiced text and to rhythmic fetal monitor. Abstract and almost indiscernible. Requires high attentiveness from listener to interpret.]

Figure 7. Detail for a *Micro-Apparatus* (*M-A*) construction with notations based on Room 3. The description and quality of each of the sending and receiving agents (*sa/ra*) are more fully elaborated within each notation. The sending agent is described, along with a description about how it is intended to be received and interpreted. Each sound must somehow relate to the M-A theme as a whole. In this case Room 3 focuses on medical monitoring, instability and disorientation, and so each sound must somehow reflect the theme. These are just sample short notations, and can of course be expanded and described in much more detail. (More focus on proximity and spatial organisation is possible, for example as are many other relevant qualities. One can be very dense or brief and can build on the text iteratively as well as add or delete agents and re-compose for better coherence.)

sustaining a non-reductive material process that recognises sound as a material, affective agent within narrative.

In our audio design for *PATTER(n)INGS*, we combined creative ideas from EAM, sound art and psychoacoustic phenomena in order to experiment specifically with the interplay of sound, spatial perception, psychoacoustic affect and other concepts. The work of Iannis Xenakis and his spatial, architectural approach to composition together with MaryAnn Amachers'works involving "structure-borne sound" had particular relevance to us in their focus on notions of space, experiential understandings and appreciation of sound, and their emphasis on shape, structure and motion outside traditional musical conventions. Further, the overall sound design, particularly in its localised setting (within the specific *rooms* of *Apt. 3B*) is drawn from research in archaeological sites and in primitive cave settings (Devereux et al., 1996; Devereux & Jahn, 1996; D'Errico & Lawson, 2006; Mathieu, 1994) but also in traditional musical composition (Shafer, 1977; Smalley, 1997). This focus on space is enhanced with other influences exploring space/time dimensions in audio

formulations. Spectromorphology itself focuses on the movement of audio spectra over time, the movement of their patterns and distribution frequency, and how spectra are perceived and interpreted in the act of sending/receiving. Smalley demonstrates how a piece of complex linear sound material can be potentially translated into a visual architectural structure, an emotional progression/evolution, or a form of narrative or metaphorical inspiration. As such it offers a useful starting framework to consider the material narrative properties of audio spectra.

2.2. Designing the Rooms of PATTER(n)INGS: sustaining sensory new material apparatuses

As we have discussed in section 1.2, our user interface for *PATTER(n)INGS* is deliberately simple with limited sensory affordances. It consists of a mouse and keyboard computer setup with an initial instructional start page giving information to the user on what and how the interface and experience will occur. Once the user enters the application by clicking on "start", they are presented with a black screen with no visual stimulus. Sound is the only perceivable experience (mediated through headphones) and when the mouse is moved, different sound material is triggered, some of it quickly and reactively as navigational aids in the two dimensional blind *room*, others in a more subtle manner dependent on the position and trajectory of the mouse movement. Some sounds are momentary *one shot* events triggered by movement, and others are better described as sound textures, ambiences, abstract sequences of sound objects, and narrations of text. The entire experience is divided into eight *rooms* separated by an audio flag or cue (the opening and closing of a creaking door triggered by a mouse click, causing the experience to move on to the next room). Each room is a self-contained environment with its own audio material, rules of interaction and kind of interactive experience. In this way, the rooms themselves become a kind of Baradian apparatus, a phenomenal and dynamic material enactment, or a performance of a material-discursive system where agential cuts—that is the severing of subject/object relations into something more dispersed and complex—occurs. This is the site where affective relations are sustained through gestural movements to make meaning. Designed to distribute information among *sa/ra* content via these audio gestures, each room becomes a located site, or as Smalley might describe, a spectral space, for composing relational narrative experiences.

It is possible then to identify each room as a *Micro-Apparatus (M-A)*, a site to distribute meanings, an agential cut in the composed spectral sound space, the audio story-world. But further, one can see the *PATTER(n)INGS* application itself, with the whole of its intra-active affordances, as having another uber-layer of apparatus, influencing the kind of performative emergence and engagement that guides users, without fixing their experiences definitively. The

Interface-Apparatus (I-A) design serves as an initial point of contact for user-engagement, and careful consideration of its gestural and sensory affordances, or how matter will come to matter, is key to considering its material operations. Note, the interface we describe is not the technical interface, as in a Graphical User Interface (GUI), but rather the social one that brings together the user and technical device and distributes the material discursive properties across a much wider experiential field. This too is a Smalley influence, as he distinguishes between the *intrinsic* features for describing musical properties in his model, and their *extrinsic* connections to the broader social context for musical compositions which, he asserts, can't be ignored as part of any interpretive aural experience. For Smalley, "music is a cultural construct and an extrinsic foundation in culture is necessary so that the intrinsic can have meaning. The intrinsic and associated extrinsic are interactive" (Smalley, p. 110). Similarly, the *I-A* we identify, is not then intended to be a closed system of reference and is open to variety and nuance, but it is also not entirely random as it is intended to direct a kind of experience with an open rule system. (See Figure 7.) In our case, for example, with *PATTER(n)INGS*, we defined the *I-A* for a single user with a specific low-sensory audio-only experience, but this could change depending on other material design goals, for multi-users, or with additional graphical content, or for input in mixed reality experiences where the material kind and density might be differently distributed. Each, however, might be initially mapped with an *M-A* and *I-A* design. The number and type of *M-A* within an *I-A* is open, and the qualities of each (the states) is determined by the number/type of sending and receiving bodies, or the agencies/phenomena within them.

We understand then that within each *M-A* (in this case our *rooms*), designers must carefully consider the matters (in this case the audio material) in each *M-A* that comprise the narrative and thus disperse the intra-actions across various kinds of modalities. The relationship between the *I-A* and *M-A* is key for some consistency (the *I-A* construes the interaction, enabling it to emerge in a special spatio-temporal dimension), but it should be in no way constrain or define. Rather it is intended to offer a relational frame. In our case each room, or *M-A*, creates an opportunity to compose/engage sending and receiving gestures for emergent meaning-making, triggered by the guiding instructions for the *I-A*. But each *M-A* too creates relational connections to the others, even if they are non-linear and unpredictable. Each room is then designed to maximise the relations of aural sending agents and their varied receptions (together constituting an experience of *something*). But more detail about each of the sounds and how they might be interpreted within the overall M-A structure be offered in text below each object as a form of notation. The sending agent (s-a), for example, might be described by what it formally and materially represents ("a fetal hearbeat") and the reception by the receiving agent (the r-a) would be focussed on the kind of interpretation one would expect a listener to

attach to it ("It is a well-known technical medical device to measure heartbeats and usually emits a pulsing rhythm connected to a living human body"). Further descriptions and the unique qualities of each agent could outline more precisely the relationship between these in written, notation form

> (The heartbeat is recognizable but distorted and is much faster than one might normally expect. It is resonant and abrasive, and it is meant to be uncomfortable to listen to. It is specifically meant to counter another heartbeat sound in the room which is more familiar).

Such description and relationality, key to new material perspectives, is also visible in Smalley's model with its vast descriptive terminology, one he identifies as key to the unruly capacities of EAM compositions which morph in unique time/space dimensions and require robust descriptions: "A spectromorphological approach sets out spectral and morphological models and processes, and provides a framework for understanding structural relations and behaviours as experienced in the temporal flux of the music" (Smalley, 1997, p. 107). In *PATTER(n)INGS*, the components or intra-active audio material present multiple layers of potential meaning, interpretation, interaction and influence on the listener/intra-active agent (or eavesdropper).

The audio material we create comes from a range of sources to challenge eavesdroppers and to hyper-attune them to listening in a way that foregrounds the matters of both the sending audio agents (what is it, *where does it come from, and how can I contextualize it in a known world*?) and the sensory/cognitive framework for interpreting it (*what is it and what can I us, what do I need to identify and measure it?*). Keeping these bodies (sending and listening ones) in different and varied states of being for listener interpretation and to sustain intra-active, dynamic relationships is key to sustaining an affective, sensory relationship to the audio material. Considering them in Smalley's terminology (in terms of their spectral density, or in terms of their evolution from beginning to end and how that is determined) combined with other notation is also helpful to consider their complex material constructions and interpretive capabilities needed for a user.

To identify the nature, or states, of the audio agents in the *M-A* (*sa/ra*) we can look more specifically at the kinds of sounds we include, and then consider more precisely how they are distributed across the *M-A* domains and how they emerge relationally. Our sound content may initially be classified as follows:

(1) Narrated text
(2) Concrete, identifiable sounds from recordings—ambient or environmental
(3) Concrete, identifiable sounds from recordings—psychoacoustic/functional
(4) Abstract, acousmatic sound material with no clear coupling to a "source" or real-world connection

And

A. Processed, abstracted and otherwise distorted narrated text
B. Processed, abstracted and otherwise distorted concrete, identifiable sounds from recordings—ambient or environmental
C. Processed, abstracted and otherwise distorted concrete, identifiable sounds from recordings—psychoacoustic/functional
D. Processed, abstracted and otherwise distorted abstract, acousmatic sound material with no clear coupling to a "source" or real-world connection.

These sound types are created to situate and locate audio agents in a wide array of receptive states within specific, purposefully defined "spaces". Each element and each space has unique capacities to elicit a response from a listener, ranging from easily identifiable (as with narrated text) to highly abstract and defamiliarised sounds that disorient (crumpling paper or resonant ceramic sounds). The users can work at their own pace and there are no time limitations. Not all rooms have the same number of sound files, so they offer varying degrees of audio experiences defined by the M-A and it's intended theme. Users may locate, or not, the sounds activated by mouse movements, and they may also right click and exit any room at will. It is possible to exit and leave a room at any time, even if no sounds are found at all. Our aim was to structure each room (*M-A*) in such a way that a variety of options were always at play, and only some sounds (such as the creaking of a door to signify entrance and exit from a room), might be repeated and consistently recognisable. Although some sounds are carried from room to room, the eavesdropper is unaware of which, and should be even uncertain how many sounds are in each room. The result is structured disorientation, without being so abstract as to be meaningless, and it requires a high level of listening to interpret, as with EAM compositions.

We illustrate this in detail by looking more closely at the sounds in two of our rooms to understand how their material processes sustain different states of being/listening. For the purposes of this paper we concentrate on what we can call Room 3 and Room 6 (of 8), even though this kind of numbering is known only to us as developers and would be unknown and indiscernible to most eavesdroppers.

Room 3 Audio Material

- Sustained looping fetal heartbeat monitor 1 (slower)
- Sustained looping fetal heartbeat monitor 2 (faster)
- Whispered text from the Yellow Wallpaper 1*
- Whispered text from the Yellow Wallpaper 2*
- Ceramic scraping sounds*

The reasoning behind the use of these sounds in Room 3 is multi-layered, but it fundamentally focuses on sustaining affective responses among *sa* and *ra* bodies. The theme is primarily on medical monitoring and it features different ways of characterising unhealthy states of being and bodies. It is also disorienting in terms of the quality of sounds, their movement around the space, and the ways they create complex proximity for listeners. (Sounds are sometimes up-close and then far-away.) The fetal monitor was chosen because, amongst other things, it provides a pulse, a recognisable rhythm that relates to both human and technical bodies. Doubling the heartbeats, and having them operate at different speeds, however, creates a kind of confusion and disorientation for the listener. The rhythms are not equal, and so they provide a kind of musical, technical backdrop but not one that grounds the listener normally. Further, if the user finds both of them, they may think there is more than one heartbeat (person) present in the room and wonder how each is distinct, or not. This foregrounds problems of constructing individual and fixed identities and also provides an audible structural foundation to anchor other sounds and create relational flows. The fetal heartbeats also have extensive potential for multiple context and associations with the listener. The sound is instantly recognisable to a great many people whether they have personally experienced it or not, universal but not naturally occurring for all. As such, it is also ambiguous as it offers no linear direction, context or conclusion for processing. Once discovered, the beat continues without acceleration or deceleration, offering no suggestion of whether it represents normality, crisis, illness, health or otherwise (although in the context of COVID, it might signal some kind of medical threat at hand). This sound is also multi-dimensional as it can refer in many ways to other related sound and human bodily outputs and contexts for expression, such as breathing, talking and whispering, respiration, health and disease, birth, and pandemic monitoring.

The whispered texts are both derived from Charlotte Perkins Gilman's nineteenth century fiction, *The Yellow Wallpaper* (2006), focused on women's mental illness, confinement, postpartum depression, and the strict patriarchal structures of the medical community. The selections are meant to evoke/reflect on closeness, intimacy, and also claustrophobia, unequal power relations, issues and themes of isolation, (medical) control and lack of agency. The whispering itself aims to inspire many questions, opening interpretive responses from the listener: who are we listening to, and why is someone whispering? What is the nature of secret they are hiding, confessing or confiding? Such questions/answers are deliberately unclear, and the textual fragments are not only hard to understand (one has to strain to hear/identify them), but ideally they should also evoke and awake emotional responses based on the disturbing content connected directly to whispered mode of delivery. Whispering is not a usual way to tell something, and our goal is to disrupt normalcy or normal modes of communication. The fact the text is not original,

even if the eavesdropper doesn't know or understand the source, also creates a source of uncertainty about the narrative context. At best, the content is impressionable, a usual way of telling a story, but not quite, while linking other forms and reflections on madness and isolation (Gilman's) to our own pandemic setting and narrative.

The ceramic sounds were chosen for both their effectiveness when close microphone recorded and their ambiguity—they can be placed and manipulated in various ways to play with proximity and intimate location within the listening room, recalling Smalley's model for composing sound space and bringing a listener into an interpretive mode. They are recognisable as something from the *real* material world, actual objects recorded and presented. But what the objects actually are when one only listens to them, hyper-attunes to them, is unclear—plates, containers, tiles, bricks, concrete, whole or broken?—nothing is made clear. These are sounds that are at the same time real and materialised, yet unknown and unnamed and it's difficult to locate them in a recognisable context, or space. They contribute to the disorientation of the space but in a unique way.

In Room 6, we find other kinds of related, but distinctive materials, and we can recognise the relationality to Room 3. In this way, we can see gestural connections between the two rooms, even though they are composed as different spaces. They are more similar, than different to other M-As. (Their gestural relationship would be indicated by the purple arrows visible in Figure 5.) But we also clearly mark the boundaries of this *M-A* identifying it as its own apparatus distinct from that of Room 3, but semi-related in terms of tone, mode of delivery, and interface interaction. Room 6 is then another kind of agential cut in a dispersed system, but one generally consistent with the gestural structures in other *M-A* rooms and to the *I-A* as a whole. In Room 6, like Room 3, there is a theme of medical monitoring, but it is also much more focused on general disorientation and hyper attention to interpretation through much more sound abstraction. Each of the sounds in Room 6 has a unique capacity for maintaining interpretive states of being for listeners, for uniquely connecting senders and receivers through the ambiguous quality of the sound materials and how they un-relate to each other. We can look more closely at them to understand their capacity for ambiguous intra-active engagement.

Room 6 Audio Material

- Looping Adult ECG heart monitor 1 (slower)
- Looping Adult ECG heart monitor 2 (faster)
- Laughing sound
- Crumpling/manipulated paper 1*
- Crumpling/manipulated paper 2*
- Tearing and ripping paper*

- 16 + individual short vocalisations: "one shot" sounds, close mic-ed
- Looping close microphone recorded "ASMR" sounds—various sources

The doubled looping heart monitors, moving at different speeds and with different levels of distortion, are in the same sound category as the fetal ultrasound heartbeat. As such it draws Rooms 3 and 6 together (although it is not possible to know which room might be encountered first, or at all, as each user follows a different path through the application). As with the fetal monitor, the heart monitor sounds are pulsing, repetitive, easily and universally recognisable by many, although also somewhat distorted in the second iteration. The beeping monitor are loaded with possible positive and negative associations and are thematically foundational to many aspects of the pandemic, to other intimate health narratives, and to a core body function, a beating heart, especially as it is mediated by technology. However, like the ultrasound, this pulsating audio material itself offers no context, resolution or emotional/social conditions. It does however mark a primal, rhythmic connection between the listening and sending bodies.

Laughter is yet another universally recognisable sound, and one that can be associated and shifted in meaning and emotional affect depending on the context, accompanying sounds, and the use in a spatial setting. In this room, and in the *PATTER(n)INGS* work as a whole, laughter is more often than not disconcerting, unsettling and inexplicable, given the other sound materials, texts and themes that are foundational to it. Further subtle digital processing makes the laughter sound *wrong* or unnerving—in this case via the use of vocoding with a white noise "carrier" signal. The result is a kind of distortion and modulation that further unsettles this basic human expression, disconnected from a determent source to decode it. Human, but not.

The crumpling and in other ways manipulated paper sounds are another example of sound material with a complex, inharmonic *noisy* audio spectrum that works well in close microphone and binaural recordings and that also lends itself well to other digital processing, such as granulation and spectral audio manipulation. The untreated sound itself is again recognisable as *real*-world material, but it is also ambiguous in nature: is it a newspaper, sheet of paper, drawing, painting, letter, photograph, contract, licence, agreement, legal document? The list is almost endless. And what is happening to create the crumbling and manipulating? Who is handling it? Is something being opened, destroyed, removed, divided? And why? In what spatial context might one encounter and interpret this sound.

In Room 6, we also experimented with having some sounds or sound *sets* more dependent and directly linked to the mouse movements of the interacting agent. The movement of the mouse in this instance influenced both how often and where the short triggered vocal sounds would occur. Other triggering of sounds could be more subtle and organic: slower amplitude envelopes, less

distinct or unconnected placement in the stereo field, longer and more detailed sounds, and the spatial elements of the sound being part of the actual recording rather than secondary placement via software. The differently embodied approach offers a play with immersion and connects the audio content to the physicality, the gesturing, of the eavesdropper's hands. As such, they might wonder about and explore their control and agency over the sound material, increasing and decreasing the immersion in the room through embodied sensory manipulation.

Field recorded sounds, or sounds sourced from actual physical objects in an acoustic space (such as ceramic scraping, crumpling paper, tearing duct tape from a roll, and pacing footsteps) were deliberately recorded and incorporated into the room using a number of techniques and experimental approaches. We wanted much of this sound material to function in the manner many ASMR (Autonomous sensory meridian response) recordings and media do—using sounds that directly affect and invoke responses in the listener, primarily by their apparent "closeness" and audible detail. The sound material best suited to this approach, in our experience and experimentation, consists of sounds with higher frequency content (usually above around 2000 hz, with particular emphasis in various zones around 2500 hz, 6000 hz and peaks around 8–12000 hz). Furthermore, sounds with what could be described as high "noise content" (containing complex frequency spectra, mostly inharmonic in nature over a broad range of frequencies) tended to be very effective—an observation reflected in much of the ASMR material found online—whispering, hissing, non-verbal vocalisations, rubbing and stroking of various materials and surfaces, manipulation of fabrics and paper, and so on. When matter of this nature is manipulated and "sounded" close to microphones, these sounds seem to bypass or at least play with the complex mechanism of hearing and produce often direct physical responses often described as tingling, electric and *hairs standing up on the back of your neck*. The experience need not be a pleasant one either. As such we wanted to employ a kind of "anti-ASMR" approach too—one where sounds could be close and intimate, but also disconcerting, unsettling, disturbing and alien. Crumpling and ripping paper in particular seemed to generate both direct physical responses and ambiguous and unsettling associations.

Our recording techniques throughout the work, but specifically as exemplified in Room 6, are created in such a way to deepen the connections to affective sending/receiving agents and to sustain the kinds of states which we characterise as central to our *M-A* worlds and agents and to our NM/SM Design Model as a whole. We employ them to heighten the material formulations, but also to particularise the sound agents as innovative, customised audio content for materially-discursive IDNs. Much of the ASMR material in *PATTER(n)INGS*, for example, is recorded using either sensitive (often larger diaphragm) condenser microphones, or a variety of binaural setups (binaural

"dummy head" mics such as the Neumann KU100, or spaced prosthetic ear models with microphone capsules inside). We tried a number of approaches, and often found that simpler techniques such as experimenting with only physical distance in a relatively sound-dampened room, or using a Jecklin disc (an acoustic baffle used primarily in recording orchestral and other acoustic music performances) at different distances and placements produced the best results. Much depended on the nature of the source material. Some materials gave the best results when recorded monophonically with a large diaphragm cardioid unidirectional condenser (and positioned/panned later in post-production or implementation in Unity) whereas other sounds gave evocative and effective results when recorded in stereo using omnidirectional pairs with different types of acoustic baffles (Jecklin disc, binaural head, or in some cases a pillow positioned between the two mics). Experimentation took place early on using Unity's HRTF (head related transfer functions) implementation in order to place sounds in three dimensions within the listening space, but the results were unsatisfactory. Often the use of hard panning left or right, or simple movement in the stereo field, combined with different types of filtering, gave better results in terms of clarity and the effectiveness of the sound material in invoking feelings of intimacy, closeness, uneasiness and other emotions. The HRTF functions served only to *muddy up* the mix, or reduce the quality of the sound material. Many times, using fragments of binaurally recorded material in different arrangements and combinations was more effective than implementing sounds monophonically using HRTF, and thus we were motivated to build a fragmented and dispersed audio world with layered structures resisting coherence and completion.

The more synthetic, artificial or processed sounds often took on the same character as the ASMR materials and further offered opportunities for sustaining layered agents and states to carry the narrative. Granulation, bit reduction, ring modulation, filtering and various forms of distortion, such as analogue circuit emulation and chebyshev polynomials, together with various spectral processing, were all employed and experimented with. The aim was to both mimic and mirror the intimate/close nature of the recorded material, but also to create ambiguous and alien sound material to contrast with the *real-world* nature of much of the other sounds. Vocal material in particular was often heavily processed in order to either produce unsettling effects, or abstract the human voice to the point where it could drift in and out of recognition and comprehensibility, further expanding the possibilities for multiple interpretations, narrative function, simultaneous interpretation and interaction with other sounds. Vocal material was broken up into clouds of meaningless fragments, creating spaces that could be dense or sparse, translucent, transparent, distant or close (these all being key words used in Smalley's spectromorphology model), which aside from our NM/SM model, also provided useful references and terminology for creating actual sound material.

The notion of gesture, as we have indicated, is also a key, and useful, design concept within our *NM/SM Design Model* and can be used to signify large and small processes and progressions through the *M-A/I-A* worlds but also between and among the individual agents. Identified by the green and purple multidirectional arrows in our primary NM/SM model (See Figure 5), gestural matter-making is key to audio IDNs, and should be measureable, and therefore practically useful for compositional and analytical purposes. Although Smalley speaks of gesture in an exclusively linear manner (relating primarily to linear fixed-media acousmatic works) gesture need not exclude non-linear phenomena and is evocative of new material semiotics. An important aspect for gesture is one of motion, but not necessarily as an objective goal, conclusion or resolution of that gesture/motion. In this way, the gestures become the performative agents, moving between sending/receiving bodies within an *M-A*, among the *sa/ra* bodies for example, but also among the total number of *M-A* cuts and the *I-A* as a whole. They keep relationality flowing, and understanding the precise nature of them through the kind of mapping we present in our model, is a helpful and practical way to "drill down" the system and begin to map the kinds of gestures in a meaningful way.

To give a possible example of gestural function and how it may be classified for an audio IDN, we consider how within Room 3, a gesture/motion is generated from a parabolic mouse movement consisting of a sequence of narrated text from *The Yellow Wallpaper*. The audio is created at a certain amplitude with momentary navigational cues coming from short, close recorded vocalisations and stereo panning, a foundational sound *space* created by a fetal heartbeat monitor and a moving spectral cloud formed by binaural ceramic recordings. This kind of gesture can be looked at spectromorphologically purely in terms of its audible characteristics, but also in terms of perceived inertia and its material, intra-relational aspects. This kind of classification simultaneously can describe and include structural phenomena based on audio processing and sound design, but also may include properties based on text, narrative function, spatial appearance, cognitive association and other contexts. They can be built into the system by expanding the gestural categories and assigning different classifications for design and analysis. By classifying and describing differing kinds of gestures inclusive of, but also independent from audio material content, a designer could collect and categorise a range of desirable gestures/forms of intra-acting elements and map/design content onto them from various media types, materials or references to identify the core elements for essential meaning making.

In another example, a tentative and careful mouse *exploration* of Room 6 could yield an experience in which two asynchronous looping heartbeat monitors form a foundation upon which crumpling paper drifts in and out of coherence, at once framing and interfering with the recorded laughing, with the mouse movement itself generating scattered ASMR "events" around the

stereo field. This brief description gives information and suggestions about how the audio material actually sounds, perhaps some spatial hints and cues, with a lot of other potential (and varying) context suggestions, dependent on the individual listener's experience. This may be combined with a more narrative (non-linear or non-human) or affective sensory analysis to further layer the material and interpretive functions and possibilities.

3. Discussion and conclusion

The audio design we have described of *PATTER(n)INGS* in relation to the *NM/ SM Design Model* is intended to serve only as an initial exemplifying step towards creating and mapping an audio-based IDN with a material narrative nature. We believe there is much more work to be done, both with further reflections on Smalley's work, but also with deeper consideration of other themes and forms. (Ours is highly pandemic related, for example, and we could instead focus on other themes, such as natural landscape spaces, or in the context of romance and intimacy.) Other ways to expand and develop the model include considering more carefully the other kinds of spectra that Smalley identifies in his model and translating them to the different forms in a particular audio IDN. Smalley provides a number of different sequences, illustrated in his numerous diagrams, each specific to a different quality and purpose. Looking at the aspects of spectral density for example, (Figure 3), the concept of space is isolated and employed. Space, in particular around perception of distance and closeness, is integral and well documented/explored in the audio world, and in particular in EAM, in a range of ways that could be inspiring and exciting to explore for future IDN design. Manipulation of perceived audible space takes place using a myriad range of tools employing delay, reverberation, panning, amplitude and filtering, and these could also be explicitly examined and used to further explore material properties of audio IDNs. These ideas, concepts and terminology could also be applied to creative design processes for cross-/transmedial material interrelations. Smalley's way of creating three overlapping continuums is a potentially useful approach that could be further examined to specifically explore emergence and evolution of matters in perceptive and interpretive functions. Designing and describing a phenomenological cut in simultaneous coordinates between *filled* and *empty*, *distant* and *close* and *blocking/clearing* provides a map of spatial potentials that might open possibilities for considering sending/receiving body relations in exciting new interactive contexts. The continuums of spectral density could even be represented two or three dimensionally—x,y,z vectors to represent possible shapes, directions, locations and navigations. Here the *spectral morphology* we propose takes on a more material and felt, tangible morphology where actual descriptive shapes and forms can be described or proposed. Likewise, trajectories, directions and motion in a three

dimensional space could be mapped. The dense terminology encapsulated in Smalley's diagrams becomes descriptive of perceived affect and potential rather than perceived audible space.

Whatever the sound material used, artificial or recorded, concrete or ambiguous, human or non-human, our intention in *PATTER(n)INGS* is to create interrelation possibilities with sound and each room can become a spectral space where the combination and interrelationship of sounds is more important than any linear logic, narrative or progression within that room. Using a compositional aid such as the proposed *NM/SM Design Model* could further enable or develop this approach by concentrating on material relationships and concepts (such as space, density but many other variables from Smalley) independent of the actual sound material or content of the recorded speech. Our design model might also form the basis of an analytical tool for those researching, not designing, IDNs, or for composers who might want to test and validate the compositional design principles they construct with users. In this case one would need to highlight the functions and relationships among designed apparatuses and their intended gestures to test the perceptions and interpretations of users within the composition. Such an analytical model, which is beyond the scope of this work, would require further refinement, but might form the basis of an interesting case and user study. Further a wider selection of sound relata (or even other media content, like video) could be designed (or analysed) in terms of a full, material "spectral morphology" illustrating how elements interrelate, function, and deliver to users in various combinations and interactions. In parallel, other descriptions, analysis and exploration of audible material, processes and motion can be applied to allow a deeper understanding of the elemental categories within the *NM/SM Design Model*. Description of sound material, within our framework, including expansive types and forms of text/narration, along with the myriad possibilities for physical audio characteristics can exist at the same time, allowing for a multi-layered structure for creation, and with refinement, potentially for analysis. In essence, the *NM/SM Design Model* we propose attempts to engage with the blurring, moving, changing, multiplicitous nature of the creative WHOLE of an audio-based IDN, rather than cataloguing and contrasting the materials and fixing the analysis of different and distinctive aspects of narrative telling, musicality, perception and reception. As such it also intends to inspire further iteration, development, testing, and validation for experimental and complex audio design.

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