

The Body in Electronic Music Performance

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ABSTRACT

This text discusses the notions of physical presence, perception and ‘gestural’ actions as an important element of a performance practice in electronic music. After discussing the meaning of the term ‘gesture’ in music and dance, a brief overview about current trends and methods in research is presented. The skills associated with the performance of electronic instruments are compared to those acquired with traditional instruments, for other physical performing arts such as dance and in technologically mediated art forms that extend the concept of the stage. Challenges and approaches for composing and performing electronic music are addressed and finally a tentative statement is made about embodiment as a quality and category to be applied to and perceived in electronic music performance.

1. INTRODUCTION

The reflection about the physical qualities of electronic, digital, mediated non-physical instruments rarely extends beyond the domain of their manufacture and the methods of control and performance. Since the physical and perceptual aspects of a musical performance involving such instruments are difficult to categorize the main discourse remains on a technological or methodological level. Yet, as much from an audience’s as from a performer’s perspective, a large part of such a musical performance experience involves perceiving the actions and behaviors of the musical artist in the actual space.

The performance situation addressed here needs clarifying. The main elements involved may be summarized as: the performer, the interfacing device and sound processes – which I shall call ‘instrument’ for lack of a better term – the music, its structure and the audience. The performer may be the composer or merely an interpreter of the music (and not necessarily a musician). The performer may be the developer of the instrument, the composer making use of the instrument or possess no awareness of how it was made. The music may be fully dependent on the performer’s actions or present generative aspects that need little input from the outside. Finally, since the audience

shares the space and music with the performer, it needs to perceive the music and its performance simultaneously.

Once situated within this space, let us focus on the performer. As the person that acts with an instrument in the musical context, she builds the tension, carries the expressive aspects and is in charge of the execution of musical materials and temporal unfolding of the ‘piece’. With the physical presence, she represents the focal point of attention and is perceived as the source of the music. Even if a large part of the musical *agency* may be located within the instrument – apart from the actual sound generation, a digital instrument is capable of autonomously generating musical and temporal structures – both the performer and the audience will ascribe the resulting music to her physical actions and gestures. In a frontal stage situation the cultural coding is such, that the performer will always be considered as the agent that expresses intentions through music. In other scenarios this connection is less obvious and, depending on the context, may be interpreted differently.

2. GESTURES

The distinction between motion or movement, action and gesture is a central issue in this discussion. Actions are constituted by movements and executed with intentions. For movement and action to become a gesture, however, more criteria need to be fulfilled.

Based on work in language- and speech-research, the term ‘gesture’ is used to denote physical actions that accompany speech and coexist with it, carrying mental imagery alongside speech [1]. Gestures in a purely linguistic context are involuntary speech accompanying motions, but are also regarded as “symbols that exhibit meanings in their own right” [2]:105. Gallagher states that: “Although speech and gesture depend on movement as a necessary condition, they nonetheless *transcend* motility and move us into a semantic space that is also a pragmatic, intersubjective, intercorporeal space. ... Although ... the body ‘lends itself’ to gesture, gesture is never a mere motor phenomenon; it draws the body into psychological and communicative orders defined by their own pragmatic rules” [3]:122-127.

Once the concept of gesture is applied outside of the domain of language in the abstract realm of music, however, it becomes necessary to clarify which aspects of gesture and movement are being discussed. It is possible to simply “define musical gesture as an action pattern that pro-

duces music, is encoded in music or is made in response to music” [4]:19. However, this ignores the semantic components that gestures inevitably carry. “The term gesture does not refer to body movement or expression per se, but rather to the intended or perceived meaning of the movement” [4]:15. In music performance, gestures carry intention and expression without a necessarily semiotic component [5].

Historically, analysis of musical forms has dealt with gestures in a metaphorical sense [6]:19, [7]:86, schemata from the physical world are transferred to the symbolic domain of music notation. These schemata are conceived as “significant energetic shaping through time” and are considered to take place within music [8]:95. By applying the concept of gesture at a symbolic musical level, a quasi-linguistic approach of segmentation and construction of semantic units takes place [9].

2.1 Music Performance

When looking at music performance in general, however, the strict dissociation between motion – the purely physical properties – and movement – the qualities of motions – on the one hand, and gesture on the other hand becomes difficult to maintain. From a purely objective point of view, only the first two categories are accessible. Measuring *gesture* as such is not possible, only interpreting measured movements and actions with a set of mental and cultural criteria. From the point of view of musical perception, however, the distinction between movement, action and gesture describes elements that range from sound production to the perception of meaning and expression in music as a whole. Most of the dynamics for music interpretation by instrumentalists and dancers are situated on a continuum within these opposites. An instrumentalist for example, will be incapable of separating purely task-oriented actions from musically expressive gestures [10].

Motion itself can be elicited by music. Neuroscience demonstrates that cross-modality between the auditory and motor-system may trigger involuntary motion, either actual or simulated [11]. Occurring both on a pre-cognitive and cognitive level, mental imitation may be considered advantageous from an evolutionary point of view, since it enables anticipation and understanding of intention of others and “enables the observer to use his/her own resources to penetrate the world of others by means of an implicit automatic, and unconscious process of motor simulation” [12] in [13]:108. Listeners are easily induced to imitate the sound-producing gestures of the musicians, either when perceived directly or from the memory of a culturally acquired image of such actions.

2.2 Dance

Dance presents an immediate form of music-induced movements and serves a number of social functions other than mere imitation. In primal societies dance fulfills a ritual role and other cultures such as african and asian civilizations have developed musical practices that are closely tied to and emphasize the act of dancing. In the early 20th century many aspects of these dance and music cultures

have found their way into western art practice. Likewise, similar evolutions have taken place in western european culture. Here, dance as an art-form has grown from a ritual, socially significant form of interaction into a stylized, classical motion language based on music (Ballet). From there it evolved into the contemporary dance forms that build on body-knowledge and the kinaesthetic sense and specifically address the relationship between the body, its space, time and music.

“In contemporary dance, gestures are considered higher-level expressive entities that convey more than just movement. The dancer attempts to render movement into something abstract and detached from everyday connotations and situations. These abstract dance-movements represent traces of physical but also mental processes concerning the body in space. The motivation for movement might be musical or visual, yet the intention does not always include the projected image of the body. Musical elements such as rhythm and pulse play a central role in structuring motion in dance.” [14]

From a vantage point of musical performance and analysis the inquiry into the relationship between motion and gesture is by no means concluded and has given rise to a vast field of investigation, both scientific and artistic.

3. RESEARCH CONTEXT

During the past one and a half decades an increasing number of research initiatives have taken place that have dealt with motion, the body and music.

3.1 Concepts

An influential methodology used “techniques to extract in real-time expressive cues relevant to KANSEI and emotional content in human expressive gesture, e.g., in dance and music performances” with the intent of codifying musical emotion [15]. The method consists of tracing expressive gesture through a series of processes and analyses: from physical signal obtained from sensors or computer vision systems to low-level features and statistical parameters, to mid-level features and maps, to high-level concepts. Gestures are recognized by segmenting low-level features into mid-level domains and mapped to high-level expressive concepts. In a method specifically related to dance the low-level features from a video-image are converted into Silhouette Motion Images from which quantity of motion and contraction indices are calculated. The motion segmentation and gesture representation is based on these basic parameters and is used to construct a symbolic representation of pause, contraction and expansion.

Looking at ‘gestural’ aspects in an individual musicians instrumental performance has led to a number of studies that tried to quantify motion aspects in repertoire pieces for traditional musical instruments. A well-known study is Wanderleys work on ancillary gestures in clarinetists. He tries to analyze “accompanist gestures and their relation to aspects of musical performance including performer-audience communication, the mental representation of music and emotional content in music” [10].

An interesting scenario for exploring the innate capacity to mimic music through gesture were the sound tracing studies carried out by Godøy [16]. Further studies have advanced these methods by using 3D marker-based motion capture systems [14]. A more recent experiment aimed to characterize both mimicking and tracing strategies; it added a set of qualitative measures based on interviews, which helped to associate the participants intentions, the perceived type of sounds and the performed sound-tracing actions [17], [18].

Since sensor technology has matured, many projects have taken place in the field of interactive dance. Rhythm as essential musical dimension has formed part of several research initiatives [19]. In artistic research applications dance also forms the basis for exploring embodiment to “generate music from dance via interactive technology and ... to explore ways of inter-medial expression, trying to identify links to specific structures and qualities and their organization as found in music” [20].

3.2 Methods and Tools

“Technology nowadays allows the measurement of almost any kind of physical manifestation of corporeal articulation. ... The main problem is the theoretical approach, the experimental paradigm, and the interpretation of measurements within a context of mind/body matter relationships” [21]:132. Thanks to current sensor technologies, gesture-related research has become a vast field of inquiry [21]:46 and its applications are pervading contemporary culture with the ubiquitous presence in game-controllers and smart phones. This creates the precondition for real-time interactive work with music, where ‘gestural’ control is integrated in an approach that puts an emphasis on sensorimotor feedback and the coupling of perception and action [22], [23], [24].

The use of marker-based motion capture systems has become one of the standard methods in the quantitative, empirical musical gesture research [25], [26] but also in artistic applications [20], [27]. The use of inertial sensors in full-body suits – its main application being physiological studies, athletics and simulation, both civilian and military – has also evolved considerably and superseded older, mainly dance-oriented systems such as the digital dance interface developed at DIEM [28]. Although complex in usage and providing a specific quality of body-related data, the inertial-sensor based systems are finding applications both in musical research and artistic practice [29], [30].

Originating from research into artificial intelligence, the applications of machine learning (ML) have in the last two decades been extended into the musical domain. From the early 1990s the first uses of ML, especially neural networks (NNs) for mapping creation, appeared. Lee used NNs for applications including learning mappings from commodity and new music controllers to synthesis parameters [31], and Fels built a system for controlling speech synthesis using a data glove [32]. More recent is the Pure-Data toolkit for NN mappings [33] and the matrix-based methods [34] that offer supervised learning. Perhaps the most well-known project at the moment is the Ges-

ture Follower [35] by IRCAM. Recent research projects pose questions relating the cross-correlation between gesture and sound using techniques such as Hidden Markov Models, to establish divergence measures in cross-modal analysis [36], or apply Support Vector Machines to cross-correlate classifiers [37].

4. PERFORMANCE PRACTICES IN ELECTRONIC MUSIC

One might argue that all real-time performances of electronic music are embodied, since they require the physical presence of the author and/or musician. Yet it becomes evident when laptop concerts are considered, where the action merely consists of controlling abstract sound-processes through a more or less elaborate technical interface, that this is not always the case. The physical presence and movements of the performers are not considered to be part of the performance, they happen in a rather incidental fashion. Most electronic performers do not consider their physical presence to be an integrative part of the performance, the movements and actions for the control of the sound-algorithms are purely instrumental or task-oriented and do not have musically or physically expressive qualities associated with them. For many electronic musicians this is not a deficiency but a deliberate choice.

There is a practice in electronic music that even consciously subtracts the physical presence of the performer from the stage setting. Indeed some of the most current forms of electronic music listening do not even require a physical space; they exist in an abstract domain of digital production and the individual space of listening on headphones. From the perspective of an improvising instrumentalist however, the loss of the ‘gestural’ and dynamic corporeal space in performance presents a real problem.

4.1 Traditional Instrumental Skills

When performing with a traditional instrument on a high level of concentration, focus and presence, many motor functions, perceptual adaptations and adjustments occur automatically and remain un- or pre-conscious. This is the result of the extensive training an instrumentalist has received. The integration of all of these functions happens naturally because the relationship with the materiality of the instrument as the physical manifestation of an acoustical principle – string, column of air, drum-skin or any other sounding body (vocal chords being a special case) – conforms to our knowledge of and skills within the physical world. This knowledge is a natural part of our human existence. Instrumental training imprints the musician’s body with instrumental and corporeal schemata that are guided through auditory, but also tactile, kinaesthetic and proprioceptive feedback. The extended sixth sense [38]:31 “function[s] as non-perceptual or non-observational self-awareness, and as such ... might be regarded as a more immediate form of awareness” [3]:54, and builds the foundation for our innate capacity for expression [3]:85; the capacity of our body for proprioception forms the basis for all of these instrumental skills and more importantly con-

stitutes an inherent part of the capacity for the appreciation of a physical performance by an audience.

However, this connection in the physical domain, which is an integral part of the traditional instrumental training, is not given per se when performing with a technologically mediated instrument. Of course, there is a technological object present, which executes the functions of the instrument in a certain manner: but its shape and physical aspect are primarily informed by the underlying technology and the industrial design of the object and not by the actions or behaviors necessary to affect or control the process. This relationship reflects Rheinberger's notion that technological objects may serve as foundation for building epistemic things [39]:70. Unfortunately, the intrinsic knowledge about physical traditional instruments and their sound-generating characteristics is a cultural asset which is often absent in new technologically mediated forms, where the sounding principle, the action space – with both its affordances and constraints – and the dynamic musical potential are removed from the physical realities that human experience consists of.

4.2 New Interface Performance

A number of performers with 'gestural' interfaces for electronic music have reached a level of proficiency that may be compared to that of a traditional instrumentalist: Michael Waisfisz, Laetitia Sonami, Atau Tanaka, just to name a few. They all spent a considerable amount of time with a stable version of their instrument and invested a lot of time and effort to reach fluidity and dynamics that transcend the affordances and constraints of their instruments. Whether and how their respective instruments influence their corporeal expression during a performance is an interesting question whose answer is obvious in some performers and not so much in others.

Performance with electronic instruments involves aspects such as *enaction* [40]:1, [40]:106, interaction and perception in the performer (and the audience), the choice of models for interface devices and sound generation processes, and the metaphors translating control or action to such processes. Embodied performance postulates an attitude that puts the body, its perception and action capabilities into the centre and poses the question of what – in technologically mediated forms – the body's relationship with the interface and sound generating technology represents. Contrary to technical control strategies, which are common when interacting with electronic tools – by using metaphors from physical devices to exert parametric control – an embodied performance tries to reach a level of (en-)action on the instrument and sound that is appropriate to the body, the perception, experience and the mental capabilities that allow us to maintain these complex relationships in balance. It is only at this level that the goal of immediate non-mediated musical and instrumental action can be achieved. This is where the performer regains an unconscious, unfiltered access to his instrument much in the same way a traditional musician possesses it.

5. OTHER SCENARIOS

Performance with electronic music may be set in a number of different scenarios. From the perspective of the improvising musician and stage performer, the traditional stage situation is the most familiar one, albeit conforming mostly to a *cliché* (a given). By accepting this situation without alterations, certain key aspects of an actual performance of musical media in front of an audience often get ignored. However these are the aspects that might prove most fruitful for the development of pieces that emphasize physical presence, for example through an increased physical proximity with the audience, redirected or increased attention or even an extended spatial presentation. The advantages of the well established frontal performance may outweigh the drawbacks, when the focus needs to be more on the musical content, the interpretation quality or other specific compositional aspects of a piece.

5.1 Interactive Installations

A different way to create an electronic music experience is to abandon the predefined stage setting and explore the possibilities for embodied presence connected with electronic music outside of the concert hall. The reactive or interactive installation in a public space or a gallery can offer a non-expert audience access to a media-situation that is to be physically experienced. Several more conditions, such as real interactivity and the ability for the audience to perceive their own presence in the piece, need to be fulfilled for this to happen, of course. The reversal of the roles of awareness and affordance from the stage situation can provide an interesting case for comparison. Here, one cannot infer previously acquired instrumental skills and behaviors or stage performance awareness. On the contrary, the repertoire of actions and behaviors is a direct reflection of everyday life and our society's knowledge about interacting with technology: with mobile devices, game devices, technological appliances etc. These form the basis of a pragmatic *enactive* knowledge of how to interact with or perform certain tasks on technological devices or instruments and can be leveraged to engage an audience more fully with an embodied interactive situation.

5.2 Interactive Dance

A scenario that represents the other extreme from the general audience's and even the trained musician's point of view in terms of embodied consciousness is that of a dancer in an interactive musical situation. That dance is embodiment in an extreme form is a truism. What the nature of the relationships between the movement language and 'gestural' proficiency and skill of a dancer with an electronic musical process might be, however, is a question that needs to be addressed anew for each individual case. The juxtaposition of an art-form that focuses on generating expression through movement with a performance practice intent on producing music with an ignorance of or disregard for the bodily presence creates an interesting tension. The vocabulary and the experiences that can be shared between a dance professional and an elec-

tronic musician are surprisingly small. Certainly, the central characteristics of embodiment become more apparent when observed in dancers. Finding a way of transferring insights about these into the performance practice of musicians with electronic (and other non-traditional) instruments presents an interesting challenge in the collaboration between the two domains [41]

In an interactive situation the dancer may or may not be tasked to consciously work with the electronic music processes. “One ultimately incongruent demand on dancers in interactive situations, where they control musical processes on more parametric level, is that they should become instrumentalists. This is a double catch, as the dancer wants to continue moving in the dance domain but is tasked with perceiving and acting on the musical domain.” [42] (quoting Marc Coniglio). In either case the sensibility to body awareness and qualities of movement is transposed via the interaction technology to the music algorithms. Two cases should be differentiated further: the conscious and willing performance by the dancer of embodied interaction with the electronic music process in addition to the dance activity; or the independent and voluntary ignorance of the specific, composed and technically mediated relationship between body and music – where the actual linking with and structuring of music is executed by somebody (sic) else. The key distinction between these two scenarios seems to be the level of awareness by the dancer about the affordances and expressive qualities of the physical action, which is linked to the musical instrument.

5.3 Location-based Media

In the author’s own experience with location-based media, a very strong sense of physical presence in real topographical space can indeed be achieved when the audience is given the possibility to navigate a sound-scape with their own bodies. The geographical space, one’s own place within that space and the combination of sensory input from the natural environment and controlled media content can build a perceptual frame of reference that emphasizes the physical presence within the work and the real land- or city-scape [43]. There are many similarities with the sound-tracing experiments from EGM as described in [27]. Here, the listener moves a tracked speaker through an actual space in order to discover sounds virtually placed at specific positions. The tight spatial and temporal synchronization between the physical position of the hand-held object and the virtual sound position generates a perception of coincidence of the two spaces, rendering the speaker quasi transparent and practically *endows* the sounds with a solid physical presence. In location-based media, especially when working with an invisible modality such as sound, the perception of one’s own real location in relationship to superposed sonic objects may become strongly accentuated. Space and spatial perception become an integral part of the composition and the body – for example by tracking it via GPS – takes on the function of a cursor that inscribes a trace through this space.

6. STRATEGIES FOR ELECTRONIC MUSIC

In order to physically perform electronic music well, part of the challenge is to find an expressive interface between body and machine. Two approaches may be taken: first the development of new interfacing methods and devices that expand the range of interactions and offer unique new ways of generating music – the NIME approach. Secondly the appropriation and use of commercially available devices and technologies that can be applied and explored for their performative potential. An obvious example for the appropriation of existing devices to new forms of electronic music performance is the turntable. It presents an interesting case of the recasting of this playback device both into a new musical instrument and a new socio-cultural context and above all has engendered an entire new musical practice, turntableism [44].

6.1 Composition

However the main task for this type of performance lies in the experimentation phase that starts once the technical aspects have been settled. Since many of the instrumental skills and perceptual phenomena have to be integrated on a pre-conscious level, strict methodical composition processes don’t work very well. By deliberately avoiding well-established performance patterns, questions about the relationship between the body and space and the body and sound tend to rise to the surface. When choosing workflows that invert the hierarchy between technology and immediate intuitive action, unexpected results tend to emerge. The order in which the elements of a piece are ‘composed’ can be reversed, letting the desired ‘gestural’ space inform the musical processes and materials. By exploring self-perception, mental imagery and the physical aspects of performing a given piece, the attitude necessary to fulfill that piece’s potential from an embodied point of view becomes more clearly perceptible for both the performer and the audience.

6.2 Performance

For a performance with electronic instruments to become embodied, a method or bridge that permits the translation of bodily aspects of motion to the technical domain is a pre-requisite. Moreover, the development of interaction methods, metaphors and structures within the digital domain which are geared towards (possibly high-level) actions on the musical processes is a requirement as well. Yet embodied performance is not merely a ‘gestural’ action or motion control of an arbitrary sound producing algorithm. Some key aspects of the physical performance in musical situations involve expression and perception as much in the corporeal as in the auditive domain. Therefore the music generation processes as well as their multimodal ‘gestural’ affordances need to reflect the intrinsic qualities of embodied performance. What these qualities may be described as is the subject of the concluding paragraph. This does not automatically imply that an embodied performance is a purely emotional or subconscious physical expression, on the contrary: the performer has to consciously ‘enact’

and ‘embody’ the musical structure, which has necessarily been – fully or in part – developed and composed for a gesture-based performance.

7. IN CONCLUSION

An audience perceives a musical performance with more than just the ear. In the case of a situation on stage, the convention demands that the visual appearance of the performer be part of the experience. This is motivated by more than just the aesthetic dimension. For the public, the performer (musician, dancer or other active member of the audience) presents a counterpart – a ‘Gegenüber’ or ‘vis-à-vis’ that evokes not merely an image, but a perception of physical presence and self-awareness. Gallagher states: “From early infancy, then, my visual experience of the other person communicates in a code that is related to the self. What I see of the other’s motor behavior is reflected and played in terms of my own possibilities. Quite literally, ... it may be the other’s movements that trigger my own proprioceptive awareness” [3]:81. The gestures in musical performance carry meaning in an intersubjective manner that is more than just a cultural code. “It is meaning that is simultaneously shared in the modalities of observation (of others) and action capability (my own). More generally, the brain areas responsible for planning my own action are the same ones activated during observation, imaginative simulation, or imitation of the action of others.” [3]:128.

What, now, are the intrinsic qualities necessary for an embodied performance? Implicit knowledge of the physical world, the perception and recognition of key elements of performance such as time (or timing) and energy, are closely related to corporeal *qualia*, such as proprioception and the kinaesthetic knowledge present in all of our bodies. Using the body to control an object, moving the body to express an emotion/intention, perceiving a physical act by seeing and hearing a performer and finally perceiving oneself during the performance are all key aspects of what our body affords both for agent and perceiver in a performance situation.

Fluency in execution is perceived as expertise and is characterized by being able to focus the attention away from the mechanics of the task at hand towards the overall *flow* of the performance. This economy and elegance is what makes “the mind of expert motor performance ... cool and focused” [45]:99-100. It is not just the trained musician herself who will experience the state of highly integrated motor and perceptual coordination. As Varela et al. state: “The result is a mastery that is not only known to the individual mediator himself but that is visible to others – we easily recognize by its precision and grace a gesture that is animated by full awareness. We typically associate such mindfulness with the actions of an expert such as an athlete or a musician” [46]:28.

A truly embodied performance with electronic music takes all of these aspects into account. Dancers learn how to build expectations through their movements and how to deceive them in the most effective manner. Electronic musicians need to learn to use their bodies and gestures de-

liberately to achieve the same. The performance that integrates presence, movement, action, gesture and music as a seamless whole has the potential to extend and transcend the traditional ways of electronic music making.

Acknowledgments

The author wishes to thank Gerhard Eckel, Germán Toro Pérez and Martin Neukom for their critical readings of sections of this text.

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