Author: Çamci, Anil
Title: The cognitive continuum of electronic music
Issue Date: 2014-12-03

CHAPTER 4

GESTURE/EVENT MODEL

EVENTS IN THE ENVIRONMENT

In the previous chapter, I have discussed *why* meaning is communicated in electronic music. In this chapter, I will investigate *how* it is communicated and will do so by describing a model which unites several of the concepts discussed so far. The emergence of this model will be grounded in human cognition, and supported by experimental data. The model will delineate the parallels between how we experience electronic music and how we make sense of environmental sounds.

Also in the previous chapter, I have identified "survival" as the first and foremost function of the human auditory system. This had significant implications in terms of how audiences deal with the material introduced into music via the electronic medium. I have described that our everyday auditory experiences constitute a frame of reference for our future encounters with not only environmental sounds but also electronic music. I will now offer a closer look at the characteristics of the mechanisms underlying our everyday hearing.

Environmental Sounds

First, I will cite a seminal description of environmental sounds by Nancy J. VanDerveer: An environmental sound (a) is produced by real events, (b) has meaning by virtue of causal events, (c) is more complicated than laboratory-generated sounds such as pure tones and (d) is not part of a communication system such as speech (paraphrased in Ballas and Howard 1987: 97).

This comprehensive definition offers points of varying significance for the current discussion. The first two items, which I will further elaborate on shortly, are particularly central to the model described in this chapter. The structural complexity of environmental sounds, mentioned in the third item, is paralleled by the sounds in electronic music. This has been acknowledged in the previous chapter when I emphasized the *complexity of listening* pertinent to the electronic music experience. Furthermore, the shift in interest from perceptual studies relying on elementary sounds towards cognitive studies on complex everyday sounds have only progressed since VanDerveer proposed this definition in 1979. The last item in this definition serves not to strip environmental sounds of their communicative capacities, but to abstract sounds that are in physical and causal relationship with environmental events from sounds that are intentionally produced for purposes of communication. While Ballas and Howard's prime example for this abstraction appears to be "speech", this very item also separates music from environmental sounds.

I corroborate VanDerveer's definition on all accounts. However, certain aspects of it demand further inspection on my part. Going back to the first two items in this definition, environmental sounds are described to have "real events as their source" and are "meaningful, in the sense that they specify events in the environment" (VanDerveer 1979: 17). This characterization can be reduced to core concepts such as events, sources, meaningfulness and environments. I have already touched upon some of these in the previous chapter. However, the concept of event is of particular significance in discussing the meaningfulness of sounds. I will now offer a closer look at this concept, followed by an overview of various perceptual models addressing how we experience our *eventful* environments.

Event

Our experiences with physical objects provide us with a variety of ontological metaphors to view events as self-contained entities (Lakoff and Johnson 2003: 26). The term "event" represents the unit with which we make sense of our immediate surroundings. The sun rises, the traffic light turns red, the water boils and the clock ticks. Multimodal stimuli originating from events are picked up by our sensory mechanisms and are processed by our cognitive systems. "Sensations of one modality can be combined with those of another in accordance with the laws of association" (Gibson 1986: 245). One component of these multimodal stimuli is sound. When an event occurs in our immediate surroundings, it emits an environmental sound, given that the physical unfolding of this event entails it.

Cognitive representations of acoustic phenomena are therefore multimodal (auditory as well as visual, kinesthetic, vestibular etc.) (Dubois et al. 2006: 869). In the logician Charles Sanders Peirce's model of semiosis, there are three types of relationship between perceived forms and the meaning which these forms signify. *Symbols* establish an arbitrary relationship between the form and the communicated content; *icons* are based on the similarity between the two and the *indexes* indicate a causality between the sign and the signified (Jekosch 2005: 193).

> Treating the object of perception as a sign carrier leads to associations, to denotations, connotations and interpretations, i.e. to the assignment of meaning. The object is processed as a sign, semiosis occurs and something is communicated. (200)

Environmental sounds are in an indexical relationship with events. An event, in its simplest form, is "a thing that takes place" (Oxford Dictionary of English) and "a sound is news that something's happening" (Jenkins 1985: 117). Therefore, environmental sounds are "processed and categorized as meaningful events providing relevant information about the environment" (Guastavino 2007: 54).

This implies that, in daily life, we listen to events rather than sounds themselves (Gaver 1993: 285). This idea is evidenced in several cognitive studies: Marcell et al., who conducted an experiment on confrontation naming of environmental sounds, stated that sounds in our daily environments "convey action and movement-related information" (2000: 833). In another experiment-based study on the categorization of everyday auditory events, Dubois et al. similarly found that, besides the few acousticians who took part in the experiment, a great portion of the participants classified sounds based on either source or action characteristics (2006: 867). That is to say, event-related meaning (i.e. semantic features) of a sound subdues its physical attributes (Guastavino 2007: 60). This is because the human perception is geared towards processing beyond acoustic patterns and recognizing events (Ballas and Howard 1987: 97).

Such reports portray an intrinsic relationship between environmental sounds and events on the basis of source and action properties. Several other experiment-based studies delineate these properties as the most salient features used by people when describing everyday sounds (Brazil et al. 2009: 2; Gygi et al. 2007: 853). Action, in this context, is the process which an object is going through (e.g. shattering is the action a glass can go through). While certain studies demarcate *source* as an object-action compound, others declare only the object as such and allocate a separate category for actions. As I mentioned in Chapter 2, my experimental method follows the latter, as I intend to draw a distinction between objects, actions and concepts as sources.

Models of Experience

Physically dissimilar sounds produced by the same type of events are perceived to be more analogous to each other than any sounds produced by different events; this perceived uniformity amongst different sounds from similar sources helps listeners develop "mental models of sound-producing events" (Gygi et al. 2007: 849). These mental models, or memorized experiences of acoustic phenomena (Dubois et al. 2006: 869), can be likened to the psychologist Lawrence W. Barsalou's concept of *perceptual symbols*:

> Once a perceptual state arises, a subset of it is extracted via selective attention and stored permanently in long-term memory. On later retrievals, this perceptual memory can function symbolically, standing for referents in the world, and entering into symbol manipulation. As collections of perceptual symbols develop, they constitute the representations that underlie cognition. (1999: 577)

Perceptual symbols can emerge in all modalities of experience including vision, audition, smell, taste, touch, action, emotion and introspection (Pecher et al. 2003: 120). The cognitive scientist Nigel Thomas attests that Barsalou's theory of perceptual symbols is conceived fairly close to the concept of *mental imagery* on the premise that such symbols are immediate causes of imagery experience. Thomas describes mental imagery as a quasi-perceptual reconstruction of a past perceptual experience in the absence of an external stimuli (Thomas 2010).

A similar model had been described by the developmental psychologist Jean Piaget: Various performances of the perceptual system become integrated and abstracted into systems of experience called *schemas*, which "provide techniques to process objects of perception as signs" (Jekosch 2005: 200).

Although rooted in different research perspectives, namely auditory perception, cognitive science and psychology, such models are intended to describe how we navigate our daily lives. We experience the environment in terms of events and we store multimodal representations of these experiences; upon an encounter with a new event, we assimilate and accommodate "non-fitting data of perception" (204) and relate them to a previous experience of a similar event in an attempt to satisfy our innate mechanisms of anticipation. This helps explain why listeners are able to identify real-world referents to sounds that are not only synthesized, but are synthesized without a poietic goal of instigating such references.

The composer Barry Truax's concept of *earwitness accounts* similarly attempts to address the mediation of the *now* through memory processes but does so from an *acoustic communication* perspective. Acoustic communication investigates the relationship between the sound, the listener and the environment by regarding them as parts of a system rather than as isolated entities (Truax 1984: xxi). Studies in this field focus on the reciprocal relationship between an acoustic environment and its inhabitants (Çamcı and Erkan 2013: 20). Research in acoustic communication therefore assumes an *ecological approach*, which has been described by Gaver as relying on patterns of information grounded in sources and environments, unlike "typical research" that focus on primitive components of sounds such as loudness and frequency (1993a: 5). Truax dichotomizes these research perspectives as the *energy transfer model* and the *communicational model*. While the former deals with sound as a physical phenomenon in isolation, the latter investigates the exchange of information and the cognitive processes which underlie this exchange (Truax 1984: 3, 9).

> Instead of thinking of sound as coming from the environment to the listener and perhaps being generated back again, we will think of it as mediating, or creating relationships, between listener and environment. (11)

This proposal, which is aimed at describing our relationship with acoustic environments, is particularly congruent with Nattiez's esthesis-poiesis model described in Chapter 3. It should be kept in mind that the esthesis-poiesis model was proposed to explain the communication between the composer and the listener, rather than the listener and the environment. These two approaches converge, however, when the trace of a composer's poietic activity is considered a spatiotemporal artifact to be experienced by the listener, much like an environment. I will further elaborate on this interplay in the next chapter.

Another approach to perception commonly facilitated in musical research (Östersjö 2008; Windsor 1995; Nussbaum 2007) is the model of *affordances* developed by the psychologist James Gibson. Gibson's studies on ecological perception stemmed from his experiments in aviation during the Second World War. Focusing mainly on an active observer's perception of its environment, Gibson postulated that invariant features of visual space represent the pivotal information for perception. Invariants are features of an object which persist as the point of observation changes (Gibson 1986: 310). While most items in Gibson's list of invariants pertain to the visual domain, his concept of *affordances* has been applied to other modalities of perception including hearing.

According to Gibson, objects in an environment, by virtue of their invariant features, afford action possibilities relative to the perceiving organism. For instance, a terrestrial surface, given that it is flat, rigid and sufficiently extended, affords for a human being the possibility to walk on it (Gibson 1986: 127). His main motivation to propose this seemingly straightforward idea is to refute the prevailing models of perception which assume that ecological stimuli are chaotic and therefore that the perceiver extracts meaning out of sensory input by imposing mental structures upon disorganized information. Gibson suggests that there are certain kinds of structured information available prior to perception in the form of invariants. The nature of these invariants is relative to the complexity of the perceiving animal (Gibson 1966: 73) and an object will have different affordances for different perceivers: a stone, on account of its physical characteristics, affords the action possibility of *throwing* for a human being, while at the same time affording the action possibility of *climbing* for an ant.

One of the criticisms of Gibson's model is associated with his demarcation of the roles of learning and memory in ecological perception. In his review of Gibson's seminal book, *The Ecological Approach to Visual Perception* (originally published in 1979), the psychologist Bruce Goldstein writes:

> Learning must occur before the information in the light can indicate what something affords, but [Gibson] mentions learning only briefly at the end of the [eighth] chapter when he states that 'affordances ... are usually perceivable directly, without an excessive amount of learning'. What is missing here is the amplification of this statement. Learning must be involved in a person's understanding of the meanings of objects, and this involvement deserves more discussion than Gibson gives it. (Goldstein 1981: 193).

This criticism, I believe, is directed mainly towards Gibson's epistemological stance: Gibson proposes the idea of *perceptual knowing* to challenge the dichotomy between perception and cognition, which at the time was prevalent in the field of psychology. Relying on the concept of invariants, Gibson suggests that "perceptual seeing is an awareness of persisting structure" (Gibson 1986: 258) and knowledge is in the environment to be picked up. Although Goldstein argues otherwise, the role of learning is patently brought into discourse, not only in Gibson's 1979 book, but also in his writings prior to that. He deems it unquestionable that an infant has to learn to perceive, and that he does so by exploring the environment with all of his organs, "extending and refining his dimensions of sensitivity" (Gibson 1963: 15; Gibson 1966: 51, 285). The perceptual system matures with learning and therefore the information it picks up becomes more elaborate and precise as life goes on (Gibson 1986: 245).

> Knowledge of the environment, surely, develops as perception develops, extends as the observers travel, gets finer as they learn to scrutinize, gets longer as they apprehend more events, gets fuller as they see more objects, and gets richer as they notice more affordances. Knowledge of this sort does not "come from" anywhere; it is got by looking, along with listening, feeling, smelling, and tasting. (Gibson 1986: 253)

When viewed in the light of modern experimental studies on perception, I consider Gibson's proposal of *perceptual knowing* as an addition to, rather than a replacement for, the existing models of learning that are based on memory processes. This sentiment is clearly materialized in Gibson's writing as well when he states: "To perceive the environment and to conceive it are different in degree but not in kind. One is continuous with the other." (258) The ecological approach addresses certain stages of our perceptual experience and complements higher-level mental processes. In that respect, Gibson's model of invariants aligns with the previously described models of experience, such as perceptual symbols and schemas. This is evidenced by the role of invariants in such models:

> Given repeated encounters with a set of objects that share certain features, birds for example, the neural units responding to the most invariant features (e.g., feathers and beaks) will grow into a highly interconnected functional unit, whereas the more variable features (e.g., color, size) will be excluded from the set of core elements (…) An assembly of neurons that forms in this fashion will exhibit many of the properties Barsalou attributes to perceptual symbols. It will be schematic, in that it represents only a subset of the features that any actual object manifests at any given time. It subserves categorization, in that the same assembly responds to varying instances of some class of objects that have features in common. It is inherently perceptual, dynamic, and can participate in reflective thought. (Schwartz et al. 1999: 632)

The complementary roles of perceptual and conceptual knowledge can be extrapolated to evolutionary processes on a grander scale. As organisms physiologically adapt to their environments, this adaptation in return informs their behavior relating to perceptual knowing. As Huron states, the *stable* features of an environment are instrumental in the formation of innate behavior over generations (Huron 2006: 61). However, behavior towards the rapidly changing characteristics of an environment needs to be learned. Although *instinctual knowledge* may appear to contrast the idea of pre-structured perceptual knowledge, it should be noted that in Gibson's model, the role of the nervous system in registering the differences between invariants is not ignored (1966: 284).

In the context of my research, affordances relate to physiological determinants of music cognition as discussed in Chapter 3. Perceptual knowing is tightly coupled with evolutionary traits which were described in Section 1 of that chapter as pertaining to low-level characteristics of sound. For this purpose, I find the concept of affordances useful when discussing features of electronic music that are corporeally relevant for the listener. For instance reverberation affords a relative sense of space while low frequency gestures afford an awareness of large entities. I will offer further examples of affordances in the following chapter when I discuss the physical dimensions of electronic music, and the *virtual* action possibilities they afford.

GESTURES IN ELECTRONIC MUSIC

Building up on the models through which we experience reality and the events contained within, I will now offer a look at the experience of electronic music. As Lakoff and Johnson states: "Human purposes typically require us to impose artificial boundaries that make physical phenomena discrete just as we are: entities bounded by a surface" (2003: 26). When the human mind is processing information, it looks for hierarchies and structural units to form systematic organizations (Özcan 2007: 198). We utilize these units to navigate through the progression of our experiences. This is valid whether we are walking down the street or watching a movie. Events, as discussed above, function as these units within everyday settings, by virtue of their meaningfulness: we make sense of and describe what transpires around us in terms of events.

Naturally, the tendency to extract events of unitary functions applies to our experience of electronic music as well. To denote the particular structures of electronic music scrutinized in this book, I propose the word *gesture*. Granted, the word is somewhat saturated with definitions from various fields of study ranging from psychology to human-computer interaction. But as I relate it to the functional characteristic of our cognitive systems discussed so far, it will become clear how such divergent perspectives contribute to a consolidated understanding of the concept of *gesture* as a unitary structure in electronic music.

From the *Oxford Dictionary of English*:

> ***gesture***
> noun
>
> a movement of part of the body, especially a hand or the head, to express an idea or meaning: *Alex made a gesture of apology*; mass noun: *so much is conveyed by gesture.*
> - an action performed to convey a feeling or intention: *Maggie was touched by the kind gesture*; *a gesture of goodwill*.
> - an action performed for show in the knowledge that it will have no effect: *I hope the amendment will not be just a gesture*.

As seen above, the conventional usage of the word *gesture* is mostly related to bodily movements. But, yet another time, the dictionary definition of the word includes concepts that are intrinsic to my interpretation of it, such as "meaning", "action", "conveyance" and "intention". Amongst these, *intention* is fundamental to my motivation to differentiate between gestures and events within the theoretical framework of this book. As in VanDerveer's definition, environmental sounds, which are meaningful in the sense that they denote events, are not part of a communicational system. Environmental sounds causally emanate from events.

Sounds in electronic music, although being similarly communicative of meaning, are designed. These qualities indicate an *intentionality* inherent to social systems of communication (Leydesdorff 2008: 1). I have stated in the previous chapter that a composer's concept does not necessarily have to match the listener's percept. This principle implicitly extends to the concept of intentionality in music (Jensenius 2007: 41). While I propose gesture due its implication of intentionality, not every unit recognized by the listener will have been guided by the composer's purposeful design. Nevertheless, once a unit is recognized (i.e. once an event is identified), intentionality will be associated with it.

> [A] gesture is a movement or change in state that becomes marked as significant by an agent. This is to say that for movement or sound to be(come) gesture, it must be taken intentionally by an interpreter, who may or may not be involved in the actual sound production of a performance, in such a manner as to donate it with the trappings of human significance. (Gritten and King 2006: xx)

Meaning in environmental sounds has been experimentally described to be grounded in actions and causalities in the real world. Gesture is similarly rooted in physical movement but is not the self-evident outcome of an event in the way environmental sounds are. The composer Fernando Iazzetta describes gesture as a movement, but one that can *express* and embody a special meaning (2000: 260). An abstraction of this concept is *musical gesture*, which specify movements in both sound and body (Leman 2012: 6).

> Musical gesture is biologically and culturally grounded in communicative human movement. Gesture draws upon the close interaction (and intermodality) of a range of human perceptual and motor systems to synthesize the energetic shaping of motion through time into significant events with unique expressive force. (Hatten 2003)

As a precursor to this description, the music theorist Robert S. Hatten defines *human gesture* as "any energetic shaping through time that may be interpreted as significant" (2006: 1). The significance of such a shaping lies in its ability to convey an affectively loaded communicative meaning (1, 3). Our interpretation of a gesture relies on the cognition of not merely an object, but of an event, whose movement displays a functional coherence with "the gestalt perception of *temporal continuity*" (2).

The composer Wilson Coker offers a converging view when he describes gesture as "a recognizable formal unit" that signifies musical or non-musical objects, events and actions (1972: 18). A similar delineation of a discernible unitary musical structure is apparent in Stockhausen's proposal of the concept of *moment form*. Stockhausen describes a *moment* as a formal unit which is recognizable by an unmistakable character (1963: 200). These approaches, as I view them, put the emphasis on the act of listening, whether on the composer's or the listener's part. When preparing material for an experiment on auditory perception, Marcell et al. designated sample durations based on the natural progression of sound events; a choice which they deem to be "artistic" (2000: 834). Our knowledge of the natural unfolding of a sound is gained through our exposure to daily sonic environments. The recognition of a unit, therefore is based on our pre-existing expectations on how a sound should start, evolve and end. Given the amalgamation of musical languages described in the previous chapter, it is the composer's decision to abide by, evade or warp these expectations.

François Delalande's gestural taxonomy (quoted in Iazzetta 2000: 262) includes *geste effecteur* (effective gesture) and *geste accompagnateur* (accompanying gesture) which are corporeal manifestations of a gesture. A third category, *geste figuré* (figurative gesture), indicates a metaphorical use of the term. Iazzetta relates Delalande's third category to the musicologist Bernadette Zagonel's conception of *mental gestures*. Mental gestures are products of inner hearing, and are inherent to listening and composition processes as models of experience stored in memory (Iazzetta 2000: 262).

In his analysis of gesture in contemporary music, the composer Edson Zampronha criticizes the procedures adopted during the early years of electronic music for facilitating "non-motivated combination[s] of parameters" (2005). In the same article, he goes on to assert that by the 1980s, gesture was being considered as a replacement to such procedures in dealing with the compositional panorama of contemporary music. Zampronha retrospectively describes this tendency towards gestural composition as an endeavor to "ground music in nature" by taking references and signification into account, and considering gestures as movements of sound entities. He describes gesture as a musical unit of delimited configuration in which parameters are treated interdependently. Although he does not state this explicitly, Zampronha contrasts parameter-based and gestalt perspectives towards music. The *action* segment of the poietic process might deal with parametric morphologies, but the perceived interplay between parameters will induce event gestalts. As Stockhausen states, individual properties of sound, such as timbre, pitch, intensity and duration, may have been dealt with by the composer separately, but "we perceive a sound-event as a homogeneous phenomenon rather than as a composite of four separate properties" (Stockhausen 1962: 40). According to Hatten, musical gestures are "emergent gestalts that convey affective motion, emotion, and agency by fusing otherwise separate elements into continuities of shape and force" (2003).

By consolidating this plethora of perspectives regarding gesture, I arrive at a unified understanding of this concept in relation to electronic music. This understanding is directly informed by poietic insights gained from my artistic practice as well as the esthesic reports obtained from the listening experiments. Paramount to this understanding is that gestures represent events: the way our cognitive faculties deal with a daily environment is not intrinsically different from how we navigate a piece of music. Therefore, ***a gesture in electronic music***,

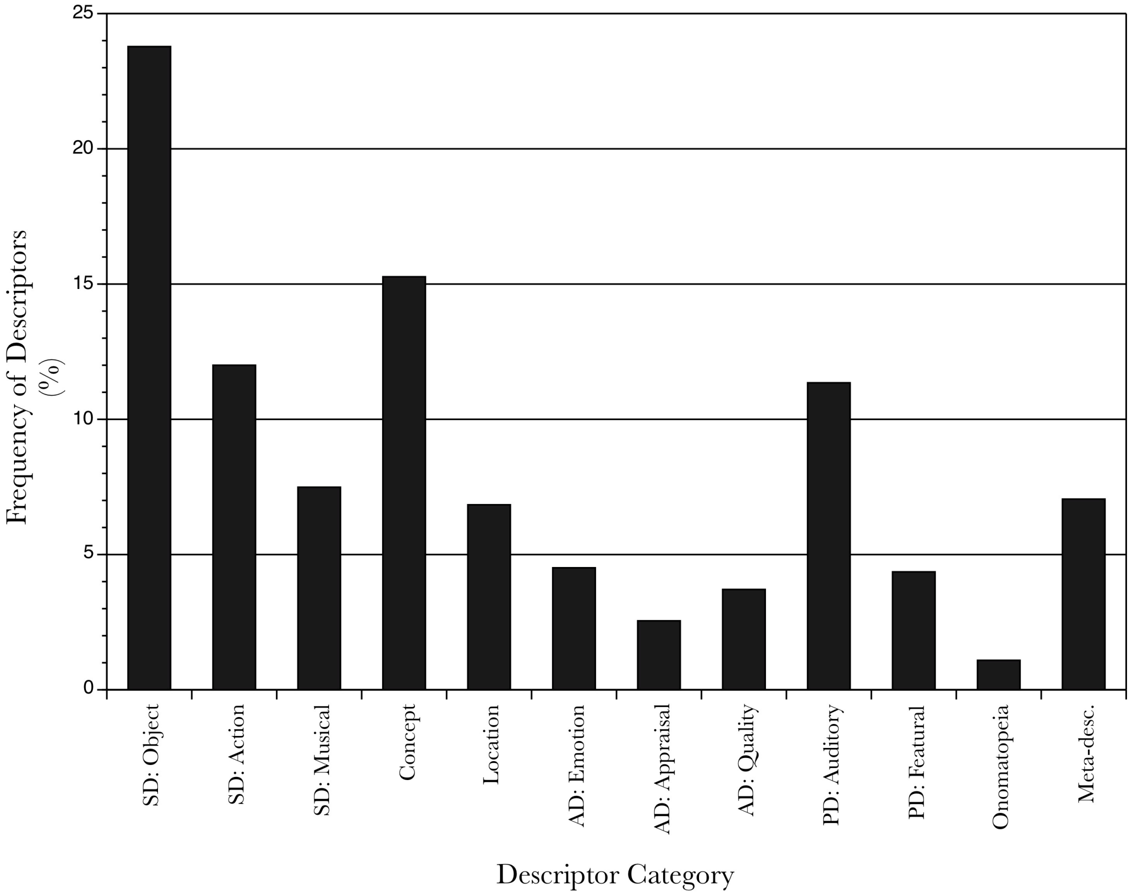
1. ***communicates meaning***,

> An object of any kind takes on meaning for an individual apprehending that object, as soon as that individual places the object in relation to areas of his lived experience—that is, in relation to a collection of other objects that belong to his or her experience of the world. (Nattiez 1990: 9)

From a poietic point of view, I, as a composer, may intend to design gestures which contribute to the narrative I would like to communicate in a piece. The meaning of a gesture can be abstract; the gesture can be intended to incite an emotion or a perceptual awareness. This meaning can also be representational. Then its purpose, as I conceive it, would be to trigger mental representations. From an esthesic point of view, my intentions, except in so far as they concern me as the listener, are irrelevant. But the gesture will instigate a semantic play regardless of these intentions. This communicated meaning is mediated by our past experiences and triggers cross-modal interactions. Although the composer and the listener meets in an absence of multimodal cues that could simplify the negotiation between the concept and the percept, sounds nevertheless induce event-related information (i.e. percepts) in multiple modalities (Warren et al. 1987: 326).

In an experiment conducted by Guastavino on the categorization of environmental sounds, participants often used the source of a sound as a metonym to describe a *sound event* (2007: 55). In another experiment, Dubois et al. similarly found that either source or action descriptors were used by separate participants to classify the same acoustic phenomenon (2006: 867). This behavior was apparent amongst the participants of my experiment as well. For instance in *Birdfish*, the same gesture was described as "water" and "boiling" by different participants. In another example, the descriptors "fly by" and "bird wings" were used by separate participants to denote the same gesture.

In a yet another experiment on environmental sound categorization, Marcell et al. produced a list of 27 labels based on the descriptors provided by the participants (2000: 830). These labels were primarily based on object types, followed by event types and finally on the location or the context within which the event is heard. Descriptors pertaining to the perceptual qualities of sounds were not consistent enough to warrant a separate label (Gygi et al. 2007: 840). In the experiments I conducted, a similar categorical disposition is observable in Graph 4.1.



Graph 4.1: Overall categorical distribution of real-time descriptors

Obviously electronic music and environmental sounds do not warrant a one-to-one comparison. This is particularly clear from the salience of the *concept descriptors*. Furthermore, perceptual descriptors (PD) are also relatively prominent. However, the source (SD) and location descriptors combined constitute an overwhelming majority. Such a distribution can be attributed to the survival function of auditory perception. A sound signifies, and that is the principal utility of a sound. Here, Meyer's distinction between designative and embodied meanings, briefly touched upon in the previous chapter, are of further relevance:

> A stimulus may indicate events or consequences which are different from itself in kind, as when a word designates or points to an object or action which is not itself a word. Or a stimulus may indicate or imply events or consequences which are of the same kind as the stimulus itself, as when a dim light on the eastern horizon heralds the coming of the day. Here both antecedent stimulus and the consequent event are natural phenomena. The former type of meaning may be called designative, the latter embodied. (Meyer 1956: 35)

Applying these two types of musical meaning to the continual association between events and electronic music, I propose a diagram of a relationship between the two:

Electronic music —*embodied meaning*—> Environmental sound —*designative meaning*—> Event

The electronic music gesture and the environmental sound are of the same modality. As discussed in the previous chapter, both representational and abstract sounds of electronic music rely on our knowledge of environmental sounds. The spectromorphological (Smalley 1997) unfolding of a gesture can be in an embodied relationship with an environmental sound. An environmental sound, on the other hand, communicates a designative meaning pertaining to an event and cannot exist as a disembodied phenomenon stripped of its causality. The sound of a bouncing ball points to an object which is not itself a sound. The semantic relationship between an electronic music gesture and an environmental event can be severed by obfuscating the embodied meaning between the gesture and environmental sounds.

2. ***serves a unitary function***,

> The flow of abstract empty time, however useful this concept may be to the physicist, has no reality for an animal. We perceive not time but processes, changes, sequences, or so I shall assume. (Gibson 1986: 12)

Gibson conceives event as the timescale of the environment. Gestures can accordingly be considered the scale at which a piece of electronic music *ticks*. Gestures are cognitive units through which we make sense of our experience of electronic music. We segment the auditory stream into self-contained structural units. This self-containment can be determined by perceptual qualities: in *Birdfish* and *Diegese*, I have utilized low frequency pulses as gestures that articulate motivic changes. Examples of these are heard at 2'45" in *Birdfish* and 1'29" in *Diegese*. These moments were marked by separate participants with perceptual descriptors such as "bass", "voluminous bass", "fat bass" and "sub".

But more significantly, the meaning of a gesture, as discussed above, can assume a pivotal role in shaping a unit. In *Christmas 2013*, a gesture of low frequency rumbling, which lasts from 0'47" to 0'54", was particularized with such descriptors as "thunder", "storm", "storm coming", "something is going to happen" and "expectation" by different participants. In terms of temporal and spectral qualities, this gesture is highly similar with the two instances mentioned in the previous paragraph. The reverberant characteristics and the amplitude envelope of this gesture charge it with semantic traits.

Another factor contributing to this sort of differentiation is a gesture's relevance to the remainder of the piece. In other words, a unitary function can also emerge from contextual meaning[16]. All of the descriptors mentioned above were submitted before the 7-second unfolding of the said gesture was completed. In other words, the sound was regarded as a self-contained element prior to the revelation of its boundaries. The anticipatory nature of some of the descriptors conforms to this semantic endowment of a unitary role. The same gesture repeats from 1'08" to 1'17" before it blends into the background as shorter duration gestures take stage. However, the first 7-second segment of this iteration is almost identical to the previous one. Interestingly, the participants who submitted the previous descriptors did not repeat their impressions. This unanimous behavior can be linked to the fact that, by this time in the piece, these participants have already encountered this gesture and witnessed how it resolved. Two participants who were not amongst those who submitted the aforementioned descriptors referred to this gesture as "rumble'.

Last but not least, gesture exhibits an inter-disciplinary analytical value as a unit, largely due to its myriad adaptations across various fields of study. In my experiences of teaching the composition and analysis of electronic music, gesture has been received by students from a large variety of backgrounds as an intuitive phrase in articulating the discernible and unitary qualities of a sound.

3. ***reveals causality***,

A gesture is a temporal unfolding in itself. Moreover, a multitude of gestures can mark the temporal unfolding of a higher-level form while serving their unitary functions as events. The brain constructs narratives out of one's experience of the world (Roads [forthcoming]). We make sense of the passage of time through the coherent relationships between the events we observe. In Roads' dramaturgical model of sonic behavior, a gesture in electronic music can be thought of as performing three activities: entering, acting and exiting (10). In his further elaboration of this model, he describes that in *acting*, a sound can stay the same, mutate (change in some way), transmutate (become something else, change identity) or "interact with other sounds, form harmonies, consonances, or contrasts/clashes" (10). The latter behavior reveals causal relationships between gestures:

> Interactions between different sounds suggest causalities, as if one sound spawned, triggered, crashed into, bonded with, or dissolved into another sound. Thus the introduction of every new sound contributes to the unfolding of a musical narrative. (Roads 2004 quoted in Roads [forthcoming])

Causalities in electronic music can be abstract or concrete in nature. An abstract causality is the outcome of an arbitrary relationship defined conceptually or by convention. Between 3'07" and 3'24" marks in *Element Yon*, the second of the four concluding *elements* display a harmonic progression resolving to a pitch about 25 cents below B2. While the progression towards this root is particularly apparent between 3'17" and 3'20", the resolving gesture is spatially distinct from this progression in an almost disembodied fashion.

[16] In the next chapter, I will revisit contextual meanings when discussing the concept of semantic coherence.

Concrete causalities become apparent when a sound object imitates the motion trajectory of a physical object. Causal relationships between sound objects, and particularly the adherence of abstract sound elements to a physical law have been of particular interest to me while composing some of the pieces associated with this research. Most particularly, the first movement of my piece *Hajime* from 2009 is a demonstration of what I have previously referred to as a *sonic Rube Goldberg machine*. Sound objects extracted from a sound recording of my voice are subjected to processes of granulation, pitch-shifting, time-stretching and micro-montage. While designing each consecutive gesture, I relied on the behavior of the previous one. For instance a grain repeating at gradually expanding durations with its pitch shifting down in each iteration implies a bouncing object that is slowing down to a halt. When it finally reaches its destination, it contacts another object and starts a new motion trajectory. Imitating the chain reactions of a Rube Goldberg machine, I composed a choreography of sonic causalities. This metaphor of causal juxtapositions was also applied to the first movement of my 2010 piece *Shadowbands*.

4. ***operates at various time scales***,

Gestures can range from the briefest sound one can hear to the longest sound one can discern as having a form. This quality of gestures is also shared by environmental sounds: both the sound of a drill working throughout the day and the sound of a buzzer going off once represent singular events. Regardless of their temporal extent, we are able to discern them as self-contained phenomena. As Gibson states, ecological events can be "nested within longer events" and they "do not flow evenly in the manner of Newton's "absolute mathematical time"" (Gibson 1986: 110).

A background gesture in the second movement of my piece *Shadowbands* begins at 1'37" and lasts for 25 seconds, which is almost one sixth of the entire duration of the piece. This is in stark contrast with the gestures from the first movement, most of which operate at sub-second time scales. As described in Chapter 1, this particular gesture, and the other gestures of extended periodicity accompanying it, are intended to reveal harmonic relations as a metaphor of order.

This is one of the qualities of the electronic music gesture which differentiate it from a gesture in instrumental music on a practical basis. In electronic music, gesture is decoupled from duration (Barrett 2012; personal communication). The electronic medium allows for a composer's gestures to extend beyond and contract below what is humanly possible. I can stretch or compress a gesture temporally to produce new gestures. I can also infinitely duplicate it. By enforcing a rhythmic grid to the timeline of a composition, I can achieve a superhuman precision in periodicity. Furthermore, by means of this grid, I can *snap* gestures of varying durations to each other and maintain exact synchronicity or proportional metric relations between these gestures.

5. ***coexists with other gestures***,

Just as we are able to separate simultaneous events transpiring in our immediate environments from one another, we can also make a meaningful segmentation of concurrent gestures in music. In his seminal lecture *Four Criteria of Electronic Music* presented at the Oxford Union in 1972, Stockhausen describes his third criterion, namely *multi-layered spatial composition*, as follows:

> Building spatial depth by superimposition of layers enables us to compose perspectives in sound from close up to far away, analogous to the way we compose layers of melody and harmony in the two-dimensional plane of traditional music. This is really very important, and nothing new in human experience: I mean, it happens everywhere, (Stockhausen 1989: 106)

The coexistence of gestures is inherently coupled with their ability to operate at various timescales. In *Diegese*, between 0'24" and 0"49", gestures of different timescales are layered on top of each other. This variety in timescales is crucial in articulating the figure and ground roles between gestures. In the farthest layer, an ambient texture persists throughout the entire section. Coming closer, a low frequency textural element is initiated at 0'32". This gesture, which gradually fades out, lasts for almost half the duration of the previous background gesture. In a concurrent layer, an organic gesture pulsating at granular scale establishes a third texture. Although this layer is in a closer proximity to the listener when compared to the first two layers that are submerged in reverberation, it is stripped of a figure role through an audio decorellation of the left and right channels. Lastly, in a fourth layer superimposed on the previous three, another organic gesture consisting of transient percussive components assumes an unmistakable figure role as it travels the entire spatial extent of the piece which has so far been articulated by the first three gestures. Separate participants addressed these four layers with the following descriptors respectively: "ambient", "saw" (oscillator), "bug" and "someone on the door".

In the next chapter, I will return to the coexistence of gestures in figure and ground relations when I investigate the spatial and semantic configurations in electronic music.

6. ***implies intentionality.***

Unlike environmental sounds, gestures are part of a communication system. Poietic intentionality is what separates a gesture in electronic music from an environmental sound. Furthermore, gestures arouse mental imagery. Similar to all devices of communication, mental imagery too bears intentionality "in the sense of being *of*, *about*, or *directed at* something" whether that something is real or unreal (Thomas 2010).

Actions on the part of the electronic music composer result in intentional electronic gestures. An action itself can be a single physical gesture. However, as I stated in the previous chapter, a gesture can also be a composite of numerous actions performed separately. Nevertheless, the resulting gesture will imply an intentionality. As noted before, not all gestures are the outcome of a poietic initiative, as in the case of algorithmic composition. Electronic music composition can encompass approaches that are completely devoid of narrative arcs. But the esthesic intentionality of gestures is persistent regardless of poietic intent. Referring to the work of Jean Piaget, the acoustic communication researcher Ute Jekosch points out that gestalt forms are "as much constructed by ourselves as they are given by the perceived items". In other words, a gestalt is the product of both an object and its interpretation. This understanding coincides with Molino's communication schema which situates the *trace* as an embodied artifact in the absence of a communicational hierarchy between the producer and the receiver. The act of esthesis performed by the receiver, which is in our case the listener, is imposed upon a trace of its own. The traces of poiesis left in the symbolic form are not always perceived (Nattiez 1990: 17):

> The esthesic process and the poietic process do not necessarily correspond (…) [T]he listener will project configurations upon the work that do not

> always coincide with the poietic process, and do not necessarily correspond to what Deliège happily dubbed "realized intentions". (17)

Or, in Molino's terms, the sender and the receiver do not have to come to the same understanding of the trace (Frisk and Östersjö 2006: 7). This is in agreement with Duchamp's perspective in which the artist and the viewer represent two poles of an artistic work and there does not need to be a correspondence between the artist's intention and the viewer's interpretation of the work (8). This sentiment, which can be applied to any form of artistic experience, is valid for electronic music as well. The composer's conception of a musical work, in terms of goals and techniques, will not necessarily translate to what is perceived by the listener (Smalley 1997: 107).

What embodies a gesture in the trace is intentionality. A gesture can originate in both the poiesis and the esthesis. Imposing a perceptual or a semantic unitary function to the physical artifact that is the trace, the listener extracts an intentional gesture. Conflicts of intentionality between the poietic and the esthesic are impossible to avoid: the perceived (or esthesic) intentionality will result in gestural hierarchies which may or may not serve the narrative goals of the composer; but they will nevertheless be obedient to the listener's construction of a narrative. But a translation of intentionality is also possible. Here is a general impression response from the preliminary studies conducted with the previous version of *Birdfish*:

> The sounds heard and experienced by a baby in its mother's womb prior to birth, and its eventual coming to earth.

In terms of its actors and context, this description is in strong disagreement with the narrative I was trying to communicate with the piece. However, there is an uncanny congruence between metaphors: my piece, at least the way I conceived it, narrates a story of evolution in which organic forms (i.e. fish and amphibians) transform as they travel from beneath the ocean into the sky. In this particular case, once the listener has constructed a narrative, poietic intentionality of the gestures was translated. But they nevertheless served functions similar to what I intended to communicate within my narrative arc. For instance, the reverberant gestures implying a cave and the gestures intended to create a sense of underwater were combined in a gestalt perception of a womb. Once this setting was established, the remainder of the gestures was contextualized and interpreted accordingly.

Intentionality will serve a further function in establishing the presence of the composer in the spatiotemporal universe of a piece. I will later discuss the ways in which the degree of this presence can be manipulated. This is one of the instances where the meta-descriptors submitted by the participants of my experiments will be of particular use.

In the next chapter, I will offer a narrative contextualization of gesture, and how the above characteristics operate at the semantic and the spatial layers of electronic music.