

**Sound Means:
Towards an Epistemology of Auditory Experience**

**by
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Abstract

The project constructs an account of the role of aural experience and soundscape perception in outlining an epistemology of auditory experience. Using ecological models, the project proposes listening and sound-making as situated, embodied, cognitive practices, and develops an account of acoustic epistemology as a form of supra-rational knowledge, based on a model of transduction between material sound energy and the conceptual. The practice of sound-making is proposed as a prosthetic 'technology of the self', and electroacoustic mediation is discussed in terms of mimesis and re-embodiment.

Keywords: Embodied Cognition, Soundscape, Listening, Epistemology, Electroacoustics, Prosthesis, Music.

*For Tanya,
who continues to inspire me to dig deeper and
soar higher than I ever thought possible.*

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Executive Summary

Sound Means constructs an account of the role of aural experience and soundscape perception in outlining an epistemology of auditory experience. Using ecological models, the project proposes listening and sound-making as situated, embodied cognitive practices, and develops an account of acoustic epistemology as a form of supra-rational knowledge, based on a model of transduction between material sound energy and the conceptual. The practice of sound-making is proposed as a prosthetic 'technology of the self', and electroacoustic mediation is discussed in terms of mimesis and re-embodiment.

The project is comprised of five chapters, each of which attend to a different aspect of auditory experience.

Chapter 1 – Introduction, provides a brief account of the forces that brought me to this project and give a short summary of each subsequent chapter.

Chapter 2 - *The Embodied Mind and the Situated Self*, proposes an argument for an embodied notion of mind with an implicit rejection of a Cartesian mind/body dualism. Drawing on work in cognitive sciences, this section shows how cognition and consciousness are intrinsically and irreducibly embodied, and that the mind is not located exclusively in the brain. Not only is the mind an embodied mind, but also the organism within which it is situated cannot be considered separately from its environment. Ecological models elucidate the co-constituting relationship between organisms and their environments. James Gibson's ecological theory of 'affordances' (1986) provides a powerful paradigm for understanding the organism/environment relationship. This model is extended and particularized to the auditory modality.

Chapter 3 - *Hearing and Listening*, considers our relationship to the soundscape through listening, both in terms of *what* we hear and *how* we go about it, and shows the intimately entangled interaction of action and perception. When we hear something through the situated, embodied act of listening, we are encountering an event that produces sound. What constitutes a sounding event as well as the event's relation to affordances is considered, followed by an examination of the mechanisms we use to

extract auditory features from the environment and identify the source of the event. Bregman's extensive study of 'auditory scene analysis' (ASA) (1990) and other studies on the cognition of auditory events (Gibson 1986; Handel 1993; Leman 2008; McAdams & Bigand 1993; Zbikowski 2002) provide the basis for an understanding of what and how we hear. The importance of identifying sound sources leads to a discussion of soundscape terminology and associated categories of sounds to work toward developing an outline of a soundscape taxonomy.

Ways of listening are discussed using Gaver's (1993) categorization of 'every day' vs 'musical' listening. A critique of Gaver's notion of musical listening leads to a discussion of what 'musical' listening may entail and proposes a wider ranging view, subsumed under the notion of a 'hermeneutical' listening which may include: phenomenological listening, resonant listening, semiotic listening, musical listening, intersubjective listening, and haptic listening. The shifting nature of intentional forms of listening is elucidated through these models.

Chapter 4 - *Sounding*, discusses both acoustic and electroacoustic practices, including the notion of play, mimesis, and the role of electronic and digital technologies in altering both our soundmaking and concurrent listening practices. Our engagement with the body and with things to produce sound is examined through phenomenological and agential perspectives. Electroacoustic mediation is considered by examining the role that the microphone, storage technologies, and amplification have had on our soundmaking practices. The role of mimetic practices, particularly with the use of electroacoustical technologies, is considered in relation to our embodied cognitive practices.

Chapter 5 - *Knowing*, discusses the epistemological implications of the previous chapters. A challenge to traditional epistemology is proposed by questioning the logocentric/rational model of knowledge. Instead, the propositional nature of traditional epistemology will be seen as a particular subset of knowledge rather than vice versa. The sensorimotor basis of knowledge and meaning can point the way to developing an aesthetics of meaning (drawing on the work of Mark Johnson (2007)) and the role of auditory experience in generating 'supra-rational' (before and beyond the rational) knowledge. Auditory experience, through the 'mindful ear' may be considered a

'technology of the self' in its role as a mindful awareness practice. The important role of space and place in auditory experience will be characterized by considering the mediating role of architectural spaces in our auditory practices. This final chapter will put forward a model based on the literal and metaphoric elaboration of the notion of transduction (converting one form of energy into another). I will suggest that not only do technologies like the microphone transduce acoustical energy into electrical energy, but also that we ourselves transduce material energy into knowledge and meaning, and in a fully duplex process we also transduce aspects of consciousness (understanding, beliefs, passions, dreams etc.) into material forms. I will finally present a model of 'music-as-prosthesis' through the notion of transduction and situated, embodied cognition by revisiting the etymological root of prosthesis as a movement 'towards a place' and as an argument for humankind's need and passion for the creative act.

Chapter 1.

Introduction

Sound means a great deal to me. Being a musician for most of my life, my interest in sound began with music of course. I still remember the feeling I had listening to my neighbour's father play the piano. The patterns of sound were moving, intriguing and enveloping in ways I had not experienced before. The bodily feeling of listening and eventually playing music myself has always been, and increasingly seems to be, intrinsic to the person who I am and continue to become. Throughout the years this conviction has deepened and broadened to include sound outside of music and musical contexts: to the sounds around me. Listening to the sounds of crickets in the summer, the twilight song of thousands of frogs, the lapping of water on the shore, the delicate touch of a leaf as it falls to the ground, the intimate voice of my lover, the rush of big surf, the roar of a waterfall, glaciers calving, the sound of F1 race cars, jet planes, cathedral bells, heavy machinery on a construction site: the whole gamut of sonic possibilities in this world of ours has not only touched me both literally and metaphorically in myriad ways, but has also contributed to the self I consider mine.

Traditional music studies taught me much about music but never convincingly addressed how I actually felt and understood sound and music in a way that went beyond the 'notes,' and how it seemed to constitute me in a tangible way. My heart still races and my mind still whirls when I hear certain sounds and music. I feel something transformative has taken place. I know that I have understood something new, that I have learned something in these instances, even though I cannot always articulate exactly what. This lacuna in my musical education has brought me here.

Is there, or can there be, an acoustic way of knowing that is in some way beyond, other than, or in addition to, the logocentric, propositional and rational? Is it possible to develop an acoustic epistemology that will bring greater understanding of our auditory

experience including that of our world and our selves? It seems that sensory experience, in this case auditory experience, brings unique forms of understanding and affords distinctive opportunities for the generation of knowledge. A certain mindfulness obtains when we concentrate on auditory experience. As we listen to the sounds of a creek, the wind through Ponderosa Pines, or to a rock band, string quartet or symphony orchestra, we become acutely attuned to our environment: we understand it and come to be in sync with it in a deep and inimitable way. It seems that the places we inhabit are generated to some extent, and can be characterized by, the feedback loop of our listening and sound-making practices. Our soundscape is not comprised of a random arrangement of pre-existing sounds found in the environment, rather it is a co-constituting aspect of ourselves as we live and move in the world.

There is a growing body of evidence in cognitive neuroscience, ecological psychology, evolutionary theory, and contemporary philosophy, that our knowledge of the world is an embodied knowledge (that our body shapes our mind), that our experience of ourselves as agents is embedded in our environment (that the world we live in shapes our cognitive capacities as we shape the world), and that through attention to auditory experience (including environmental sound, our acoustic sense of place, and our aural experience of music in both acoustic and technologically mediated forms) we may find a conduit to a closer, more haptic, visceral, proprioceptive, and multi-sensorially grounded relationship with the world. Consciousness, the mind, and the self may be seen as emergent phenomena from our embodied, situated existence in this world and from the actions we take to regulate and develop our physical, emotional, mental and social states.

I propose an acoustic epistemology that posits our listening and sound-making practices, which develop through our auditory and sensory experiences, as 'technologies of the self,' in that these practices, both conscious and unconscious, are formative of our selves and have a constitutive role in generating knowledge and meaning in our lives. By considering our listening and sound-making practices through these frameworks, I propose to develop a supra-rational model of auditory knowing based on models and metaphors of transduction and prosthesis. Transduction refers to the process of converting one form of energy into another. A microphone transduces acoustic energy into electrical energy, and our ears transduce acoustic energy into electro-chemical

energy. By extension I will suggest that our minds convert these forms of material energy into emotions, ideas, beliefs, concepts and so on, and that in turn, these are converted into material forms through activities (speaking, moving etc.) and the creation of cultural products (music, song, literature etc.), artifacts, and behaviours.

Prostheses allow us to do things that we could not otherwise accomplish: they allow us to 'reach' further. Prosthetic limbs let those with damaged or missing arms and legs regain their previous mobility, but prosthetics need not be considered only in the context of replacing lost abilities. Rather, prosthetics may extend or enhance our currently existing abilities. The microphone, amplifier, and loudspeaker allow us to hear that which we could not before. Musical instruments allow us to make a greater variety of sounds than we could unaided. I argue that any technology that becomes intrinsically enmeshed with our neural make-up may be fruitfully considered as prosthetic, and that our use of tools and instruments may constitute prosthetic practices. Musical instruments provide a paradigmatic case where the years of practice required to master them result in the instrument's deep integration into our selves. By extension, I suggest that all practices arising from the use of such technologies may also be considered forms of prosthesis. Sound and music-making extend our 'reach' into the world and interact with the acoustic and cultural characteristics of our environment: they allow us to know the world in ways in which we would not otherwise.

All of these activities and associated technologies are important to how we constitute ourselves. From listening to the everyday sounds around us, to acoustic or electro-acoustic music, to making sound and music ourselves, we shape our interactions and understanding of our world. These are all truly technologies of the self. Considering these aspects of our auditory experience may bring greater understanding to the constitution of our selves, to our interaction with others, and to the generation of meaning and value.

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sound energy and the conceptual. The practice of sound-making is proposed as a prosthetic 'technology of the self', and electroacoustic mediation is discussed in terms of mimesis and re-embodiment.

The project is comprised of four additional chapters, each of which attend to a different aspect of auditory experience. After this introduction Chapter 2 - *The Embodied Mind and the Situated Self*, proposes an argument for an embodied notion of mind with an implicit rejection of a Cartesian mind/body dualism. Drawing on work in cognitive sciences, this section shows how cognition and consciousness are intrinsically and irreducibly embodied, and that the mind is not located exclusively in the brain. Not only is the mind an embodied mind, but also the organism within which it is situated cannot be considered separately from its environment. Ecological models elucidate the co-constituting relationship between organisms and their environments. James Gibson's ecological theory of 'affordances' (1986) provides a powerful paradigm for understanding the organism/environment relationship. This model is extended and particularized to the auditory modality.

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Chapter 2.

The Embodied Mind and the Situated Self

2.1. Embodiment

We are embodied beings. We all have bodies, enabled in various ways, and with particular features, for better or worse. Most would also agree that we have minds and I suspect many would make the mind the locus of our knowledge: of self, of the world, of culture, and so on. Many would likely insist that the body has little or no influence on knowledge formation and meaning. What could bodies possibly have to do with developing concepts? What could bodies possibly have to do with knowledge?

Philosophies of disembodiment have marginalized sensory experience. The Cartesian legacy in Western culture and philosophies of transcendence have removed the body from accounts of epistemology. The body, along with the emotions, have become things that the mind must control. The body has become an impediment to knowledge, truth, and meaning. We do not normally notice our body's contribution to our thought processes. Because we have an intentional focus on what we are doing at any time, the body moves into the background of our consciousness. Shaun Gallagher suggests that we rely on *body schemas* to accomplish intentional acts, allowing us to focus on the acts themselves rather than the mechanics involved in achieving them. He says that a body schema is "a system of sensory-motor functions that operate below the level of self-referential intentionality. It involves a set of tacit performances – preconscious, subpersonal processes that play a dynamic role in governing posture and movement." (Gallagher, 26) It is easy and maybe even intuitive to consider our thoughts and our ability to reason to be firmly rooted in our minds, with the body being relegated to the locus of feelings and sensations. At least since the Enlightenment rationality has been the realm of the universal and the ideal. Feelings, emotions, and the passions have

been considered to be mired in the corporeal world of all that is situated, contingent, and transitory. To be rational meant that feelings, emotions, and passions were kept under control: they were to be no part of the reasoning process, and in fact, were considered detrimental to rationality. The ideal rational person is dispassionate and disengaged when applying their logical faculties to any problem. Val Plumwood puts forward a scathing critique of modern disembodied forms of rationality. She suggests that:

we should not mistake rationalism for reason - rather it is a cult of reason that elevates to extreme supremacy a particular narrow form of reason and correspondingly devalues the contrasted and reduced sphere of nature and embodiment. Feminist thinker Elizabeth Grosz puts her finger on the basic denial mechanism involved in the irrationality of rationalist forms of reason when she writes that the crisis of reason “is a consequence of the historical privileging of the purely conceptual or mental over the corporeal: that is, it is a consequence of the inability of western knowledges to conceive their own processes of (material) production, processes that *simultaneously rely on and disavow* the role of the body. (Plumwood, 4)

Plumwood insists that disembodied forms of rationalism are fundamentally irrational. It isn't 'logical' to disregard a major aspect of our experience, that of embodiment, to focus on a world view from nowhere (the God's-eye view), which valorizes the universal and the transcendental over our day-to-day experience: of the contingent and temporary. This dominant Western ideology with roots going back to Plato, through Christian and Cartesian world-views, has marginalized the historically, culturally, and geographically contingent aspects of our lives and their contribution to the generation of knowledge and meaning.

Recently there is growing evidence in the cognitive sciences that the role of the body and emotions is critical to both knowledge and reason. (Clark, Damasio, Gallagher, Tucker) The human mind is an embodied mind. It is neither Descartes' *res cogitans* nor Kant's *transcendental ego*. But mind is not simply a thing, synonymous with the brain either. Rather, mind “is an emergent process, never separate from body.” (Johnson 2007, 48) Gallagher suggests that “there is no disembodied perception” because our experience is always “framed by the body.” (2005, 59) All of our knowledge and understanding is grounded in the sensorimotor capabilities of our bodies. Damasio states that “the body, as represented in the brain, may constitute the indispensable form

of reference for the neural processes that we experience as the mind.” (Damasio 1995, xvi)

The brain possesses a far-ranging neural plasticity allowing its structure to be reconfigured based on the sensorimotor experience of the organism it resides within. Brain development depends on experience. The brain’s plasticity has evolved to allow continued development and adaptation throughout the organism’s life. For humans this process begins in the prenatal stage, where auditory and proprioceptive development is dependent upon sensory and motor input. Prenatal neurological development “depends upon prenatal auditory stimulation and movement.”(Gallagher, 170) The prenatal brain forms connections “through a process called *subtractive elimination*” through which a great many synaptic connections are made initially after which those that aren’t used are eliminated in a process of “functional sculpting,” (Tucker, 160) or as Edelman puts it: “what fires together wires together.” (55) This process continues, not only through the neonatal stage, but throughout life. (Edelman, 57) So, while there are genetically influenced structures based on evolutionary adaptation, the development of brain structures also depends on the contingencies of the individual’s interactions with its environment: the experience of the organism within its environment is crucial to neural development. Experience cannot be considered separately from the organism’s environment: the notion of ‘experience’ must include the interactions of the organism and its environment. (Gallagher, 171)

A clear consequence of this notion of experience is that “the human brain is a selectional system, not an instructional one.” (Edelman, 55) While the brain is crucial to generating knowledge it is not designed for that task specifically. The structure of the brain has evolved through our actions to resonate with the environment by altering its structure to allow the individual to adapt to its niche. The entangled activities of action and perception are central to shaping and reshaping the plastic brain. Edelman echoes Plumwood’s critique of rationalism when he points out that brains, “being selectional systems...operate prima facie not by logic, but rather by pattern recognition,” (58) and that “brain action cannot be considered...as a detached process of machinelike calculation in the absence of emotion.” (60) This understanding opens the epistemological field up by allowing non-rationalistic accounts of knowledge to include all of our activities and experiences: no longer do we have to treat art, ethics, emotions,

morality and so on as separate entities that must somehow be connected to what have traditionally been considered 'properly' cognitive activities.

There are several mechanisms that have contributed to the brain's ability to adjust its structure in response to the organism's activities, including brain maps, sensory portals, encephalization, the process of inscribing emotions onto the body in the form of somatic markers, and building body schemas. While these are general processes which affect all of the sense modalities, they may be particularized to the auditory register.

"To find the mind, we must look to the body." (Tucker, 16) The mind's neural structure is mediated and altered by our sensorimotor and visceral experience and one of the brain's major functions is to organize this experience and create information. One strategy that accomplishes this mediation is the brain's ability to create maps. (Damasio 2010) Brain maps are dynamic, continually changing maps unlike the static printed maps that we are more familiar with. Brain maps change based on neuronal activity which "reflect changes in the interior of our body and in the world around us." (Damasio 2010, 66) Maps are created for every pattern that affects the body's structure: the position of our limbs, the temperature of the air, pressure on the hand from picking up an object and so on. "When the brain makes maps, it *informs* itself." (Damasio 2010, 63) It is in our interaction with objects and our environment that brain maps are created. All of our activities contribute to the brain's map-building processes. The brain is not a tabula rasa waiting for formal education to inform it: rather the brain relies on our activities to shape and structure it whether those activities are consciously determined or not.

There are mapping processes for all of the sense modalities with the most detailed being constructed in the cerebral cortices, and coarser maps being created at sub-cortical levels. Mapping sound begins in the cochlea within the inner ear with the tonotopically organized basilar membrane. Tonotopic organization refers to frequency based mapping, with the basilar membrane responding to physical vibrations in the inner ear's cochlear fluid: sensitive to high frequencies at the basal end of the basilar membrane to the lowest frequencies humans can hear at the apical, or far end, of the basilar membrane. This physical mapping is passed on through six separate areas culminating with the primary auditory cortex. (Damasio 2010, 68-9) This is an example of

what Damasio refers to as a 'sensory portal map.' (2010, 196) Sensory portal maps are a critical component in both creating a sense of perspective and "the construction of qualitative aspects of mind." (Damasio 2010, 196) A sense of perspective is fundamental to our experience of self and world. Without the knowledge that it is 'we' who are hearing, seeing, and feeling from our own unique perspective we could not negotiate our world effectively. We know that it is 'ourselves' that are hearing with our own ears, and seeing with our own eyes and so on. It is through the sensory portals that we become aware of our interaction with the materiality of the world, and it is these very structures that are inscribed on our brain in spatially analogous ways.

There are three primary dimensions of functional brain networks. Hemispheric specialization is the lateral or left/right dimension. Popularly considered the left/logical and right/creative areas of brain specialization, more recent research suggests that the left hemisphere is responsible for detailed and analytic thought processes, while the right hemisphere is responsible for more holistic or diffuse processes. The interaction between the two hemispheres seems to be more integrated than previously thought. (Tucker) The front/back dimension has the frontal networks responsible for action while the posterior networks are for perception. Finally the inner/outer (or core/shell) dimension refers to the relationship between the inner visceral, limbic core of each hemisphere and the somatic, sensorimotor outer shell (newer structures) which interfaces the brain with the world. This latter core/shell dimension is the least well understood and is proving increasingly significant in our understanding of mind, consciousness, and self. Despite the process of encephalization (where more recently evolved brain networks 'take over' functions from evolutionarily older parts of the brain), there is much evidence showing that through the core/shell dimension the visceral and emotional core functions are necessary mediators of newer cortical structures that allow language and rational thought to occur. (Tucker, 19-28) Rather than newer structures just taking over functions from the older brain structures, encephalization is a process of developing more complex ways of elaborating these functions than the older structures allowed. These processes elaborate on "two primitive bodily structures: internal visceral control and external somatic interface." (Tucker, 20). The older more primitive structures are not so much taken over as elaborated upon: the newer structure does not make the older obsolete but instead provides more differentiated and specific elaborations, still

dependant upon the older structure. This process of “vertical integration,” (Tucker, 157) refers to both the evolution of higher level brain systems and how these new, higher levels are able to integrate the function of the older or lower level brain systems.

Antonio Damasio has done extensive work with patients who have suffered various forms of damage to their prefrontal cortex. He cites several cases where patients’ emotional abilities were compromised due to their injuries, and that this emotional disability interfered with their ability to reason. They particularly had trouble in making long term plans that were in their own best interests. (Damasio 1995) In his book *Descartes’ Error*, Damasio proposes a “somatic marker hypothesis” (1995, 173) to account for the importance of emotions, feelings, and intuitions to the process of reasoning. Somatic markers are embodied, emotional states that indicate, in a pre-rational way, some state of affairs. These are the ‘gut feelings’ that we have that some course of action will or will not be good. Human beings are not really “optimal calculators [but rather] in most situations...rely on domain-specific, ‘fast and frugal’ heuristics.” (Slingerland, 42) The basis of our concepts are “somatically marked with visceral and often unconscious feelings of ‘goodness’ or ‘badness,’ urgency or lack of urgency, and so on, and these feelings play a crucial role in everyday, ‘rational’ decision making.” (Slingerland, 43) These somatic markers provide heuristics to assist in making decisions and typically work much faster than reflective reasoning. Somatic markers allow us to react correctly and immediately. In more complex situations (planning one’s retirement, investments, route finding on a glacier etc.) these heuristics narrow the field of choices from vast and complex to focus only on those that would likely be fruitful.

Don Tucker in his book *Mind From Body: Experience From Neural Structure*, similarly emphasizes the importance that the emotions have in making decisions. (15-16). He provides an argument for the importance of the core-shell relationship in providing emotional impetus and guidance to the decision-making process. He sees the core limbic brain structures as providing crucial mediating forces that work in concert with the more highly differentiated cortical structures. These core limbic structures provide the urgency of ‘inner’ experience and proprioception to mediate the cortical ‘interface’ to the outside world. The sensorimotor information provided by the cortical interface with the world is mediated by the limbic system to provide our sense of the visceral significance of our own sensorimotor experience. Meaning, Tucker suggests,

emerges from the “neural network patterns traversing both the visceral (personal significance) and somatic (reality interface) structures of experience.” (16)

Tucker emphasizes that we need to recognize the differentiation between the somatic and the visceral pathways in the core-shell structure of the brain and the integrated function that these pathways provide. The somatic pathways provide the neural interface between body and world, including not only the skin, but also vision and audition. The visceral pathways regulate the body’s internal organs and are equally important to our lives as the somatic. The entangled relationship of these pathways provide “motivational and emotional regulation of the somatic sensorimotor systems.” (63) Tucker suggest that this is true even at the highest levels of differentiated cortical activity. He continues by pointing out that through our experience we develop expectancies which are embedded in our limbic networks. These experiences contribute to our expectations, and also to what we value, because this process of limbic structuring provides us with predictive models for how we expect the world to be. We ‘know’ this through how things feel due to the way experience structures our limbic core. “Through resonance with the environmental data patterns in sensory networks, perceptions are continually arbitrated between the internal (visceral) and external (somatic) interfaces.” (Tucker, 181) So, through our somatic interface with the world the core limbic structures of the brain are shaped and re-shaped based on ongoing experience. Our actions proceed from limbic motivation moving to the somatic shell. The feedback process between these dimensions of the brain continues to reshape our “core motives and intentions according to what is available and possible.” (Tucker, 182) Tucker further suggests that our development of concepts, motives, and intentions emerge through the feedback process of the core-shell dimension of the brain. The basis for thought and action are rooted in the visceral core of the brain and is then articulated progressively into “a more differentiated, actualized, somatic embodiment...and fed back to the motivational structures at the limbic core before ideational products - concepts - are fully formed.” (182) This strongly suggests that the limbic core is not merely the source of simple needs and urges, but is crucial to the development of thoughts, ideas, and concepts that apply to long term planning and memory, which may no longer be related directly to immediate, concrete needs. This vertical integration is important to motivating and developing action plans over long time scales. These resonant patterns

are somatically inscribed, elaborated, and embodied via the core-shell dimension. The body becomes a locus for knowledge in the development of body schemas.

Gallagher distinguishes between 'body image' and 'body schema,' suggesting that body image is constituted by the beliefs, attitudes and perceptions we have about our bodies, whereas body schemas are systems of "sensory-motor capacities that function without awareness or the necessity of perceptual monitoring." (2005, 24) Body image is something that we are aware of to varying degrees. We have a sense that our body is ours and that it fits into our world in particular ways: that it sometimes is an asset that works for us while at other times it is an impediment that 'gets in the way' of our intentional activities and modes of interaction with others. This body image is at least to some degree, even if not fully, something that we are consciously aware of. Our body image helps us differentiate ourselves from the world by emphasizing the boundaries between inner and outer by giving us a sense that our body is 'ours' and distinct from others. Our body image is an important part of our personal lives and contributes to the sense that we as individuals are differentiated from our environment.

Body schemas on the other hand, are not something we are consciously aware of. Instead of differentiating ourselves from the world, the body schema integrates us with our environment. Body schemas influence consciousness without being part of consciousness. Our body schemas develop from our interactions with the environment and are influential in the development of mind and consciousness. Gallagher states that body schemas "control the interaction of body and environment...through its posture and motor activity the body defines its behavioral space and environment under constraints defined by environmental affordances." (2005, 37) By recognizing the affordances of our environment we develop body schemas to better integrate ourselves into the world. This process is so integrative as to even incorporate objects into our 'selves.' Things that are not usually considered part of our body image become incorporated into our selves through the development of particular body schemas. This is particularly striking with objects that require significant effort to develop expertise with. Musical instruments and the craftsperson's tools become integrated into neural structures in this way. Body schemas are not to be considered as a form of representation, but more as subconscious performance of the body: "one that helps to

structure consciousness, but does not explicitly show itself in the contents of consciousness.” (Gallagher 2005, 32)

2.2. Ecological Relationships

If the body is necessarily a frame for the emergence of mind, and if this embodied mind functions through perception, then we must also acknowledge that it is embedded within an environment in the world. Perception is always a ‘perception-of.’ The interactions between an organism and its environment are crucial to the embodied nature of cognition, and may be seen as co-constitutive. Varela et al see “cognition as embodied action,” (1991, 172) and propose an ‘enactive’ approach to understanding mind. They state that:

the enactive approach consists of two points: (1) perception consists in perceptually guided action and (2) cognitive structures emerge from the recurrent sensorimotor patterns that enable action to be perceptually guided....The reference point for understanding perception is no longer a pregiven, perceiver-independent world but rather the sensorimotor structure of the perceiver....This structure – the manner in which the perceiver is embodied – rather than some pregiven world determines how the perceiver can act and be modulated by environmental events. (1991, 173)

This ‘structural coupling’ of organism and environment (Varela 1991) produces neural maps in various cortical groups in the brain “driven primarily by regularities in the environment.” (Johnson 2007, 130) Synapse structures are created, altered, and reinforced, based on our specific organism-environment interactions. So, not only is the body in the mind, the environment is as well, and all are tied together by the entangled notion of action and perception, about which Noë says that:

perception is something we do. The world makes itself available to the perceiver through physical movement and interaction. What we perceive is determined by what we do...it is determined by what we are ready to do...we enact our perceptual experience; we act it out.” (Noë 2004, 1)

Although cognitive experience emerges from our enaction of the world, it should not be considered fully private, individual, or passive. Gallagher, in reference to Dewey, criticizes such a view and instead states that:

experience is not something that happens in an isolated mind; rather, experience is biological, insofar as it involves an organism in an environment, and social, insofar as that environment is intersubjective. Cognition, then, emerges in the transactional relations that characterize organisms and the physical and social environment with which they engage. (Gallagher 2005, 37)

We are always (re)-negotiating these relationships in an ongoing dynamic flow. This emphasis on the organism-environment relationship is a fundamentally ecological one. Ecological models can provide useful reference points in our consideration of auditory experience.

Ecological models have developed from James Gibson's notion of ecological psychology as an alternative perspective to traditional behaviourist and mentalist paradigms. (Gibson 1986) An ecological approach posits the co-evolution of the organism and its environment as central: that we cannot consider either the organism or the environment as completely independent entities. There exists a co-constituting reciprocity between the two. (Gibson 1986) Gibson developed this ecological model through his theory of affordances, (Gibson 1986, 127-143) by which he proposed that

the *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*....It implies the complementarity of the animal and the environment....[and these affordances] are unique for that animal. They are not just abstract physical properties. (Gibson 1986, 127)

Gibson suggests that as we go about our daily business what we normally perceive when we encounter things is not a set of independent physical properties, but rather the affordances they offer us. (1986, 134)

He also makes an important distinction when he cautions not to consider the perception of affordances as a purely subjective experience though, because, while "affordances are properties of things *taken with reference to an observer* [they are not] properties of the *experiences of the observer*. (Gibson 1986, 137) The implications of

this statement are important because Gibson goes further to suggest that this approach to perception redefines what value and meaning are, by taking those concepts out of the realm of the purely or abstractly mental, and grounding them in the material world. He states that

the perceiving of an affordance is not a process of perceiving a value-free physical object to which meaning is somehow added in a way that no one has been able to agree upon; *it is a process of perceiving a value-rich ecological object.* (Gibson 1986, 140 emphasis mine)

Attending to ecological objects, rather than merely physical objects, requires us to consider the emergence of values and meaning from the perspective of our situated, embodied, selves.

Ecological theory often sees perception as a form of resonance between the organism and features of the environment (Clarke 2005; Gallagher 2005; Gibson 1986; Noë 2004; Varela et al 1991) where “the pick-up of environmental information is intrinsically reinforcing, so that the system self-adjusts so as to optimize its resonance with the environment.” (Clarke 2005, 19) To ensure that ecological theory has explanatory value, Eric Clarke proposes three factors that “make the theory both more realistic and more interesting: the relationship between perception and action; adaptation; and perceptual learning.” (Clarke 2005, 19)

Both Noë and Clarke see an intricately entangled relationship between action and perception. For them perception is an exploratory activity, a form of action where the organism seeks out aspects of the environment through the recognition of affordances and constrained by the structure of both the embodied organism and its environment. (Clarke 2005; Noë 2004) Noë suggests that action and perception are equally a form of contact with the environment. He states that when we act and perceive “we experience the way the environment structures sensorimotor contingency.” (Noë 2004,103) We are constantly orienting and re-orienting ourselves to our changing environment in a “constant search to optimize and explore the source of stimulation....Actions lead to, enhance, and direct perception, and are in turn the result of, and response to, perception.” (Clarke 2005,19) Noë, by extension from Gibson, proposes the notion of ecological rather than physical optics in his reference to the “ambient optic array...[which

is] the structured space of appearances...that provides the basis for our awareness of the environment.”(Noë 2004, 104-5) Auditory experience may be characterized in parallel by reference to an ‘ambient acoustic array’ as the structured space of sounds in pursuing the notion of ecological acoustics. Where the ambient optic array “is how things look from here in these conditions,” (Noë 2004, 104) the ambient acoustic array may be considered to be ‘how things sound from here in these conditions.’

Our interaction with the ambient acoustic array is one which allows resonances to develop. The attunement of organism and environment with resonant results is a form of adaptation. According to Clarke “the resonance of a perceptual system with its environment is a product of evolution and adaptation in the same way that an organism’s feeding behavior is adapted to the available food supply.” (Clarke 2005, 24) As mentioned previously, the development of sensory portal maps is an active process based on specific organism-environment interactions, and is an important part of the organism’s process of adaptation. This adaptation functions not only on the long term evolutionary scale, but also on the human time-scale in that individuals adapt themselves to the situations they find themselves embedded in, and not only on a behavioural or socio-cultural level but also on a physiological one where human neurological structures may be altered due to the particular organism-environment interactions that obtain. (Czink 2009a, 7) These active attunement behaviours result in powerful organism-environment resonances that change the neurological structures of the organism which then further change behaviours in a dynamic, ongoing feedback loop. The environment an organism finds itself in is both changed by the organism and changes the organism itself. The sense modalities are powerful mediating interfaces in this process of perceptual learning.

Ecological models consider this perceptual learning as a process of “progressive *differentiation*, perceivers becoming increasingly sensitive to distinctions within the stimulus information that were always there but previously undetected.” (Clarke 2005, 22) Perception and action are again shown to be intimately entangled. We can attend to this process in relation to the ambient acoustic array in the development from infancy of our understanding about pitch, dynamics, loudness, space, reverberation and so on, both in terms of basic ‘primitive’ perceptual learning which occurs in a rich acoustic

environment, as well as in the enculturated sense of learning from others and from the formal study of historically situated auditory practices.

It seems increasingly clear then, that cognition is not only embodied but is also situated enactively in the world. Humans, as many other animals, co-constitutively enact themselves and their world. We have seen how deeply we are affected by the environment down to the deepest recesses of our brain structures. The ecological model makes it clear that perception is not a passive process but is “geared to tracking possibilities for action” (Clark, 50) through the recognition of the affordances offered by the world and its objects. The ‘situated cognition’ model (Robbins and Aydede) takes this perspective further by suggesting that not only is cognition embodied and that we are in an ecological relationship with our environment(s), but that cognitive processes and the mind are not always bound by the physical extension of the organism: the physical boundaries of our skin do not always limit the extension of cognition. This position states that many cognitive processes are off-loaded onto features of the environment or onto tools that we have found or built. Andy Clark calls this process ‘scaffolding’ by which he means that structures external to us “mold and orchestrate behavior.” (1997, 32) He takes an inclusive stance on this considering not only physical aspects of our environment but also language, culture, institutions and so on. Clark offers some simple examples such as notebooks to help us remember, use of a compass to draw a circle, or having an expert ‘talk one through’ a complicated procedure. He sees these examples as showing how we off-load some portion of our cognitive activities to features of our environment: utilizing any “augmentation that allows us to achieve some goal that would otherwise be beyond us” (1997, 195) allowing us to reach out into the world to more fully understand it and to more effectively maneuver through it. His emphasis is on the idea that it is a mistake to consider ourselves (and other organisms) independently from the world. We use the structures of the environment, including objects that we have fashioned ourselves, to augment our cognitive capacities where we, as embedded agents, draw on the resources of mind, body, and world together. (Clark 1997, 46-7) Our autonomy is as organisms with agency, but our cognitive activities extend beyond the boundaries of our skin and therefore compromise that autonomy.

The issue of agency is important as not only are we partly defined by our activities in the environment and are affected by environmental forces, but we also

modulate those forces. (Preston, 54) Therefore the environment cannot be thought of as merely a container or the space that surrounds us: "it is a way of life." (Preston, 54) Preston goes further to suggest that this process of niche building is not only essential to our adaptation to things like food supplies and the construction of shelters, but also to the "provision of thought and the construction of theories." (56) Through our agency and activities we guide our production of knowledge and beliefs in a kind of collaboration with the environment and the artifacts within it. Knowing, or the generation of knowledge, "is a kind of activity or performance rather than the creation of a mental map of how the world is.... [and we] cooperate with the environment in constructing beliefs at the same time as the environment is shaping what and how [we] know." (Preston, 56) This describes a process of transduction where the material forces and energies that we encounter and enact are 'converted' into concepts, feelings, beliefs, and knowledge: material forces are converted into conceptual ones.

While it has become clear that knowledge is necessarily perspectival, that does not mean that it is all 'just relative' and completely subjective. Even the individual's subjective perspective is subject to invariants and constraints imposed by the structure of the environment and the organism itself. In our activities and our enactive experience we notice patterns and invariants in the environment. Environmental invariants, coupled with the structural constraints of our bodies and their associated perceptual mechanisms ensure that much of our knowledge of the world is common to all those who are similarly embodied and embedded. Knowledge can be verified and compared amongst individuals because we are all similarly embodied: we can all see relatively far, we can only touch things that are relatively close and so on. The shape and location of our ears are determining perspectival structural constraints on our auditory experience: something most of us share. The structure of our bodies as co-evolved with our environment, imposes constraints on the brain and nervous system and how they function. Shaun Gallagher, citing Chiel and Beer notes that "the nervous system cannot process information that is not transduced by the periphery, nor can it command movements that are physically impossible for that periphery." (Gallagher, 149) Our activities "involve the attunement of the body to the environment, as well as the homeostasis of the body itself." (Gallagher, 150) These seemingly physiological processes, through the constraints they impose, therefore clearly have important

ramifications for perception and the development of our knowledge of the world as we are situated within it. Our specific and collective activities will therefore also have an important influence on the development of mind, consciousness, knowledge, and self. Auditory practices specifically, as well as the involvement of all our sense modalities in general, offer distinct contributions to the constitution of our selves and the generation of our knowledge of the world.

Action and perception seem now to be intricately entangled according to the enactive view. The feedback loop of action and perception is a key feature of this entanglement: it is a (re)iterative process where the two supposedly distinct processes coalesce as a sort of union of the perceiver and the perceived. Cognition as perceptually guided action (Noë) results in “functional...action-oriented couplings between organism and world.” (Clark 1997, 171) Clark characterizes the action/perception nexus as a form of “continuous reciprocal causation” and refers to Merleau-Ponty’s statement that “the properties of the object and the intentions of the subject are not only intermingled: they also constitute a new whole.” (Clark 1997, 171)

We develop sensorimotor skills as part of our active engagement with the world. We are active participants in our world, not detached observers. Action and perception are necessarily linked so that as we act and move in the world we are constantly updating and generating new knowledge so that we may best proceed with whatever we are doing. We generate predictive knowledge through the action/perception feedback loop and dynamically alter our understanding of the world. Our sense modalities afford us modes of exploration of the environment. It is through action and perception that we come to know the regularities of the world and respond to changes and anomalies. Auditory experience offers a particular form of contact with our world. The constantly changing ambient acoustic array affords us understanding of events unfolding around us and involve us actively in developing strategies to shape and reshape our engagement with our world.

What has been implied but not explicitly stated so far is the importance of movement in developing sensorimotor skills and subsequent knowledge. Descriptions of sensory experience tend not to mention movement, implying by that omission that the subject is completely still. Even when deliberately being still in observing a scene or

listening to the soundscape there are small microscopic movements taking place: our eyes dart from object to object as we observe a landscape; our heads move to reorient our ears when listening to sounds in the environment. Our constant movement highlights the dynamic flowing nature of experience.

Sensorimotor contingency theory has developed to account for “the importance of real and anticipated bodily movement in perceptual experience.” (Gibbs, 65) The premise is that sensory experience, perception, is something we do, not something that just happens to us. Gibbs elaborates by stating that “sensorimotor contingencies are a set of rules of interdependence between stimulation and movement.” (Gibbs, 65) We as agents in the world learn to develop mastery of sensory experience to recognize how sensory information “changes as a function of movement with respect to the environment.” (Gibbs, 65)

Clearly the sensory information we receive at any point in time does not give us access to all of the environment around us. We need to reorient ourselves by moving to see what is hidden behind an occluding object or what is behind us. Similarly we need to move to better hear a sound coming from off to one side or from an indistinct location. Even when something is within our phenomenal reach our intentions making us attend to something in particular often prevent us from seeing something within the phenomenal field in a phenomenon known as ‘change blindness.’ There have been many demonstrations of change blindness where subjects are asked to attend to a particular task while some other stimulus is introduced into the scene. Often the majority of subjects do not notice the extraneous stimulus even when it is quite obvious on reflection. Gibbs cites an example where during a distraction in an interview, the interviewer was switched with a different person, and most subjects did not notice the change even though the new interviewer wore different clothes. (66) Our intentions and actions direct our perception and through movement we are able to integrate the changing sensory information to be able to effectively maneuver in the world. We are able to direct our bodies to access parts of the environment that we need at any point in time: we depend on our ability to anticipate the sensory results of our actions.

These models of cognition and sensory experience can of course all be particularized to the auditory modality. The forms of action needed to understand our

world include, for most of us, auditory experience. Overtly auditory activities, where the intention *is* to make sound, such as speech and music, are tied in to ecological models and form (at least for speech and some forms of music) rule-governed systems that are elaborated and particularized in specific interactions. Speech, through its embodiment, imparts more meaning than written language possibly could. We gain meaning through the intonation and emphasis of paralanguage. Music, embodied through performance, similarly produces meaning even if in a more intangible and ineffable way. We are modulated by the force of music in powerful ways that can significantly change how we come to understand ourselves and our world. Speech and music are central to enacting each individual's personal, social, and cultural worlds in ways that, through their embodied nature, offer something in addition to any propositional knowledge we may have formulated.

It is through environmental sounds though, that a strong relationship to physical space is created. Speech and music may figure into this as well, but it is through our listening and soundmaking practices whose main intention *is not* to produce sound, where sound may be a byproduct of other intentional or unconscious activities, that we generate knowledge of the world we are situated within. This relationship to our "aural architecture" (Blessner and Salter) is a significant contributor to our sense of place, whether in natural or human-made scenarios. Our soundscape is a critical factor in understanding our world.

These models of cognition as perceptually guided action are all fundamentally ecological, and in terms of auditory experience all of them may be subsumed within the notion of the soundscape. While it may be tempting to consider the soundscape as analogous to landscape in terms of the physical layout of objects in space (and therefore sounds in space) this would ignore an important dimension of the idea of the soundscape. The notion of the soundscape is fundamentally ecological in character in that it includes the inhabitants of the environment and their perceiving role within it as a defining aspect. The term 'soundscape' "emphasizes the way in which the sonic environment is *understood*." (Truax 2001, 50) The soundscape resonates with ecological theory "in emphasizing the mutualism of organism and environment...it adopts a more embodied outlook through the central relationship between perception and action." (Clarke 2005, 194-5) Listening and soundmaking may both be considered as

manifestations of perception and action, and “since the listener is also a soundmaker,...it is the entire *system* of the listener plus environment that constitutes the ‘soundscape.’ (Truax 2001, 65) All listening is situated listening, and the idea of the soundscape embraces this fact.

Chapter 3.

Hearing and Listening

While we are certainly situated within our environment we are also part of our environment in all its aspects. We modulate and are modulated by others: things, events, persons, histories and so on. What and how we hear and to what and how we listen are important embodied modes through which we understand our world. Auditory experience encompasses everything from the mundane to the extraordinary, from the trivial to the astounding. Hearing is a primary way of enveloping ourselves in the world: in our auditory experience we find ourselves situated within the world. The activity of listening immediately establishes an intersubjectivity: between ourselves and others, ourselves and things, ourselves and events, ourselves and signs, ourselves and histories. By this intersubjectivity we mark our alterity from the world and the particularity of our selves. Through our experience of the sonorous we interact with the traces, the indexes, that the world of events affords us.

This encompassing intersubjectivity anchors our auditory experience in at least two ways: the noise of the other and the clamour of the world; and the quiet solitude of our selves rooted in the ground of our own sounds; breathing, beating heart and footsteps. Therefore our ways of listening are intimately entangled with our soundmaking practices: intentional ones or not. In this way, as Barthes says, “listening speaks.” (1991, 252) Our ways of listening can change with mercurial fluidity depending on our changing intentions and the agencies acting upon us. Is it possible to characterize our ways of listening? What forces or factors are at play when we listen? How does the ground of hearing influence the world of listening?

3.1. Hearing Everyday

William Gaver suggests that we have two ways of listening: everyday listening and musical listening. (Gaver 1993a) After first considering everyday listening I will return to critique Gaver's characterization of musical listening and propose other models. He characterizes everyday listening as “the experience of hearing events in the world rather than sounds per se, [and that] the perceptual dimensions and attributes of concern correspond to those of the sound-producing event and its environment, not to those of the sound itself.” (Gaver 1993a, 1-2) An auditory event is produced by an encounter between things and forces in the soundscape. An event, according to an ecological stance, is a change “in the layout of affordances of the animal-environment system.” (Chemero 2000, 39) Defining events as dependent on our apprehension of affordances points to the fact that we have not only perceived physical changes in our environment but rather, we have perceived “action-related, personally scaled changes in [our] surroundings.” (Chemero 2000, 40) This definition is consistent with the ecological character of the soundscape.

Sounds communicate information about events situated in space. What are the determining factors which allow us to identify sound sources? How may we classify or categorize sounds? Bregman proposes ‘auditory scene analysis’ as a framework for determining how we extract auditory features from sounds in the environment and identify their sources. (1990) He suggests that we segregate ‘streams’ of sound to help identify sources, in both sequential and spectral dimensions. His account relies heavily on Gestalt grouping principles where we have evolved to be able to identify events based on likely environmental scenarios. We understand through our experience and interaction with the world that some behaviours are more likely than others: we will integrate certain common patterns rather than random ones.

This process functions on both what Bregman refers to as ‘primitive’ as well as ‘schema-based’ organization. Primitive forms of segregation involve “neither past learning nor voluntary attention.” (Bregman 1990, 667) This is part of the developmental process of individuals and is found in infants. Schema-based segregation acknowledges the influence of learning, memory, and culture. These are often conscious and intentional aspects of listening. Bregman states that “primitive processes *partition* the

sensory evidence whereas schema-based attentional ones *select* from the evidence without partitioning it.” (Bregman 1990, 669) The primitive processes are generally unconscious and gained through our embodied interaction(s) with the environment as we develop from infants to mature adults. Schemas are often also unconscious, but do allow for more intentional activities, learning, memory, cultural influences and so on. Cognitive scientists suggest that we develop schemas to allow us to apprehend

particular classes of signals, such as speech, music, machine noises, and other familiar sounds of our environment...Each schema incorporates information about one particular regularity in our environment. (Bregman 1990, 666)

These regularities range from the simplicity of particular sounds, to words, sentence construction, bodily awareness etc. (Bregman 1990; Gallagher 2005)

Grouping or integrating segregated streams of sound takes place both sequentially (temporally) and spectrally. Bregman, in his extensive study of auditory scene analysis, outlines in detail the many factors that contribute to, or prevent auditory stream segregation in both of these dimensions. Processes of sequential integration involve what Gaver refers to as 'complex events.' (Gaver 1993a) These are events whose continuity and extended temporal nature are crucial to identifying the source of the sound. Footsteps would be an example of a complex event. The sound of an individual footstep may not be correctly identified if removed from the context of a series of footsteps. Even further, if we isolated the components of an individual footstep we are even less likely to identify the source. If, for example, we isolated only the heel of a shoe striking the wood surface of a floor, without the temporal context of the whole footstep (heel-strike and the rolling of the foot) let alone the context of a series of footsteps, the difficulty of identification becomes very great. Only with the full temporal context can we reliably identify such sounds.

Gaver goes on to specify the physical types of sounds that we hear and suggests that they fall into three categories: vibrating solids, liquids, and gasses. (Gaver 1993a, 9) He also points out the importance of the environment in structuring the sounds we hear in the movement from event to experience. (Gaver 1993a, 7) While the physical invariants of the sound producing materials allow us to identify them with some accuracy

across various environments, the 'aural architecture' (Blesser and Salter 2007) is always a factor in determining what we hear. Aural architecture "refers to the properties of a space that can be *experienced*, by listening." (Blesser and Salter 2007, 5) Sounds occur in environments and these environments always colour the resultant sound, and not in a merely value-neutral way. Our "auditory spatial awareness is more than just the ability to detect that space has changed sounds; it includes as well the emotional and behavioral experience of space." (Blesser and Salter 2007, 11) The effects of space on sound are ontologically rooted in the embodied experience of sound in all cases.

As suggested above, sounds are not value-neutral physical occurrences. The fact that a sound is produced by a vibrating solid, liquid, or gas seems less important in everyday listening than other factors that may be more meaningful. Most people likely do not analyze the physical forces involved in the production of the sounds that we hear. We are more likely to respond to social and interpersonal aspects of the sounds around us.

Schafer has specified several categories of sound that we experience in our soundscapes. Key among them are those that specify the function of sound in the soundscape. (Schafer 1993, 9-10) 'Keynote' sounds are those that are ubiquitous in a particular environment and set its tone: a pervasive presence that influences all of the inhabitants of the area: the sound of falling rain in a rainforest eco-system, the sound of vehicular traffic in urban centres, the sounds of waves in ocean communities and so on. The 'soundmark' specifies unique sounds that identify particular places. Vancouver's nine o'clock gun warning small marine traffic to return to dock, and the 'O Canada' horn marking twelve o'clock in the downtown area are examples. These are important in terms of the identity of place, self, and community. Schafer feels that soundmarks, like landmarks, often deserve to be preserved due to their historical importance. (1993, 9-10) Bernie Krause chooses to categorize sounds using words coined by scientist Stuart Gage, in terms of whether they form part of either the

geophony: the nonbiological sources of natural sounds, such as landslides, wind, weather, water, and geophysical acoustic phenomenon (earthquakes, avalanches, volcanoes, and other geothermal events),...[or] anthrophony, defined as all of the human-generated sounds that occur in a given environment: physiological (talking, grunting,

body sounds), electromechanical, controlled sound (music, theater, etc.), and incidental (walking, clothes rustling, etc.). (Krause 2008, 73)

in addition to his own term "biophony...to express the combined aural sensation that groups of living organisms produce in any given biome." (Krause 2008, 73) In terms of listening, sound sources within these categories may very well have differing levels of saliency for the listener depending on what his or her situation, focus, and intention are. It seems almost certain that in most possible scenarios of every day listening our intentions are more likely concerned with whether the sounds we hear are created by other people, animals, and so on, rather than the physical characteristics of the objects producing sound: it is the cultural 'what' producing sounds more than the physical 'what' that we concern ourselves with.

3.2. Ways of Listening

What we hear and the meaning of what we hear is directly affected by how we listen. Listening may or may not be consciously controlled: our forms of attention will influence how and for what we listen. Truax identifies three levels of listening attention. 'Listening-in-search' is the most active and fully conscious form of listening, "involving a conscious search of the environment for cues." (Truax 2001, 22) 'Listening-in-readiness' identifies "an intermediate kind of listening, that in which the attention is in readiness to receive significant information, but where the focus of one's attention is probably directed elsewhere." (Truax 2001, 22) Finally, 'background' listening takes place when we are not self-consciously aware of sound at all, but if we were asked to describe what we had heard we most likely would be able to do so to some degree. This type of listening is where keynote sounds typically make their impact. All of these forms of listening explicitly refer to the context within which the subject is situated. These are all ecological models outlining our attentional level of interaction with our environment.

As mentioned above, Gaver has posited two forms of listening: everyday listening and musical listening. His account of everyday listening is nuanced and compelling, but his characterization of musical listening seems simplistic in comparison. While he correctly associates everyday listening with identifying sounds in terms of their

source, he states that in musical listening one is attending to sounds in terms of their sensory qualities. (Gaver 1993b, 286) This seems to be too narrow a definition, and one that is not borne out by my own experience. What Gaver describes as musical listening seems to suggest a different kind of listening where one is concerned with the physical sensation of the sounds one is hearing: perhaps a phenomenological or resonant listening. In considering this paradigmatic case of listening to music, musical listening seems to be not only concerned with the physical sensation of the sounds, but also their interrelationships, their structural role, how they form melodies, harmonies, rhythms, meanings, affect, and emotion.

There are likely an indefinite number of ways to listen that are rooted in forms of attention and intention, sometimes invoked deliberately while other times subconsciously. What may other ways of listening be and what might they entail? Can we identify ways of listening other than everyday and musical listening as suggested by Gaver, or those that function in addition to and in conjunction with the everyday and the musical? Can musical listening be everyday listening?

While considering Gaver's cursory characterization of musical listening referred to above, several other possible ways of listening suggested themselves. A phenomenological listening seems to offer something closer to what Gaver describes. There are many varieties of phenomenological thought and practice all of which may have direct implications to listening practices. What might a phenomenological listening entail?

The originator of phenomenology, Edmund Husserl's rallying cry was "back to the things themselves." (1964, 6) Husserl wanted to get away from traditional philosophical concerns of metaphysics, philosophy of mind and so on, and move on to what he considered most crucial for philosophy and for everyday life: how we experience things. By concentrating on a first person perspective, phenomenology was meant to uncover the structures of experience. (Gallagher and Zahavi, 7) The meaning of subjective experience is central to the phenomenological approach. To the phenomenologist "experience is never an isolated or elemental process, it always involves reference to the world." (Gallagher and Zahavi, 7) One of the goals of phenomenology is to call into question "the comfortable assumptions afforded by ordinary awareness." (Ihde 2007,

220) Phenomenology concerns itself with the intentions of the subject: the meaning of the subject's experience of the affordances offered by his or her world. It is not so much a focus on an isolated autonomous subjectivity but rather the interaction of the embodied subject with a world that he or she is situated within: a world where meaning and knowledge are generated in the interactive ongoing flow of experience.

Phenomenological listening would certainly, then, involve a focus on the sensory quality of the sounds one is listening to: the phenomenal aspect of listening to music or the soundscape. It would also consider the "intentional, spatial, [and] temporal" (Gallagher and Zahavi, 9) in its characterization of our auditory experience. This is a listening to tone, timbre, and resonance. This is listening to how auditory experience situates us in space and, importantly, how our experience of sound in this way contributes to the transformation of geometric space into inhabited place. A phenomenological listening would set aside (bracket in Husserl's terms) other aspects of auditory experience. Such a listening would try to avoid judgement based on the symbolic, the social, the cultural and so on, to focus intently on auditory experience.

Jean-Luc Nancy, in his poetic and provocative book *Listening*, suggests that the phenomenological subject is a *seeing* subject. (21) He says that the phenomenon of sound is not based on a "logic of manifestation" (20) of the visual, but rather what he refers to as an evocation, where "evocation summons (convokes, invokes) presence to itself." (20) Nancy proposes that what the *listening* subject does instead is "open up to the resonance of being, or to being as resonance." (21) He understands this as fundamentally different from the phenomenological and as a distinct mode of being: that of being resonant. Resonant listening would involve setting aside the visual and its vocabulary, from "an intentional line of sight, to a resonant subject, ...perhaps no subject at all, except as the place of resonance." (21-2) The resonant subject disappears into the sonorous, or, is open to the sonority of the moment. This suggests a somewhat Heideggerian take on phenomenology as one of making our selves open to experience, to the given, allowing experience to surprise us: putting ourselves into a mode of active reception, one that is not solely mediated by or reduced to language.

Immersing in the sonority of resonant listening has an ecological tone, where the subject 'disappears' into a momentary unity with the environment he or she is situated

within. This kind of resonant listening may be a primary form of resonant learning where the commonalities of the embodied person with its environment contribute to the enaction of self and place through a process of active attunement with the environment.

If phenomenological and resonant listening encompass the experience of tone in both the soundscape and music, then a 'hermeneutical' listening may afford us the opportunity to attend to other aspects of auditory experience. According to the *Oxford English Dictionary* the word hermeneutics comes from the root 'to interpret.' A hermeneutic listening would then be an interpretive listening: a listening which analyzes the soundscape or music and interprets the experience to help us understand the meaning of what we are listening to in its ecological context.

Hans-Georg Gadamer in *Philosophical Hermeneutics*, ties hermeneutical practices directly to language. To him "understanding is language-bound." (15) His notion of hermeneutical practice is rooted in what it is possible to say within the bounds of language. Gadamer's characterization of how we go about understanding things (texts, events, experiences etc.) is historically situated, co-constitutive, and has a Gibsonian ecological perspective. He rejects mind-body dualism and concepts of scientific knowledge that rely on the notion of a disinterested scientific observer with a view from nowhere. To interpret the meaning of things we must engage with our subject or object of interest in the here and now. We must embrace and make as explicit as possible our biases as these are the historically pertinent precursors to our engagement with the world. This is a fundamentally temporal process through which we change our biases through confrontation with the thing in question and therefore change the nature of the thing in turn. Through our understanding thus gained, we refigure the subject/object of interest by reshaping ourselves. Understanding is not so much the application of a formal methodology to 'extract' information about the object but rather a form of active mediation. In the Introduction to *Philosophical Hermeneutics*, David E. Linge states clearly that "understanding is an event, a movement of history itself in which neither the interpreter nor text can be thought of as autonomous parts." (xvi) Gadamer adopts Heidegger's need for us to be open to the thing, the event, where "the interpreter genuinely opens himself to the text by listening to it and allowing it to assert its viewpoint." (xx-xxi)

There seems to be much potential in adopting a hermeneutical stance when listening. By acknowledging our biases and formulating questions about what we are listening to we have the opportunity to reconstitute ourselves and develop a richer understanding of that to which we listen. A listening that is consciously historically situated will allow the past history of both the individual and the context within which he or she is situated to reconfigure each other and to generate knowledge and meaning through the interaction. A hermeneutical listening to music may be particularly fruitful to develop. What 'questions' does the musical event ask? How does our previous knowledge and experience with music and life mediate our understanding of a particular musical experience?

Some of these questions may also be semiotic in nature, possibly constituting a distinct way of listening where we consider the sounds we hear "as a symbolic system." (Feld 2003, 225) How can we conceive of our soundscape in this way? Can music be subject to a semiotic listening or does this only make sense in relation to the soundscape as a whole? Steven Feld, in his groundbreaking work *Sound and Sentiment* engages in an extensive sonic ethnography of the Kaluli people of Papua New Guinea characterizing their relationship to the tropical rainforest soundscape and the development of their language, music, and social structures. How do our soundscapes and musical listening practices influence our understanding, our language, and our social structures? By asking questions of the symbolic aspects of our soundscape and music, a semiotic listening may unearth illuminating insights to the forces that have shaped our cultures and ourselves.

Roland Barthes has identified three ways of listening, through which he proposes a fourth, and has tied them directly to the hermeneutical project. Of the initial three forms he calls the first 'alert' listening. This is the basic listening we do on an everyday basis where we are attending to sound as the index of events. Truax's three modes of listening are appropriate to this category: listening-in-search, listening-in-readiness, and background listening. Barthes calls his second category 'deciphering,' where we are trying to "intercept certain signs." (1991, 245) He suggests that this is a uniquely human mode of listening where we listen in the way we read: "according to certain codes." (1991, 245) Such a 'deciphering' listening would ask questions about what symbolic codes are in operation or circulation in a particular auditory event.

These two modes of listening are how we stay in touch with the world, to literally make sense of our world. Barthes explicitly ties these modes to hermeneutics by saying: "Listening is henceforth linked to a hermeneutics: to listen is to adopt an attitude of decoding what is obscure, blurred, or mute, in order to make available to consciousness the 'underside' of meaning." (1991, 249) These forms of listening are tied directly to our use of language as a basis for knowledge. We pay attention to the indexes of events to understand what is taking place in our vicinity. We understand the codes through which we are able to apprehend the meaning of sonic events, and especially culturally coded events such as music. The deciphering way of listening helps us make sense of our historically and culturally situated being.

Barthes' third form of listening is the 'intersubjective.' This is where the focus is not on *what* makes sound, or the symbol(s) evoked by sounds in their cultural context, but rather on *who* makes sound: who speaks, who emits, sound. This kind of listening creates "an intersubjective space where 'I am listening' also means 'listen to me'...." (1991, 246) This form of listening encompasses the language of speech, but also that which is beyond or before language: paralinguage, affect, gesture, body language and so on.

This intersubjective listening "where listening speaks" (Barthes 1991, 252) is where Barthes proposes a fourth form of listening: psychoanalytic listening. He considers this form of listening as a form of intersubjectivity where one unconscious communicates with another "from a speaking unconscious to another which is presumed to hear." (1991, 252) He suggests that what is communicated in this form of listening is unconscious knowledge: that which we are not aware of or, as a Freudian perspective might suggest, that which we would prefer to suppress. This may be considered in sync with the hermeneutical project if the listening subject asks appropriate questions to bring to the surface the meaning of what lies below in the depths of the unconscious. One could also see this as a supra-rational (before and/or beyond the rational) challenge to the hermeneutic tradition. How can we attend to what lies below consciousness? By trying to fix these meanings to logos would the meaning of this kind of communication be betrayed? How can we consider this a form of communication at all? Barthes says that the psychoanalytic listener "hovers" (1991, 253) in readiness, waiting for "a resonance permitting him to 'cock an ear' toward the essential." (1991, 254) By paying attention to

more than just sound, by listening to body movements, gestures, facial expressions, the texture of the voice, the rhythm of the breath and of language, the psychoanalytic listener has the opportunity to learn something new through the intersubjective scene.

All of this suggests that perhaps we listen with more than just the ear. Sound does seem to bridge the distance of vision and the intimacy of touch. We feel the vibrations of sound with our bodies as much as we hear them with just the ears. The low bass frequencies in amplified music produce a feeling, a crush of the chest: an undeniable tactility. The sound of heavy machinery, race cars, earthquakes, waterfalls, big surf, avalanches, large orchestras, and of course, amplified music, all produce strong physical sensations involving much more than our ears alone. These aspects of our listening may be best described as haptic. Haptic experience is all about touch and tactility. In haptic experience we are in touch with our environment: contact between our 'selves' and the environment we are situated within help us establish ourselves and our orientation. Giuliana Bruno brings the etymology of the word haptic to the fore: "haptic means 'able to come into contact with.' As a function of the skin, then, the haptic - the sense of touch - constitutes the reciprocal contact between us and the environment, both housing and extending communicative interface." (Bruno 2002, 6) The haptic emphasizes or highlights aspects of contact with the world. The tactile and the auditory as well as the olfactory are foregrounded. Haptic listening extends what we know, and perhaps what we can know, by considering the contribution of other, often marginalized, sense modalities to what we can hear, listen to, and understand.

The kinesthetic, our ability to sense our position and movement in space, is also an important aspect of the haptic. (Bruno, 6) Movement is an important aspect of our interaction with the world. We orient and reorient ourselves constantly, even in scenarios that we may often consider still. When listening attentively we reorient our ears by moving our heads, cocking an ear as Barthes says, (1991, 254) changing our orientation to sound. Michel Serres' notion of a "proprioceptive" hearing is clearly related to the haptic when he states that "proprioceptive hearing controls our gait." (142) Movement, and walking in particular are central concerns for Serres and he relates the experience of walking directly to auditory experience. He says that:

The body stands and walks through the space of messages, orients itself within noise and meaning, amidst rhythms and rumblings. As it hears through the soles of its feet, through the sites where muscles, tendons and bones are attached and articulated, and finally in the space where the inner ear connects with the canals which control our balance, it can be said that our whole posture is linked to our sense of hearing. (142)

The profoundly deaf virtuoso percussionist Evelyn Glennie speaks of her ability to hear and listen opening up when she became profoundly deaf in her youth. Her deafness forced her to become sensitized to hearing through more than her ears. She performs in bare feet so that she can feel vibrations through the floor, and holds her mallets in ways that reorient and open her body to the vibrations of her instruments. Glennie challenges those with unimpaired ears to listen with the whole body: if they only listen with their ears she says, they are more deaf than she herself.

The practice of soundwalking implicitly acknowledges haptic listening. Soundwalking has developed as a kind of awareness practice focussing on the sounds occurring in different places. By walking through particular places and attending to the soundscape, the soundwalker learns to understand the place he or she is embedded in. (Drever) The constant reorientation of moving through the environment and the changing contact through the whole body produces a profound connection to place in an ongoing negotiation of sound and spatiality. The soundwalker's own sounds of footsteps and breathing move in concert with the sonic indexes of events in the environment providing a conduit to a deep connection with, and generation of, place.

3.3. Listenings...

What emerges from considering these diverse ways of listening is that our listening practices and listening possibilities are dynamic and responsive to the situation at hand. That listening is multimodal and multifaceted also seems to be evident. Returning to where I started, with Gaver's notion of everyday and musical listening, I suggest that these ways of listening are not as homogeneous as the terms themselves may suggest. Both everyday and musical listening are complex and diverse. The listener likely brings to bear many of the ways of listening I have suggested, and likely many more that I have not yet considered, in either of these contexts depending on the

listener's intentions, agency, and history as well as the intentions, agency, and history of those and what he or she is interacting with. Where, with whom, and with what one is in contact with will be greatly influential on which ways of listening will be most likely called upon. When we go out on a soundwalk we often listen to the soundscape as if it were music: we establish an aestheticized stance. This is where we compose our listening in relationship to the sounds occurring around us. The soundscape composer takes this further by literally composing with the sounds and sonic structures of the environment.

Musical listening is clearly not just about the physical sensation of the sounds. Musical listening also has clear hermeneutical, semiotic, and haptic possibilities. The formal characteristics of music are also important: the structural role of musical sounds and how they interrelate to form melodies, harmonies, rhythms and so on exert a strong influence on how we listen. It is also important to consider how music influences our selves and our emotions. Intersubjective listening is often in play as well, particularly in music-making activities. What is being communicated in such forms of listening? The complex contingencies of particular listening situations need to be teased out and characterized through the attentional direction of these different ways that we listen: through multiple listenings....

Chapter 4.

Sounding

Sounding. To sound. Making sound. Try as we might, we are never silent while we listen. Often we make ourselves as quiet as possible while listening, but sounds emanate from us: breath, heartbeat, stomach. Footsteps, coughs, sneezes. The rustle of fabric against fabric, fabric against flesh, flesh against things. These are the unintentional soundings we make as we act in the world. These often unnoticed soundings situate us in the spaces we inhabit and traverse, producing place. Our spatial awareness is tied to anthropomorphic scale through the sounds we make. Our sounds: human-scaled sounds. Our knowledge of place is generated to a great degree through our auditory experience: the corporeality of place is incorporated into us in this way.

Intentional soundmaking always also involves listening. These are not separable acts. As action and perception are intricately entangled (Noë) so are soundmaking and listening. Our soundmaking practices, from the mundane to the musical, are forms of perceptually guided action (Noë) and are therefore cognitive. Auditory experience is, to co-opt a phrase by Giuliana Bruno, “a spatial form of sensuous cognition.” (2002, 6)

To sound is to sound out. It is a call, an evocation, an invocation, a provocation, an invitation, an incantation. To make sound is to auscultate: to reveal surfaces, exteriors, and interiors. To sound is to make manifest, to touch the unseen. To sound is to inhabit, to dwell, to territorialize. The silent resonance of space becomes full with our sound. From the most intimate - flesh against flesh, a whisper in the ear, a kiss - to the most ferocious - explosion, torrent, wall of sound - to sound is to include, to exclude, to seduce and to dominate.

4.1. Body

Our embodied selves are the ever-present baseline for the sounds we make. From the body comes all the human-scaled reference points in our sounding lives. The loudest and the most quiet give expression to our jubilation, our anger and outrage, our fear, our love, our determination. Our living, breathing selves establish the rhythms which shape and mediate our interactions. Through the gait of our footsteps, the rhythm and texture of our breath, our heartbeat, our cycles of sleep and wakefulness, of hunger and eating, we establish the rhythms of active life. It is against these rhythms and sounds that we take measure of our world.

The human voice may in some ways be the sound most associated with our sense of selves and for many, probably most, people it is their primary form of soundmaking. The voice is, of course, a major carrier of language. The voice is the articulate and supremely personal conduit to the self. Speech emanates from us bodily, with the texture, tonality and impact of the person: of the 'me.' And more than just the carrier of language, the voice reveals more than language alone can communicate. Language is embedded in the voice and depends upon its nuances: its 'tells.' Our 'tone of voice' can reveal unspoken meanings: our passions, fears, truths and lies. Paralanguage: the contours, tones, and accents of our speech generate meaning on its own. Many of us have 'listened' in to conversations in a language we do not know and have been able to have a sense of how the conversation went.

It is through the voice that the social is instigated. To speak is to communicate and expects response. I know the other through his or her voice. I know you through your voice. We converse: we "keep company with" each other, according to the Oxford English Dictionary (OED). We discuss, where we "shake things apart" again according to the OED. I recognize and acknowledge you in your voice and I in mine. We laugh and cry in our own individual ways. And we sing songs: language and thought become music and the musical in thought is given voice. Emotion, affect, experience: rooted in voice.

4.2. Things

Of course we make sounds with more than just our voices. Humans have spent great time and energy in appropriating things and building things specifically to make sound and music. The materiality of these devices anchors our soundmaking actions in the world. Making music with an instrument is deeply corporeal. How can we characterize our relationship with musical instruments? What forces are involved in this relationship? What kind of a thing is a musical instrument anyway? Is it a sculpture thing? A status symbol thing? A sound thing? How should one go about describing it? Is it just a matter of describing the visual outline of its occluding edges? It would seem that a description of the instrument's mechanics would likely be pertinent. If one were to include an account of the sound of the instrument then what would that do to the boundaries of it? Is the architectural space within which it resides and sounds a part of the instrument? And what of the musician and possible audience(s)?

A musical instrument is certainly at least a 'sound-thing' and, paraphrasing Heidegger's use of thing as a verb, I will suggest that sound 'things' (Heidegger 1971) through not only the instrument itself, but also through the entanglement of a vortex of agencies swirling around it. Ecological psychology (Gibson 1986, 127-43) can once again offer a fruitful entry into understanding our relationship to musical instruments, and harmonizes well with the etymological origin of 'thing' as a gathering or event. Unlike most things, the primary affordance of musical instruments is to make musical sound. While this requires the agency of the musician it also ascribes agency to the instrument, both in terms of offering an invitation to play, as well as the demand that the musician submit to a disciplinary regime to become skilful. The requirement of disciplined movement and nuanced tactility make the production of musical sound with the instrument a necessarily embodied action. And yet this interplay of agencies still does not address the resultant sound. While it may be tempting to attribute a particular sound to a particular instrument, it is important to consider the 'aural architecture' (Blesser and Salter 2007) of the space within which it resides. Every space contributes some colouration to the sound depending on common resonant frequencies between the space and the instrument. This must be considered an integral part of the instrument's sound: there can be no pre-existing instrument sound independent of space. This means

that making musical sound is both a spatial as well as a temporal practice: one that territorializes the architectural space and the audience within it. The feedback loop of playing/listening becomes an exploratory action where the performance of music may function as a prosthetic to reach out and generate knowledge and meaning from the 'intra-action' (Barad 2007, 33) between the musician, the instrument, the architectural space, and the inherent sociality of music. Altering any of these elements necessarily changes the others in a quantum entanglement (Barad 2007, 247-52) of mutually co-constituted agential intra-actions. The instrument, musician, space, sound, and audience are inextricably entangled within a 'causal nexus' (Gell 1998) of agencies.

The origin of the word 'thing' takes one to the notion of an assembly or gathering. (Latour 2009, 160) Immediately the instrument can be seen not as a mere physical object, but also as a thing that can invite or inspire people to gather: a material anchor (Fauconnier and Turner 2003, 195) for the occasion of music making. Things, through their affordances, exert agency. Elizabeth Grosz suggests that we should consider

the *thing as question*, as provocation, incitement, or enigma. The thing...enables practice... [and] is our provocation to action and is itself the result of our action. But more significantly...it also functions as a *promise*, as that which, in the future, in retrospect, yields a destination or effect, another thing.... The thing is the point of intersection of space and time, the locus of the temporal narrowing and spatial localization that constitutes specificity or singularity. (Grosz 2008, 125)

Again, things are not merely inert, passive, physical objects, but exhibit forms of agency. Susanne Kuchler similarly says that "no longer can we regard things as passive receptacles of discursive thought; rather,...thought can conduct itself in things, and things can be thoughtlike....[and that] things partake not just in thinking, but also in the shaping of knowledge." (Kuchler 2005, 225-6)

So what affordances does a musical instrument offer and what agencies are involved? The instrument can afford being status symbol, play, pattern making, perhaps niche building as well (Gibson 1986, 128), but the primary affordance of a musical instrument is, unlike most other things, that of making (musical) sound. While other things may be co-opted into making musical sound, musical instruments are designed specifically for that purpose. What agencies are involved? The instrument can be seen

as an index of the builder's agency. But, once made, the instrument has its own agency. An affordance is itself a form of agency. The instrument 'invites' one to play it and produce music sonorously. Importantly the instrument also 'demands' the pianist to submit to a long term, disciplinary regime of training and practice to become skilful at playing it. The instrument 'determines' in a way, what kinds of movement and what kinds of tactile interaction must be made to successfully and skilfully play the instrument. Both through an instructor's physical feedback and through individual practice the musician's mode of touch and of movement are changed by the demand of the disciplinary agency of the instrument.

Not only are movement, posture, and tactility affected, but the very structure and material of the brain is changed. (Gaser and Schlaug 2003) Cognitive development is dependent not only on the individual's genome, but also on organism-environment interaction. (Czink 2009b, 61) This has profound implications regarding the notion of selfhood. The musical instrument becomes a vehicle of personhood and the locus of exchange between itself, the instrument builder, the musician, the teacher, and those audience members present at the time of performance. It is "a congealed residue of performance and agency in object-form, through which access to other persons can be attained." (Gell 1998, 68) The self is no longer the disembodied, solipsistic, Cartesian self, but rather it has become "an intrinsically social, interactive, and mobile experience." (Cumming 2000,10)

Let us now identify some of the agencies involved in the "causal milieu" (Gell 1998, 37) of the musical instrument. The instrument of course has a maker who works from a design. The musician has a teacher who instructs him or her in the appropriate ways to move and interact with the instrument, based on either a score by a composer, or by the creative agency of the musician as improviser. The sound of the instrument couples with the aural architecture (Blessner and Salter 2007) of the space (Czink 2009a, 4-5) which is heard by the musician and any audience members, among whom may be the composer of the score.

Alfred Gell has developed a terminology and associated methodology to identify the roles and interactions of multiple agencies in the causal nexus of the artwork. (Gell 1998) Gell is concerned with the social agency of not only persons but also of things.

Persons and things do not exist as independent entities, but as social agents within a milieu. Gell differentiates between 'primary' and 'secondary' agents, with primary agents exhibiting will and intentions (i.e. persons), while secondary agents do not (i.e. things). According to Gell it is possible for both persons and things to be social agents because he defines a social agent as one that "causes events to happen in their vicinity.... An agent is the source, the origin, of causal events." (Gell 1998,16) Gell's social agency is a relational, situated form of agency consisting of 'agents' and 'patients.' Agents are causes of events while patients are subject to the forces of the agent in question.

The musical instrument functions as the material anchor for the creation of music in this milieu of social agency. Its materiality and agency are not independent of all the other players in this nexus. Music emerges as an embodied action within the social milieu. The music/musician feedback loop is particularly salient in that it suggests the inseparability of action and perception, and of self, instrument, and environment.

The disciplinary practice of mastering instrumental technique and the tactile interactions with the instrument become incorporated into the musician's body and cognitive structure via processes of self-modification. The musical instrument becomes simultaneously part of the musician's cognitive apparatus, becoming a prosthetic more than a mere instrument, and an agent of structural change to the musician. Through listening with the whole body the sound the musician is generating feeds back and alters the musician's actions. The musician, attunes him or her self to the specific materiality of the instrument, to the aural architecture, to any other musicians, and the audience. Musician and environment are mutually co-constituting. Even the anechoic chamber has a 'space' of sorts. By removing all the acoustic reflections in a space, the anechoic chamber makes a 'non-space' that is very disorienting. We are used to the cues offered by acoustic space in reflecting sound back to us and have difficulty in assessing the space of the anechoic chamber. The musician uses the instrument to 'work out' the music, which in turn constrains the musician's movement and alters his or her cognitive structures. The musical instrument becomes part of the musician's mind so to speak. According to Clark the "environment becomes a key extension to our mind." (1997, 61)

Not only can the musical instrument be considered a prosthetic device, but by extension, so can the practice of music-making. Alva Noë states that "art can be...not

only concerned with the making of objects, but more significantly with the investigation of perceptual consciousness." (2000, 128) Creating music sonorously is not only a process of 'internal' reflection and conceptualization, but rather, "a mode of active engagement with the world." (2000, 128) Playing music becomes a form of perceptually guided action, where some of the musical thought extends to the musical instrument itself and the sonorous interaction between the music and aural architecture of the space.

Prosthetics are meant to extend our reach and abilities. According to the Oxford English Dictionary the origin of the word prosthesis stems from words meaning 'towards' and 'place.' Towards a place: an extension and possibility of action. The prosthetic duo of musical instrument and music facilitates "wider possibilities of acting...[where] life itself becomes extended through things." (Grosz 2009, 130) There is a kind of transduction of energies in this milieu, where the interconnected agencies surrounding the musical instrument are changed from the material to the experiential. Through this transduction the musician comes to know his or her milieu: not in a merely rational way, but in a manner before or beyond the rational and propositional into what we may call the supra-rational. Making music allows us to acquire "an intimate apprehension of the unique particularity of things, their constitutive interconnections, and the time within which things exist." (Grosz 2008, 133)

The musician, in a Deleuzian sense, through the transduction of energy into music, territorializes the space and others within it. Not necessarily a territorialization of aggression but also the possibility of inhabitation. For Deleuze and Guattari "territorialization is an act of rhythm that has become expressive, or of milieu components that have become qualitative," (1988, 315) and they further suggest that this may be the emergence of art (Deleuze and Guattari 1988, 316). Territorialization then, as a form of niche-building. The making of music sonorously becomes a possible world of sorts, territorializing the space and its inhabitants and creating knowledge through the cognitive act of perceptually guided action.

What all of this should make clear is the mutually entangled states of all of the agents within the milieu of the musical instrument. None of the agents or things within this milieu exist independently of one another. Changes in any one necessarily entail changes in others. This informs the notions of Deleuze and Guattari's irreducible

'multiplicities' (Deleuze and Guattari 1988 11-12), of Gell's 'causal nexus,' and Heidegger's 'thing.' Karen Barad draws from the world of physics to discuss the notion of 'quantum entanglement' as a model to describe the specific material interconnections among things. (2007, 247) In her book *Meeting the Universe Halfway: Quantum Mechanics and the Entanglement of Matter and Meaning*, she relegates the word 'thing' to refer to objects, and instead proposes the term 'phenomena' to refer to the "ontological inseparability of agentially intra-acting components." (Barad 2007, 33) She also specifically rejects the term 'interaction' replacing it with 'intra-action,' which she says "signifies the mutual constitution of entangled agencies." (Barad 2007, 33) Her concept is relational in that particular agencies emerge through their intra-action in the world. This is very closely aligned in spirit to Gell's causal milieu. She further sees "matter as a dynamic and shifting entanglement of relations, rather than as a property of things." (Barad 2007, 33, 35) Barad paraphrases physicist Niels Bohr when she states that "the central lesson of quantum mechanics is that we are part of the nature that we seek to understand." (Barad 2007, 33, 247) It is therefore impossible, or at least deluded, to consider ourselves and our things as independent of the world we inhabit.

While Barad is primarily concerned with the philosophy of science it seems fitting to bring her notions into the world of music and art making because of her focus on materiality. Her formulations seem perfectly apt within the nexus of art and music, particularly if we accept that art and music practices do constitute forms of knowledge. Barad says, again paraphrasing Niels Bohr, that "our ability to understand the world hinges on our taking account of the fact that our knowledge-making practices are material enactments that contribute to, and are part of, the phenomena we describe." (Barad 2007, 33, 247) Barad sees our activities in the world, regardless of whether they are scientific, artistic, or anything else, as being a natural process in the world. She says that:

Practices of knowing are specific material engagements that participate in (re)configuring the world. Which practices we enact matter – in both senses of the word. Making knowledge is not simply about making facts but about making worlds, or rather, it is about making specific worldly configurations. (2007, 91)

So what kind of a thing is a musical instrument? It is a sound thing certainly, but more importantly it is a 'worlding' thing: one which exerts agency and is situated in a historically and temporally contingent milieu of intra-acting and entangled agencies. The instrument, musician, music, aural architecture, and audience all come to being agentially through the intra-action of their inextricably entangled and mutually constitutive agencies.

4.3. Electroacoustics

Electroacoustic technology introduces a potentially disruptive change in the tightly integrated nature of acoustic communication systems discussed above. There is potential with the introduction of electroacoustic mediation that for the first time this acoustic integration may be challenged as the various aspects of sound and its technological manipulation can detach and separately manipulate the elements. The displacement of sound from its origin and re-embodying it in loudspeaker technologies has the potential of disembodiment of sound entirely. The role of microphone, storage, and amplification technologies profoundly changes the dynamics of acoustic communication systems.

Audio technologies offer affordances for forms of representation in musical practices unavailable before their advent. The recording 'chain,' from microphone to storage medium to amplified reproduction allows the incorporation of 'real-world' sounds into musical, or organized sound, contexts. These electroacoustic technologies frame environmental sounds in seemingly neutral or naturalized ways, although they are by no means neutral. It is important to remember that environmental sound recordings are transduced, mediated representations of environmental sound(s), and that both human and technological agency are always implicated in these processes of mimesis. The temporal and spatial displacement of environmental sound recordings allows the creation of "surrogate environments" (Truax 2008, 104) both in terms of our mediated everyday soundscape, as well as in the potentialities afforded to composers.

Mimesis has long been considered in the visual arts, but only peripherally in regards to music. It provides a powerful model for interrogating the fascination of using

environmental sound recordings as compositional materials, as well as in considering other mimetic practices afforded by computer technology. Modelling natural processes such as the statistical structures of rain drops, the self-organizing principles of swarms, flocks, herds, and shoals, evolutionary models, artificial life models and so on, may fruitfully be considered as forms of mimesis.

These mimetic electroacoustic practices can be considered embodied forms of transduction and prosthesis. The environment can be considered as a form of music, and music, as a kind of niche building, can be considered as a form of environment made possible through audio technologies. Both listening and sound-making can be considered as technologies of the self and forms of awareness practice affording us a more nuanced understanding of our world.

The advent of audio technologies has allowed composers to record sounds from the environment and to incorporate them into their work. This process begins with the transduction of sound into analog electrical form through the mediation of the microphone. This technical description seems detached, neutral, and mechanistic, but in its seeming objectivity belies the effect of the microphone itself and the agency of the recordist who wields it. Like the photographer with a lens, the recordist chooses when and where to point the microphone. Recording environmental sound requires decisions to be made regarding what is 'worth' recording. The recordist must be engaged in a very conscious and active form of listening: a "composed listening." (Norman 2004) Recordists compose their listening and therefore also the recordings they make, through not only their own intentional act, but also through the "secondary agency" (Gell 1998, 20) of the microphone.

The microphone exhibits a form of agency by requiring recordists to move in particular ways, and by mediating their choices through the polar response pattern and frequency selectivity of the device itself. The microphone distorts or transforms the sound being recorded by altering the frequency balance, by recording in particular spatial patterns (depending on the polar response pattern of the particular microphone), and by reducing the spatiality of sound as found in the environment to a discrete number of channels. The microphone, in effect, defines the space and sound of the resulting recording in conjunction with the intentions, interests, and goals of the recordist. As

soundscape composer Hildegard Westerkamp, in an interview with colleague Katharine Norman says: “the microphone can impart an intense glamour...[where] listening is a silent intelligence that directs us to what we think matters.” (Norman 2004, 77, 86)

Transduction is defined by the Oxford English Dictionary as the process of converting one form of energy into a different medium or form of energy. The microphone (and loudspeaker as well) is a transducer in that it converts acoustic energy into electrical energy. This definition may be qualified by considering the microphone as a ‘transducing prosthesis’ since we may consider recordists to be actively transducing their composed listening into the material form of a recording and composition through its use. The microphone will never, after all, transduce anything on its own, just as a prosthetic leg “certainly will never go out dancing without [its owner!] (Sobchack 2009, 280) This prosthesis allows the recordist to reach, or in this case, listen, further or more closely than otherwise possible. The microphone sounds new worlds in a way similar to the photographer’s lenses showing new worlds through altered perspectives. As our listening becomes more acute with the use of the microphone, our listening practices necessarily change in response in a transductive feedback loop where the ways in which we choose to listen through the microphone change our ways of listening which in turn change how we choose to listen through the microphone. Ideas are transduced into recordings which transduce once again into ideas.

The recording itself has also fundamentally altered how we listen. The ability to store sound recordings, particularly in our current digital era, changes how we may interact with sound. By dislocating sounds from their point of origin, and by allowing us to store the resultant recordings we can experience sound in new ways. Before the advent of sound recordings, sounds were fleeting and ephemeral. One had to pay attention to the sound as it occurred. Once a sound had ended there was no way of revisiting or contemplating that sound again. Only through the embodied storage of memory could sounds past be (re)considered. Audio recording technology has changed that.

The ability to re-listen to sounds from the past is in itself already a fundamentally new situation. But sound recordings are more than merely passive documents that give us access to some objective historical reality. Referring to photography, but very applicable to soundscape recording, Wells states that “there can be no document that is

merely a transcription of reality. Rather, as part of a discursive system, it constructs the reality that it purports to reveal.” (Wells 2003, 105) Speaking specifically about soundscape recordings Proy suggests that they “offer information depending on our attitude and capability of listening. Recordings are sonic traces that at the same time reveal and hide sonic information.” (Proy 2002, 16) The document changes our understanding of, and interrelationship with, the soundscape immediately in the act of creating it.

Sound as stored in a recorded document displaces the original sound from its time and place of occurrence. Traces of the space within which the original sound took place are inscribed into the recorded document. We can hear the ‘aural architecture’ (Blessner and Salter 2007) of the space to some degree in every recording, although certainly not without the mediating contribution of the microphone and recordist’s auditory perspective. Even the common technique of close miking, used to minimize the sound of the acoustic space, imposes its own particular intimate and eroticized perspective. The recording has us hear the traces of another space and time embedded within our own. While Schafer considered this as a negative psychological condition in coining the term ‘schizophonia’ (Schafer 1993), it has become the norm in today’s society. Our sonic environment, and our ways of listening to it, have changed fundamentally through recording technologies, allowing new opportunities for their creative use to emerge.

The very materiality of recordings opens up the possibility of further transformations and distortions of the recorded sounds. The audio recording industry, particularly through popular music and film sound, continues to develop tools for the transformation of recorded sound at a tremendous rate. Popular music and film sound both have embraced sound technology as a creative rather than merely representational medium, albeit typically under the guise of a naturalized form of illusion. Electroacoustic composers have embraced, and indeed in many cases created, these tools. Interactions with sounds and sound recordings have allowed composers to integrate real-world sounds into their compositions and to therefore allow us all to re-hear sounds in new contexts and develop new musical practices. Recordings have “become active components of research...rather than passive artefacts whose function was simply to reproduce.” (Dack 2010, 272)

Amplification and reproduction allow us to experience sound in previously unheard of ways. Amplification may work like a sonic microscope giving us access to sounds that would otherwise either be difficult to hear, or would be impossible to hear at all. Westerkamp's *Kits Beach Sound Walk* lets us hear the sound of barnacles, something normally impossible, particularly within an urban environment. David Dunn in *The Sound of Light in Trees* using specially developed microphone technology allows us to hear the movements of beetles under the bark of trees. Amplification allows us not only to hear sounds like these in isolation, but also in 'balance' with other sounds. Sounds that would normally prevent us from hearing small sound can be balanced by selective amplification in the mixing process, affording us the opportunity to establish new, previously unavailable relationships in the process. The medium of recording, through its mediation of our listening experiences, and by allowing new relationships to be discovered and created, changes our relationship to sound, the environment, music, ourselves and each other.

4.4. Mimesis

The environment, through recordings and soundscape compositions, becomes music. We can hear our environment musically and compose our listening in accordance. By composing with real-world sounds we are engaging in mimesis: we are imitating aspects of our world. Audio technologies, including recording as well as computer based audio technologies, allow us unique opportunities to engage in mimesis. Soundscape compositions constitute obvious examples where environmental sound recordings are directly incorporated into compositions with varying levels of transformation. Historically, *musique concrète* (Manning 2013) established the use of recorded real-world sounds in developing new forms and methods of composition along with an attendant taxonomy.

Electronic and digital sound synthesis methods may also be mimetic by imitating the sound of acoustic instruments. Synthesis methods are often evaluated by how accurately they are able to imitate existing acoustic instruments. A great deal of time and effort is put into creating synthesizers, particularly software synthesizers in the digital realm, that can effectively substitute for the acoustic original. Creative uses have of

course emerged from the development of these synthesis methods, and these uses often do not take mimetic practices as the primary goal. Electroacoustic composers often develop sounds which pursue increasingly abstract variations on acoustic sounds and may even abandon acoustical principles entirely.

There are also numerous examples of computer modelling of natural processes which are clearly mimetic. Algorithms have been developed over the years to model the behaviour of complex natural events. Stochastic distributions are used to model the sound of raindrops for example, and algorithms have been developed to model the behaviour of swarms, herds, and flocks, subsumed under the rubric of 'self-organizing systems.' These are systems that exhibit complexity on the micro level but demonstrate coherent overall behaviour without any central organizing principle or agent. (Miranda 2011) Evolutionary models and forms of artificial life have also been used to create new forms of music. (Miranda 2011)

Why this interest in mimesis? It may, at least initially, have stemmed from the sudden ability to do so. Mimesis in music before audio technology was fairly limited, certainly in comparison to the possibilities afforded by audio, and particularly since audio went digital and computing power escalated to a high level, and with it the sophistication of new software. Perhaps it was the revolutionary possibilities for breaking old musical codes which were seen as dusty relics of old orders. With the development of modernity, post-modernity, industrialization and global communications technologies and culture, many artists and musicians embraced opportunities to develop new forms of expression and communication.

Of course this is not to suggest that mimetic practices have replaced other electroacoustic practices. As already mentioned, the development of complex sound synthesis methods has afforded electroacoustic composers the opportunity to increasingly abstract their composed sound world from the acoustical world. The idea of music with no mimetic references is alive and well. In fact, many electroacoustic composers work within the intersection of these sound worlds. Unmanipulated phonographic works are often marginalized and not considered on the same aesthetic plane as more composed and manipulated works, possibly due to the long term inheritance of developmental and transformational compositional practices.

Adorno contrasted mimesis with rationality: “between the representation of reality and the abstract techniques through which such reality is mediated within the art work.” (Windsor 1996, 192) Adorno considered mimesis as a threat to the autonomy of the art work: a process he associated with ‘primitive’ forms of art and culture. For Adorno, “mimesis is not merely the re-presentation of nature. Instead, mimesis is that which precedes rationality, a state in which ‘primitive’ man establishes power over things by imitation.” (Windsor 1996, 192) This is the abject opposite of Adorno’s characterization of art “as the product of enlightened rationality.” (Windsor 1996, 192) Composers who engage in mimetic practices clearly are not perturbed by Adorno’s notion of art and rationality. It may exactly be the conscious pursuit of the ‘primitive’ or the pre-rational that fuels composers to pursue mimesis in their work as a way of overturning old codes and models of knowing and engaging with our world in a post-colonial turn. Mimesis may be a power source that the composer may tap into.

Michael Taussig, in his book *Mimesis and Alterity*, considers mimesis as fundamental to our understanding of the world we inhabit. He defines what he terms the ‘mimetic faculty’ as “the nature that culture uses to create second nature.” (Taussig 1993, xiii) He continues by saying:

the wonder of mimesis lies in the copy drawing on the character and power of the original, to the point whereby the representation may even assume that character and that power....[and that] it is as necessary to the very process of knowing as it is to the construction and subsequent naturalization of identities. (Taussig 1993, xiii)

Taussig’s study engages particularly with technological developments that he refers to as “mimetically capacious machines” (1993, xiv) which he considers having caused a “recharging of the mimetic faculty.” (Taussig 1993, xiii) To Taussig, mimesis is positive in its opposition to Adorno’s notion of a universal and context-free rationality and valorization of the abstract. Enlightenment forms of rationality as they have developed in Euro-American culture in the 20th century are seen by Taussig as the end-game of an abject atomization of knowledge and experience. What is lost in such forms of rationality is, according to Taussig:

not merely the resistance of the concrete particular to abstraction, but what [is] crucial to thought that moves and moves us – namely, its

sensuousness, its mimeticity...[and where, (quoting Adorno in reference to Benjamin's writing)] thought presses close to its object, as if through touching, smelling, tasting, it wanted to transform itself. (Taussig 1993, 2)

Mimesis is, in effect, a form of embodiment, even through the mediation of 'mimetically capacious machines' like the audio recorder, which is often considered disembodied.

4.5. Technology and Embodiment

Auditory experience and audio technology afford unique forms of embodiment. Sound is experienced as an enveloping and immersive medium. This is true whether we are hearing acoustic sound or technologically mediated sound reproduced through loudspeakers. While there is clearly a difference between recorded sound in its displaced context and the original sound in its original context, we experience sound similarly in both cases, that is, as dimensional sound in space. While the literature often refers to our concern with the source of environmental sound (Gaver 1993a, 1993b) it does not often make a distinction between the source and origin of sounds. What is generally referred to as the source of a sound should be considered its origin. The source of electroacoustic sound is the loudspeaker, whereas the origin of the sounds heard will refer back to the now displaced original context of the sound recorded. This distinction clears up the problem of considering recorded sound as 'disembodied.' (Chanan 2000) We can consider that the origin may be disembodied or displaced, but the experience of the reproduced sound is located in the situated space of the listener, and can only be embodied, or rather, re-embodied. (Wishart 1986)

Sound particularizes space whether acoustic or electroacoustic, and we experience this particularization in an embodied way. This is in contrast to dominant and current forms of mimetic visual representation which 'record' three-dimensional space in two-dimensional form. This particularized embodiment of sound is especially potent in terms of auditory experience because it is:

perceived in the here and now of an embodied space, [and] returns to the listener the very same qualities that media mediates: that feeling of being here now, of experiencing oneself as engulfed, enveloped, enmeshed, in short, immersed in an environment. Sound surrounds. (Dyson 2009, 4)

Don Ihde also considers the role of technology in embodiment as fundamental to our modern urbanized experience. He speaks of experiencing “the phenomenologically based insight that bodily perceptions can be embodied through instruments.” (Ihde 2002, xvi) and that through the use of technology there can be “an enhancement of certain dimensions of whole-body perception.” (Ihde 2002, 40) Auditory experience as mediated through audio technologies emphasizes “the irreducible bodily or *analog* basis of experience, which...has *always* been conditioned by a technical dimension and has *always* occurred as a co-functioning of embodiment with technics.” (Hansen 2006, 8,9) Media technologies “stimulate or provoke the power of the body to open the world.” (Hansen 2006, 9) Embodied experience is the only kind of experience we have, and are able to have, whether it occurs in a technologically mediated environment or not. Sounding out our corporeality, sensuous cognition: breath, heartbeat, swarm.

Chapter 5.

Knowing

5.1. The Mindful Ear

We have seen how the mind is embodied, and how sound envelopes us, bridging our visual and tactile experiences in powerful ways. Much of our auditory experience functions unconsciously, having receded into the background as we are engrossed in our intentional activities. We take for granted what our sense modalities offer us. The ear is more than just an 'object' but is, rather, something that generates knowledge, allowing us to pursue our interests with skill and sophistication. How we listen and what we listen to is central to how we understand the world around us and our place within it. The mindful ear presupposes close attention to our listening practices and from that position develops a discipline of awareness to structure our auditory experience in particular and personal ways. By listening with a mindful ear, we not only understand and develop ourselves, but we also grow to understand the 'other' through awareness of our intersubjectivity.

Clearly listening is central to the mindful ear, but what do we know when we listen? Listening certainly gives us information about the world around us: about events taking place and a sense of the space within which they occur. Listening is an embodied act and therefore also a mode of perceptual learning that mediates our understanding of the world. The soundscape affords us more than propositional knowledge. When we listen we become in tune or in touch with our world: we resonate with aspects of our environment and gain a wider awareness of our connection to things and our place in the world. "Sound, like other forms of sensation, activates the listener's passions." (Smith 2004, 38) We know more than what can be rationally, propositionally stated. "Knowledge is always embodied knowledge." (Smith 2004, 39) We develop things such

as feelings, intuitions, and emotions that help us negotiate our world effectively. Damasio's somatic marker hypothesis suggests that our ability to reason would be compromised if we did not develop these embodied markers to help narrow the possibilities of a situation quickly. (Damasio 1995, 173-5) This 'supra-rational' (before or beyond the rational) form of knowledge is grounded in our sensorimotor engagement with the world working together with our ability to reason thereby constituting an important form of our embodied knowledge.

Action is *in* perception as Alva Noë makes clear. The feedback loop of action/perception and of listening/soundmaking is fundamental to what we do and how we understand and negotiate our world. Damasio considers these sensorimotor feedback loops as enabling a kind of “reverberating process...[where] input cascades aimed at the brain would be complemented by output cascades aimed at the very ‘flesh’ where the signals originated, thus contributing to the integration of inner and outer worlds...[with] the auditory system being a prime example.” (2010, 261) Integrating inner and outer experience is a key goal of many mindfulness practices. Becoming mindful of auditory experience can help this integration by helping to develop our awareness of how we are embedded in particular places: by allowing the somatic and visceral to interact.

We *need* not consider our auditory experience explicitly: but what if we choose to? What if we pay close attention to our listening? What if we become explicitly aware of our soundscape and auditory practices? The ‘mindful ear’ opens us up to the specificities of auditory experience and brings that experience to the foreground. By attending to our mindful ear we can become more aware of how we are connecting to the things and events in our environment. The auditory modality may invite a more receptive and aware attitude to our situated selves. Of course each of the senses offer unique modes of awareness. Seeing, touching, and hearing are ways of encountering the same environment with the difference being that in each case it is “an encounter with different patterns of appearance.” (Noë, 107) Each sense modality offers something unique to our experience of the environment and affects our thinking accordingly. Reed concurs when he states that thinking is “the development of skilled ways of regulating and controlling one’s awareness, especially one’s prospective awareness.” (Reed, 177) Being mindful of our auditory experience is a profound way of ‘regulating and controlling’

our awareness. Our thought is influenced by the mindful ear as we open ourselves to auditory experience. We experience events as a process of 'allowing-to-happen' as intentional not so much in a wilful way, but rather as one which opens us to the resonance of the world: echoes of Nancy's move from the phenomenological to the resonant register where the dynamicism of being becomes the foreground rather than the more usual static manifestation of materiality and object-hood. The mindful ear is an ecological ear: we do not attend to abstract objective events separate from us but rather, we attend to events from our particular perspective and with our particular motivations. It is *our specific encounters* with the environment that allow us to explore the affordances of the world we are situated within. The mindful ear is an exploratory ear.

Listening may by extension be considered a form of awareness practice. By focusing on the auditory modality we are able to change our attention allowing us to attend and become attuned to the resonances of our environment. Jean-Luc Nancy, regarding his resonance model of knowing states that 'listening strains toward a present sense beyond sound...where sound and sense mix together and resonate in each other, or through each other.' (2007, 6-7) He understands meaning "as a resonant meaning, a meaning whose *sense* is supposed to be found in resonance, and only in resonance." (Nancy 2007, 6-7) He states that "to be listening is always to be on the edge of meaning...[and that] sound is also made of referrals: it spreads in space, where it resounds while still resounding 'in me'" (Nancy 2007, 6-7) Listening makes tangible our understanding of the world in myriad ways, allowing us to be more involved and aware of our practices within it. A focus on listening as an awareness practice may prove to be a transformative approach to experience.

Awareness practices may be seen as one of many technologies of the self. Auditory awareness, whether through quiet contemplation, or soundwalking practices through to music making and other soundmaking practices, is such a technology of the self. Through mindful awareness of our listening and soundmaking practices we are shaping and reshaping ourselves in an ongoing dynamic negotiation with the world. Foucault considered technologies of the self to be one of four types of technologies we employ to understand and to fashion ourselves. In his own words Foucault states that technologies of the self permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct,

and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality. (1988, 18)

We engage in particular modes of training and self modification by acquiring and developing various skills and attitudes. (Foucault 1988, 18) The senses are central to this development and focussing attention on a particular sense modality will bring specific and unique aspects of experience to the fore. Auditory experience through its strength at enveloping us in the world, brings particular attention to the structured patterns of feeling: what Mark Johnson refers to as “vitality affects.” (43) We have seen how feelings are critical to effective decision making, from the presence of somatic markers to the vital motivating aspects of the core brain. According to Johnson, feeling “lies at the heart of all meaning.” (43) The patterns of feeling that we experience, the ‘flow’ to life experience, have particular affective contours, and changes to those structured patterns result in changes to our understanding of the world we are situated within. The mindful ear is particularly sensitive to the flow of events around us and therefore has a profound impact on the ongoing development of our selves. This development begins in an exploratory way by bringing to consciousness our interaction with our environment, and eventually, as the particular patterns of feeling are incorporated into the technology of our selves, becomes performative, particularly through our soundmaking and musical practices. Resonant experience, in Nancy’s sense, through the mindful ear, is the process of becoming aware of, to cite Noë, “experience in the act of making the world available to us.” (Noë, 176)

Much of this suggests that the self, the mind, and consciousness are phenomena that are emergent from our material and ecological interactions with the world: physical, social, cultural, historical, personal, and interpersonal. The self is not predetermined but is rather a complex self-organizing system which is modulated by the world and its events and, importantly, also modulates the world by initiating events. The role of auditory experience is central to any such emergence. Veit Erlmann provides a twist on listening by reference to the “listener function...that fixes...meanings with the goal of circumscribing and prescribing the auditory ways in which individuals acknowledge themselves as subjects.” (24) Our sense of self is intimately tied to our auditory experience, and auditory experience, like all experience, is rooted in place.

5.2. Space and Place

We cannot consider ourselves separately from the places we inhabit. Our sense of self, our experience of the world, and our interactions with others are all situated in particular places. The built environment, and particularly the domestic environment, is of particular significance as so much of our experience is rooted in the places we build. Bachelard, in his well known book *The Poetics of Space*, speaks extensively of the role of the home in shaping thought and directing the imagination. (Bachelard 1994) Similarly Michel Serres emphasizes the importance of domestic space to the generation of meaning and a sense of our selves when he states that “the house functions as a space of transformation where forces are calmed, like a high energy filter, or converter. (1985, 146) He suggests that the home is a “second skin” (Serres 1985, 147) which in effect extends the boundary of our bodily selves. Blesser and Salter’s term ‘aural architecture’ emphasizes the role architecture has in shaping our auditory experience and generating place from space. Considering the aural architecture of the places we dwell in shifts our focus from the hegemony of the visual register in architectural representations to the enveloping and resonating aspects of our auditory experience. The sounds we make are entangled with the acoustic shaping of the spaces they occur in and contribute to the enactment of place by colouring sound in ways unique to each space. We come to know places by the way they contribute to the constitution of all sound occurring within them. We feel and understand place by our sounding activities and interactions within them. We find information from the places we inhabit through our auditory experience and from that information we generate knowledge and meaning.

Architectural space is most often considered and represented visually though: often with photographic images devoid of signs of habitation. This is not surprising as we live in a culture that privileges the visual to the detriment of the other senses. Focused vision tends to distance us from the objects that we observe. What we see is always 'out there,' away from us, always other and distant. We lose our sense of intimacy with things when we emphasize the visual at the expense of the experiential. Juhani Pallasmaa states in his book *The Eyes of the Skin: Architecture and the Senses* that:

the gradually growing hegemony of the eye seems to be parallel with the development of Western ego-consciousness and the gradually increasing

separation of the self and the world; vision separates us from the world whereas the other senses unite us with it. (25)

Our experience of architecture, and our environment in general, is an embodied one. Pallasmaa again points out that "an architectural work is not experienced as a collection of isolated visual pictures, but in its fully embodied material...presence." (Pallasmaa, 44) Visual representations of architecture are representations of geometrical space abstracted from inhabited space. "A house that has been experienced is not an inert box. Inhabited space transcends geometrical space." (Bachelard 1994, 47) This notion is echoed by others: De Certeau's "space [as] a practiced place," (De Certeau, 117), Bourdieu's 'habitus' as a "spatial acting out of place" (Bourdieu, 300) and Heidegger's notion of dwelling poetically (Heidegger 1971), all recognize the primacy of space as a fully embodied experience, and one that cannot be reduced to a rationalized vision.

Attuning ourselves to the passive acoustics of a space, to the ambiance of a space, requires an intentional sensitivity to the more intimate and haptic experience of listening. Our experience of sound bridges the near and far. We feel sound as well as hear it: Sound touches us in an intimate way. It is difficult to remain distant and merely 'rational' when experiencing sound. Sound invades, envelopes, and penetrates us in ways that images do not. The aural architecture of built spaces is a major determinant of our sense of self in relation to the world. "To enter and come to inhabit a place fully means to redraw the limits of our bodily existence to include that place - to come to incorporate it and to live it henceforth as ground of revelation rather than as panorama." (Jager, 220) In a sense the architecture becomes part of us as our selves 'tune' into the resonance of the space. Bachelard uses sonic metaphors to elaborate on his notion of poetic image. He says that:

through the brilliance of an image, the distant past resounds with echoes, and it is hard to know at what depth these echoes will reverberate and die away....It is in reverberation...that I think we find the real measure of the being of a poetic image. In this reverberation, the poetic image will have a sonority of being. (Bachelard 1994, xvi)

Bachelard seems to be getting at a more palpable sense of materiality for the poetic image than just that of propositional understanding. He seems to be reaching for

a sense of the image as a supra-rational and embodied result of the human imagination at work. This resonates with notions put forward in evolutionary theory and cognitive neuroscience. Eric Clarke suggests that the perceptual system 'resonates' to environmental stimulus and that "perception is a *self-tuning* process." (Clarke, 18-19) This process of the self's resonance with its environment is seen by Clarke not as a passive process but rather as "a perceiving organism's active, exploratory engagement with its environment." (Clarke, 19) The self and the environment are mutually constituting.

Bachelard sees this relationship between self and environment as being rooted in the acoustic. "Images are born directly from the murmuring voice - to which one listens in speaking nature." (1971, 108) Bachelard is pursuing the supra-rational again here: getting at the 'sense' that is beyond or before sense in its more common cognitive guise. The creative imagination produces meaning other than the logocentric. The receptive posture of listening and tuning in to the ambiance of interiors is fundamental to generating meaning that is not simply propositional. This receptivity is at the root of Bachelard's notion of the daydream, of reverie: "all imagination must learn again how to dream." (1971, 109) In daydreaming our intentional being is decentred, allowing memory, thought, and environment, to flow and generate unique creative images. Daydreaming is a deterritorialization of intentional cognitive thought processes: the nomadic thought of Deleuze and Guattari. "Nomadic thought...is not a matter of making long journeys around the world...[rather] it could happen without stepping outside one's apartment." (Ballantyne, 38) This is the space where memory and reality may interact allowing for the "ever-recurring creative moment...a refrain...[that] addresses itself to a deeper singing." (Ballantyne, 52-53) Imagination doesn't reject the real world, rather "it mobilizes its potencies of transformation...[where] reverie designates imagination as a constant re-creation of reality...[and is] the purest expression of human freedom." (Bachelard 1971, 101)

Our activities within our built spaces all contribute to the enactment of place. Our soundmaking practices can be considered as an auscultation of the places we inhabit. Auscultation refers to the medical practice where doctors tap on the body of their patients to make diagnoses based on the resultant sounds heard through the stethoscope: the tones of the body's resonating chambers. When we make sounds we

are in effect auscultating the chambers of our dwellings. These auscultations actualize the latent resonances of architectural space and produce audible effects on the sounds we produce. The ambiance of interior spaces is not only determined by surfaces and light, but also by their aural architecture. (Blesser and Salter) Each room's unique configuration of surfaces and objects colours the sounds produced within the space in a unique way by acoustically amplifying frequencies whose wavelength is in a harmonic proportion to the room's geometry. Most of us have likely heard the sound of an empty room as we move into and through it. The difference between the sound of an empty house and a furnished inhabited home is dramatic and sets the tone of our dwelling.

5.3. Towards an Acoustic Epistemology

The knowledge we produce through our meaningful interactions with the environment often results in knowledge that cannot be expressed linguistically. This form of knowledge, which I refer to as supra-rational because it is not irrational or anti-rational in any way, is critical to our understanding of the world and our place within it. While we have developed language as a tool to further articulate our knowledge of the world, it too is rooted in the supra-rational sensorimotor ecological activities we create and participate in. This perceptual learning is the ground to all forms of learning: to all forms of creating knowledge and of seeking and finding meaning in the affordances of our environments, be they physical, personal, inter-personal, cultural and so on. We “cooperate with the environment in constructing beliefs at the same time as the environment is shaping what and how [we] know.” (Preston, 56) Knowledge is not a mental state so much as an activity and an interaction. It is “an ongoing process of being able to function in an environment that continually exerts its energy and forces upon [us].” (Preston, 56) Our sensorimotor engagement with the world provides us with the opportunity to discern particular kinds of structure.

The auditory modality offers particularly enveloping and resonant forms of understanding. Through auditory experience we actively produce knowledge and meaning within our particular niche in the world. The mindful ear, as a technology of the self, provides a specific form of exploratory engagement with our world. Through the auditory tools and associated practices we have developed, music and language

particularly , we have built specific niches in the environment where we have developed profound forms of perceptual knowledge alongside rational and logocentric forms. While language is an important tool for understanding and communicating, according to Gibson, “words...are severely limited relative to the breadth and complexity of what is actually picked up from the ambient array.” (63) Language is one tool among many which allow us to interact with the world, but it is not the sole locus of knowledge. As Edelman states simply: “thought can occur in the absence of language.” (153)

Perception is an exploratory activity motivated by our interests and our desire to thrive. It is through our sensory experience that we explore the world around us. To paraphrase Reed by moving into the auditory register we can say that our ears do not listen for pressure variations in air, but rather they hunt for “informative structure” in the sounds we listen to. (105) We begin learning how to use our sensory tools in the prenatal and neonatal stages of our lives and continue improving on our sensory abilities throughout life. Perceptual learning is a technology of the self in that it is “the increasing refinement of functional exploratory activity.” (Reed, 105) Along with all of our sensory modalities, auditory experience provides important and unique tools for exploring our world.

5.4. Performing Knowledge

Reed, referring to Gregory Bateson, speaks of activities and their attendant technologies as providing ‘interaction frames’ for reorganizing attention. (Reed, 163-5) All technologies have particular ways of reorganizing our attention. Technologies of the self, such as the mindful ear, provide specific interaction frames for our activities. We may speak of the interaction frame of the mindful ear as providing ways of understanding the world we live in: our places, our selves, our friends and colleagues and so on. This is where sonic relationships provide meaningful interactions with the places within which we dwell. We develop understanding of our position in space and our relationship to others. We hear and feel how we are situated by locating the sound of events, by discerning their rhythms, and by producing sounds and rhythms in response and to invoke response.

Material tools and instruments also offer opportunities for reorganizing our attention. We have seen how the complex nexus of agencies involved in the musician-musical instrument interaction produce disciplinary regimes. These agencies impose a specific range of movements and forms of material engagement for the creation of music. The materiality of the instrument extends our cognitive abilities and activities: the boundary of our selves comes under scrutiny.

In generating meaning and knowledge from information we gather from the environment we are engaged in a transductive process, as we have understood through examination of our technological and prosthetic practices. Auditory experience is both literally and figuratively transductive. The inner ear literally transduces mechanical energy, the waves in the cochlear fluid of the inner ear, into electro-chemical impulses in the nervous system. One form of energy is transformed into another. Metaphorically this transductive process continues through the emergence of concepts, beliefs, and desires through our listening and soundmaking activities. Simultaneously our mindful ear transduces our concepts, beliefs, desires and so on, into the soundings of language and music.

Transduction implies interfaces. In the case of the ear the transductive interface is comprised of the mechanisms of the inner ear where mechanical energy is transformed into electro-chemical energy. Interfaces exist on many scales, especially when we consider transduction in the broader definition I suggest. These interfaces are technological ones. The technologies of our material bodies, but also found and built technologies. As the extended cognition movement suggests, our technologies are extensions of our selves. The boundary between our physical bodies and the technologies that we create and engage with is somewhat arbitrary and certainly fluid. Adrian Mackenzie in his book *Transductions: Bodies and Machines at Speed*, states clearly that “technologies are not a domain exterior to human bodies, but are constitutively involved in the ‘bodying-forth’ of limits and differences.” (52) N. Catherine Hayle, a theorist of the ‘posthuman’ condition says that “the posthuman view thinks of the body as the original prosthesis.” (Smith and Morra, 7) Finally, Bernard Stiegler, possibly the person who has most thoroughly studied and developed the notion of the prosthetic, states that “the prosthesis is not a mere extension of the human body; it is the constitution of this body, *qua* ‘human’...it is not a ‘means’ for the human but its end.”

(153) The boundaries between the human and non-human may not be as distinct as we may have thought.

We have always already been prosthetic. Our musical instruments are prosthetic devices. We incorporate their materiality into how we think and create. A musical instrument is a “cognition amplifier.” (Clark 2005, 236) It affords us the opportunity to think and create differently. As we master the instrument it is incorporated into our cognitive makeup by reshaping the brain and its body. We have co-evolved with our technologies and have developed a great diversity of ways to create and imagine music. I suggest that it is not so much our instrument technologies that are prosthetic, but rather, that our practices are prosthetic. We use our technologies to reach out further into the world, to add and augment the possibilities of our experience. These technologies are integrated into our neural makeup. Auditory experience allows us to understand the world in particular ways. We are able to explore and know our environment in its physical, social, and cultural aspects in unique ways through the auditory modality. The creation of music is a sonorous cognitive act that potently marries the exploratory with the performative. When we make music sonorously, when we sing, when we speak, we are performing knowledge.

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