

Move/Bevæg Dig

An Interactive Sound Art Installation

Stina Marie Hasse Jørgensen
Department of Arts and Cultural Studies
University of Copenhagen
Copenhagen, Denmark
stinahasse@gmail.com

Jeff Snyder
Department of Music
Princeton University
Princeton, NJ, USA
josnyder@princeton.edu

***Move/Bevæg Dig* is an interactive sound installation. In the paper, themes related to the interactive sound art installation *Move/Bevæg Dig*, presented at the demo session at the Music, Mind and Invention Workshop (MMI), will be discussed.**

Interactive sound art; aesthetics; music perception; sound technology

I. MOVE/BEVÆG DIG

Move/Bevæg Dig consists of a pair of headphones, connected to a computer. When a listener engages with the installation, he or she puts on the headphones to listen. The sound the listener hears is a prerecorded voice attempting to pronounce different words. Ultrasonic distance sensors on the headphones register the distance to the nearest object, such as a wall or other people walking by, and this information is used to control the playback position of the sound. The effect is that motion in space through the physical environment produces motion through the time of the sound installation. The piece is a process, rather than a finite work; it is open-ended in time and requires the listener to actively shape its structure.

The installation explores the listener's experience of words as musical expressions and sonic experiences. Move/Bevæg Dig makes it possible for the listener to walk inside a sentence or a word and scrutinize every detail of the utterance. Depending on how the listener moves around in an environment while wearing the custom-designed headphones, a voice will try to speak the words "Move" or "Bevæg Dig", the Danish equivalent to "Move". In this way, the interactive element (the sensor technology) produces a dynamic relation between the human body, the surrounding environment, and the sounds generated real-time.

The purpose of the proposed paper is to investigate how the interactive sound work is perceived by the listener as something that *performs* itself as an *utterance*, a *relationscape*—that is, an utterance that has not yet found its expression but

is in its becoming in relation to the listener, the surrounding space and the technology.

In the following, after a technical description of the design of the sound installation, an analysis and discussion of interactive sound art will be set forth on a more general basis and in connection to the interactive sound installation Move/Bevæg Dig that will be shown at the demo-session at MMI. The paper will approach the experience of interactive sound art and the interactive sonic installation Move/Bevæg Dig in three ways:

1. as an *utterance*
2. as a *relationscape*
3. as a *technological space*

II. TECHNICAL DESCRIPTION

Move/Bevæg Dig has a hardware component, the modified headphones, and a software component, a Max/MSP patch running on a laptop. The basic design of signal flow for the system is shown in figure 1. There are two ultrasonic distance sensors, one for each ear of the headphones. An Arduino Nano microcontroller serves as the brain of the hardware, and controls the ultrasonic distance sensors. The sensors used are the Maxbotix MB1200, which are able to take a digital input signal to initiate sensing, so that multiple sensors can be activated one after the other to avoid acoustic collisions that would otherwise occur when multiple ultrasonic sensors are used in the same space. The sensors each emit an ultrasonic noise bursts, then wait for the echo, and send to the microcontroller brain a single number that is proportional to the distance to the nearest object within the detection zone of the sensor. The microcontroller collects this data and sends it as serial messages over USB to the laptop computer. The computer uses the data from the microcontroller to determine the playback position in an audio file and generates audio to be sent back to the headphones.

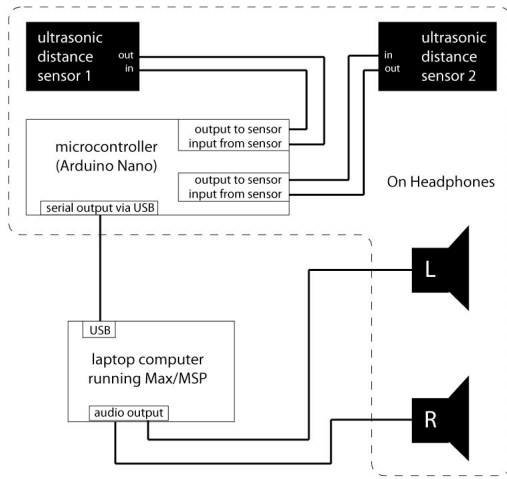


Figure 1: the signal flow of the installation

The physical design of the Move/Bevæg Dig headphones is shown in Figure 2. They are a standard pair of commercial audio headphones that have been modified by the addition of the ultrasonic distance sensors and the microcontroller. One design choice that has a strong effect on the listener's experience is that the sensors are affixed to the headphones with their sensitivity aimed out from the sides of the head, similar to the positioning of the ears on the human head. This means that the sensors do not register any changes in the distance of objects in front of or behind the listener. This choice is in contrast with the visual mode of interacting with the world, in which the direction of sensing is the same as the direction in which the head is facing. Another design choice that has interesting consequences for the listener is the lack of any sensing system beyond the ultrasonic sensors, leaving gestures involving feet or arms (when held below the shoulders) undetected. The effect is that it is not the listener that is being sensed, it is the environment and the listeners position within that environment. Other sensing options, such as accelerometers or computer vision systems, would produce a vastly different experience.

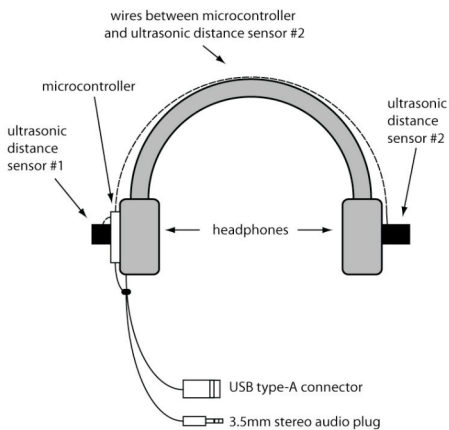


Figure 2: the design of the Move/Bevæg Dig headphones

Figure 3 shows the mapping of the sensor data to the position in the audio file. This is done in the Max/MSP software environment, using a patch that borrows liberally from a phase vocoder implementation developed by Dan Trueman. The patch loads a single audio file into two buffers, each of which are accessed by a phase vocoder. This audio file changes every few minutes between a voice speaking the English word "Move" and the Danish phrase "Bevæg Dig". The phase vocoder performs an STFT (short-time fourier transform) on the audio signals, converting the time-domain signal into the frequency domain. In the frequency domain, the audio file is represented as a sum of sinusoids that were present at specific amplitudes and phases within small chunks of time (called frames) in the original sound file. The Move/Bevæg Dig Max/MSP patch then resynthesizes audio from these STFT frames, and which frame to resynthesize is determined by the incoming data from the distance sensors. The mapping for this is simple: the closest distance reported by the sensor (20cm) will resynthesize the first frame of the sound file STFT, and the farthest distance reported by the sensor (around 760cm) will resynthesize the last frame of the sound file STFT. All sensor output between these limits will result in resynthesis of a frame between the beginning and the end of the sound file, with a linear relationship between the sensor value and the STFT frame position. A 1.5 second smoothing filter is applied to the sensor input to remove jitter caused by noise on the sensors. While the input sound file for each of the two channels is the same, the phase vocoder and sensor control is independent for the two channels, so that the current frame of the STFT that is resynthesized will usually be different between the left and right ear. Also, because the sensor data is constantly changing, and is updating at a rate of between 10 and 200 milliseconds, the frame positions in the sound file are also constantly in flux as the listener moves around the room, or as other people move around the listener and enter the field of the distance sensors.

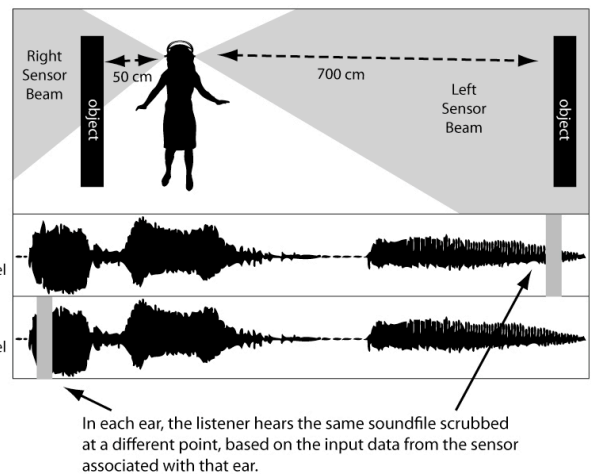


Figure 3: the software mapping of distance-to-audio used in the installation

III. THEORETICAL APPROACH

The field of interactive sound art is developing rapidly and it is hard to tell how it will develop because we are still in the midst of its unfolding process of becoming. Rather than providing an overview and a fixed definition of what interactive sound art is, the purpose of the text below is to explore aspects of what interactive sound art is as artistic material and how it is experienced.

Since there exist no theories specifically aimed at analyzing interactive sound art, we will borrow concepts formulated within different theoretical orientations such as: performance theory, digital art theory, sound theory and process philosophy. This is done both to avoid locking the art into one fixed theoretical paradigm and because the art as an artistic medium can be said to be a hybrid form that calls for a diversity in the theoretical approach.

IV. THE UTTERANCE

Move/Bevæg Dig is manifested as an action through the listener's interaction with the work. As the performance theorist, Camilla Jalving, writes in her book *Værk som Handling: Performativitet, kunst og metode* fra 2011,¹ art can be seen as:

an action in that it creates, stages, actualizes, dramatizes, or *performs* itself. The answer to what work *is*, will then be that the work is what the work *does*. The work is its action. As audiences, we must orientate ourselves, not only on *what* work is, but also *how* it is. That is, how it works, how it presents itself and not least how I, as a viewer, interacts with it.² (Jalving, 2011: 14)

Although Jalving is writing about contemporary art in general rather than sound art specifically, this concept is especially applicable to interactive sound art. The performance theory of Jalving enables us to experience the interactive sound installation as an action rather than a passive object. The artwork is what the artwork does, or as Jalving states, "The work is its action"³ (Jalving 2011, 14). The viewer is not just a passive recipient but should be seen as someone who actively engages in the work of art. This leads, according Jalving, to "a reconsideration of the role of the viewer"⁴ (Jalving 2011, 17). The approach to the artwork is no longer as an object being autonomous from its surroundings. Instead, the artwork is

¹ Besides Jalving, it is mostly Dorothea von Hantelmann who uses performance theory to analyze contemporary art.

² Translated from Danish by the author. In Danish it reads: "en handling, idet det gestalter, iscenesætter, aktualiserer, dramatiserer eller *performer* sig selv. Svaret på, hvad værket *er*, vil i så fald være, at værket *er*, hvad det *gør*. Værket *er* sin *handling*. Som beskuere må vi derfor orientere os, ikke kun mod *hvad* værket *er*, men også *hvordan* det *er*. Det vil sige mod, hvordan det virker, hvordan det stiller sig selv frem og ikke mindst, hvordan jeg selv som betragter interagerer med det." (Jalving, 2011: 14)

³ Translated from Danish by the author. In Danish it reads: "Værket *er* sin *handling*" (Jalving 2011: 14)

⁴ Translated from Danish by the author. In Danish it reads: "en revurdering af betragterens rolle" (Jalving 2011: 17)

understood as something that performs in relation to its surroundings. The performance theory⁵, as formulated by Jalving, allows an analysis of how interactive sound art can be seen as an act, a *doing*, created in an interaction with the listener.

One can understand Move/Bevæg Dig as an aural expression, an *utterance* that does something. The difference between the viewer in Jalving's description and the listener in the interactive sound art is that the listener is an active co-creator of the sonic piece, and not just an on-looker perceiving the performance of the artwork. In Move/Bevæg Dig, the work's performance of itself is co-created in relation to the listener's interaction with the work. The listener can be said to actualize the sounds in the work, as utterances, through his or her bodily movements in a space with the sensor headphones on. The creation of the *doing* in Move/Bevæg Dig is made by the listener's interaction with a digitally constructed space in a physical space.

V. THE RELATIONSCAPE

In the Canadian philosopher and media artist Erin Manning's book *Relationscapes: Movement, Art, Philosophy*, Manning argues that before one can understand the language as utterances and words, one must understand what language is composed of before it took shape as such. To understand this, Manning writes, one must understand how something takes shape as a whole. She argues that we should understand the becoming of words and utterances, as movements that occur in relation to an embodied experience and cognition of the artwork. (Manning, 2009: 7) These movements can be seen as something pre-linguistic, something that has not already taken shape, as it is in a constant process of becoming (until the movement has stopped). Manning explains this movement using the example of the process that unfolds when we take a step with our foot.

Manning describes how the pre-acceleration in the movement of the foot contains many potential points of landing for the foot - but as soon as the foot has lifted itself and has started to rotate on its curve, the course has been given and the potential landing points have coalesced into one possible landing place, which is where the foot lands. The fact that the foot lands exactly there is due to the oscillation of the foot in relation to the surrounding space (the landing point of the foot is different depending on whether you are on a staircase, or on a floor). In order to understand why the foot lands where it does, one must relate the foot, the movement and the surrounding environment in relation to each other. This *relationscape* demands that we understand the foot as something that is becoming in relation to its oscillation and the surrounding place.

⁵ Performance theory has found great inspiration from the philosopher John Langshaw Austin's speech act theory as he argued in his William James lectures at Harvard University in 1955, later published as the book *How to Do Things with Words* from 1976. One of the key elements of Austin's speech act theory is his development of what Austin calls performative sentence, a phrase which is characterized in that it does something.

Manning argues that her example of the foot can be seen as a metaphor for how an artwork comes about, as something that becomes in a relationship between the artwork and the human (listening) body.

Duration is the plane of experience on which expressive finality has not yet taken hold. As thought shifts toward expression, it moves through concepts in prearticulation. (Manning, 2009: 6)

The prearticulation of thoughts are like words in their becoming. Since the words are in their becoming, the language does not yet know what it means. The language is only felt in its nascent articulation, as something that does not know where it is heading.

In *Move/Bevæg Dig* the word becomes a materiality that we as listeners can experience and feel. We can move inside the word and experience every single phoneme of the word, as auditory expression created in relation to the surrounding space. This allows us to experience the word as tonality, rhythm, timbre, dynamics and music. The installation makes us rediscover the sensory material behind the word: as a vocal sound instead of a linguistic referent. *Move/Bevæg Dig* examines in this way the voice as an aural physicality with phonemic musicality before it becomes a medium for meaning. In the installation, we hear the quality of the voice as tonality, rhythm, color and accent, as a kind of music or a soundscape. The philosopher Mladen Dolar writes in his book *A Voice and Nothing More* that the voice is both a source of aesthetic admiration and a sense-producing tool:

What defines the voice as special among the infinite array of acoustic phenomena, is its inner relationship with meaning. The voice is something which points toward meaning, it is as if there is an arrow in it which raises the expectation of meaning, the voice is an opening toward meaning. (Dolar, 2006: 14)

As Dolar points out, the voice can be used as a tool that can enable meaning, but the meaning is not given by the voice itself. *Move/Bevæg Dig* displays the voice as a movement arising in relation to the listener's gestures, as an arrow pointing towards meaning through its exhibition of language as a pre-linguistic sensation: a movement that shows language in its becoming, as full of potentiality as the foot in its oscillation. The voice is a foot suspended in mid-step.

The installation is a display of creation of language: the articulation of each phoneme in relation to one another, to space, to the sound and to the listener. The language is called forth through the musical sounds of the phonemes: their tonality, rhythm and dynamical momentum. The phonemes swing in a constantly evolving network of relationships. The installation is thought-feeling on its way to articulate linguistic utterance. The work shows the words in their genesis.



Figure 4: Thomas Milholt experiencing *Move/Bevæg Dig*

VI. THE TECHNOLOGICAL SPACE

In order to understand and discuss the experience of an interactive digitally programmed piece of art, one must look at what role technology plays in the work. How does the technology enable the meeting between the work and the listener?

The philosopher Don Ihde writes about the corporeal experience of things mediated through technology. He writes that we always acknowledge things multidimensionally through our bodily embodiment of them. Ihde argues that there is a difference between how we experience the world without technology or through technology. One of the differences is the limit of our physical horizon of experience. Ihde writes how he experienced not being able to hear sound frequencies that others could easily hear. As he explains:

clearly I cannot (directly) experience beyond the limits of my experiential horizons, nor can I even place my embodied, situated experience there perceptually – I cannot recognize my limits by getting outside myself and my situation, noting it from 'above' as it were. Yet, I recognize that I have come up against my perceptual limits, but how? My answer is *by means of technological, instrumental mediation.* (Ihde, 2010: 56)

Ihde argues that we can transgress our physical limits for experiencing by using technology. Interactive sound art does not aim to extend the limits of our experience horizon, as a sonic mediating prosthesis that can extend our aural perception of the world (as Ihde argues the hearing aid to be). Rather, interactive sound art intends to question the use of technology as prosthesis. Is the hearing aid's technological mediation of the sounds occurring in the space around us "real representations" or is it something else? As Ihde argues, there is a difference between technological recreation of sounds and the sounds that "naturally" occur in physical spaces. (Ihde, 2007: 244-246)

One of the differences lies in the hearing aid (or other sound technologies) transformation of the materiality of sound, whether analogue or digital. Since the sound is reproduced, one can detach the sound from its original context. As sound- and media theorist, Frances Dyson writes in her book *Sounding New Media: Immersion and Embodiment in the Arts and Culture*.

Through audiophony – whether analog or digital – sound can be heard at any time, in any place, by any listener. Divorced from any phenomenal relation to the forms and flows of sounds occurring in the environment, no longer bound to the here and now of lived experience, sound becomes a pseudo-object.’ (Dyson, 2009: 136)

This allows for aural experiences playing with the experience of sound as something that takes place here and now. That you want to create as "realistic" a sound as possible for the hearing aid user is a choice made by the hearing aid manufacturer. Unlike the hearing aid, Move/Bevæg Dig stresses the digital and programmable in the sonic representation. When the listener walks with his or her ears very close to a wall or an object, they hear how the sounds are approximations of discrete samples of audio waves. The sounds of the installation are no longer pre-articulations becoming an utterance. The sounds are rather a form of stuttering and stammering that no longer reacts to the listener's movements in the physical space. In this way the interactive sound work stops being interactive and instead performs itself as a digitally constructed discrete system that is programmed to react only within a certain physical field –or relationscape. The becoming of the word is transformed into the becoming of the technology, because the stutter has taken over –until the listener starts moving away from the wall/object and out in the relationscape.

VII. CONCLUSION

In the theoretical discussion of Move/Bevæg Dig we hope to have brought new theoretical concepts into play in relation to what interactive sound art is, does and can do as interactive and technologically mediated artistic material.

Throughout the paper there has been a focus on the listener experience and on the listener as co-creator of the interactive sound work in a relationscape that concerns the dynamic movements and relations between the sound, the technology, the listener and his or her movements in a physical and virtual space. It has been argued that this interaction

within the relationscape makes it possible for the artwork to perform itself as an utterance, and as a prearticulation that suggests the language system. This, it has been argued, creates a listening experience of something in the process of becoming.

However it has also been pointed out that the listener's co-creation of the interactive sound work only exists within a relationscape defined by the digital technology in the artwork. It has been argued that as soon as the listener moves to the edge of the defined relationscape-field, the digitally constructed sonic space performs itself as a stutter not responding to the movements of the listener. This creates a listening experience that call into question how we listen to the world around us. More generally, interactive sound art can be said to ask what role technology plays in our experience of the artwork and in our experience of a world increasingly mediated by digital technologies.

ACKNOWLEDGMENT

Dan Trueman, Tania Ørum, Hanne Marie Svendsen, Thomas Milholt, Cathrine Hasse, Katrine Møllebæk and Martin Skjærbæk.

REFERENCES

- [1] Dolar, Mladen. *A Voice and Nothing More*. The MIT Press, Cambridge, Massachusetts. 2006
- [2] Dyson, Frances. *Sounding New Media: Immersion and Embodiment in the Arts and Culture*. University of California Press, Berkeley and Los Angeles, 2009.
- [3] Ihde, Don, *Stretching the In-between: Embodiment and Beyond*. Springer Science + Business Media, 2010.
- [4] Ihde, Don. 'Embodying Hearing Devices: Digitalization' In *Listening and Voice: Phenomenologies of Sound*. State University of New York Press. Albany. 2007 p. 243 -273
- [5] Jalving, Camilla. *Værk som Handling: Performativitet, kunst og metode*, Museum Tusulanums Forlag, København, 2011.
- [6] Manning, Erin. *Relationscapes: Movement, Art, Philosophy*. The MIT Press. Cambridge, Massachusetts. 2009
- [7] Snyder, Jeff and Stina Hasse: *Move/Bevæg Dig* <http://cargocollective.com/move>, located 11.03.2012