# Auditomotion – Immersion in haptic environments

*Auditomotion is an interactive sound installation with haptic (tactile and kinesthetic) properties, exhibited at Bergen International Festival in 2021, 2022 and 2023. Auditomotion is made for children of all ages and consists of fifteen large textile objects with integrated audio players.*

*The importance of how the body and the movement of the body affect the immersive experience of sound has been central to the design of Auditomotion. Sound activates feelings and emotions through properties that move bodies.*

*The article presents and discusses the design considerations (kinesthetic, tactile, spatial, visual and auditory) that went into the design of the installation, as well as how it functions in meetings with the public, in light of a model for immersive design.*

## Introduction

A bench outside Siljustøl[1], the house where the late composer Harald Sæverud lived and composed. It is a sunny day in June 2023. Below, out in the garden children play in what I describe as a haptic sound installation: *Auditomotion*[2] (Hoem, Enger and Ringheim, 2021-23).

I find myself in a distance from the ongoing play. Most of the children seem to be inside the installation for 10 to 20 minutes, but some literally stay there for hours. I realise that many of the children seem to be immersed in the ongoing play, but at the same time I recognise that this immersion in most cases is somewhat different from my intentions when I developed the ideas and designed Auditomotion, back in 2020.

Still on the bench I feel somewhat detached from the fact that we have designed and produced the environment that the children are currently playing around with. I begin wondering: is it possible to say something of significance about the children's experience of Auditomotion. This will then be based on my subjective ideas and design decisions, and seen in relation to the observations from my current position, well outside the current event.

The following will discuss these observed experiences from my perspective, an artist/designer, with emphasis on how the interplay between sound and physical objects can engage an audience in an immersive experience. Sound and touch has aesthetic potential beyond what is immediately perceived. Both sounds, and the experience of touch can become part of our implicit memory, and linked to the body in ways that are outside our consciousness. Therefore experiences linked to sound and touch may appear as stronger than what is observed with the visual sense.

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[1] Blog post with videos from the performance at Siljustøl https://blogg.infodesign.no/2023/06/auditomosjon-pa-siljustl.html

[2] http://foredrag.infodesign.no/kunstprosjekter/auditomosjon-2021

*Illustration 1: Children at different ages playing inside Auditomotion, at Siljustøl – the home of the late composer Harald Sæverud.*

Virtually everything that surrounds us is affected by or results in sound. Even in a quiet mountain landscape, the soundscape is full of information about what is unfolding around the listener, regardless whether the sounds are experienced as significant or less important. This invading and immersive nature of sound makes shaping soundscapes a powerful artistic tool (Rudi, 2011). With Auditomotion we have tried to work with three dimensional objects in a similar way, making objects that not only immerse the users in sound, but also occupy significant parts of the field of view for small children.

## The sound installation Auditomotion

The installation Auditomotion (Hoem et. al. 2021) was developed for Bergen International Festival, and performed in 2021, 2022 and 2023. The installation consists of fifteen large textile objects, or what we soon were to call “sound creatures", in various shapes and colours. The installation is designed to be explored by children of all ages.

Each of the sound creatures has its own underlying background sound. These background sounds are constantly present, and create a soundscape, depending on the given constellation of the fifteen sound creatures. The sounds are played from small computers that feed directly into relatively large speakers, one located inside every of the sound creatures. The computers receive signals from motion sensors, and the computers are programmed to respond as soon as the objects are set into motion.

If all the sound creatures lie still, they only play their respective background sounds. The audience's interaction can then consist of moving through the present soundscape. This soundscape can then immedialtly be changed by moving the sound creatures. With each movement, a rhythmic sound will

be activated within the respective sound creatures. The rhythms change tonality by different orientations of the individual sound creatures. As a result of the interaction, the juxtaposition of all these sounds can be played in a controlled way. However, the constellation of background sounds and rhythms can easily become chaotic, like when a number of users are in the installation and set all the sound creatures in motion simultaneously. This places Auditomotion between a kind of instrument and a physical playground.

Auditomotion is the result of experiments with encounters between sound, programming and physical interfaces, but also an arena for exploration and learning about the relationship between sound, space and movement. In the following, this article discusses some of these perspectives. An underlying question is how to design a sound environment in ways that can expand the user's immersive experience through haptic interfaces, i.e. a combination of sound and how this can be influenced through physical touch and bodily movement.

*Illustration 2: Audition motion during Bergen International Festival in 2021. The sticks were used to move the sound creation, and cleaned each time they were used by a user. They were implemented because of COVID, as infection prevention.*

In total, the installation has been on public display on eleven occasions, and several hundred people have experienced Auditomotion. However, these numbers are very differently distributed among the various occasions. The audience has mainly been children of pre-school age, partly parents and partly other adults of the entire age range.

## Method

This author has been deeply involved in the design process, production and the actual performances of Auditomotion. A number of prototypes were developed and tested at short intervals, and converged towards the chosen solutions. Physical conditions, knowledge and technical affordances affect the processes. This theoretically informed development can be characterised as a form of media design, a methodical approach that involves trying to experiment with everything involved in a new medium (Hoem and Nyre, 2018). Media design is closely linked to the materiality of the media and has much in common with artistic development work, understood as processes that lead to a public performance of a product where a reflection takes place around the development, presentation and reception of the product (Hoem, 2021).

The investigation of Auditomotion as an immersive phenomenon starts from this author and designer's own experiences, supplemented by what can be extracted by comparing these experiences with a series of observations of how others interact with the installation. The reflections are to a large extent based on subjective observations and corresponding interpretations.

## Sound, movement and immersion

Auditory perception has a lot in common with what we can sense and perceive with the sense of sight. When it comes to how we experience spatial conditions, most people can register both sound and visual expressions stereoscopically, using two ears and two eyes. Our brains also have a number of ways to compensate for incomplete sensory impressions. Auditory, visual and haptic impressions supplement and complement each other, and help individuals to determine direction and distance to objects in their surroundings.

The design of Auditomotion began with an interest in the potential relationship between movement and sound. When one first pays attention to how sounds are connected with the body's position and the surroundings that emit and influence sounds, it soon becomes interesting to speculate what happens if the person who experiences sound also has the opportunity to move and/or manipulate the sound sources.

The senses be seen in relation to physical distances, as a form of practical and theoretical framework from which to think:

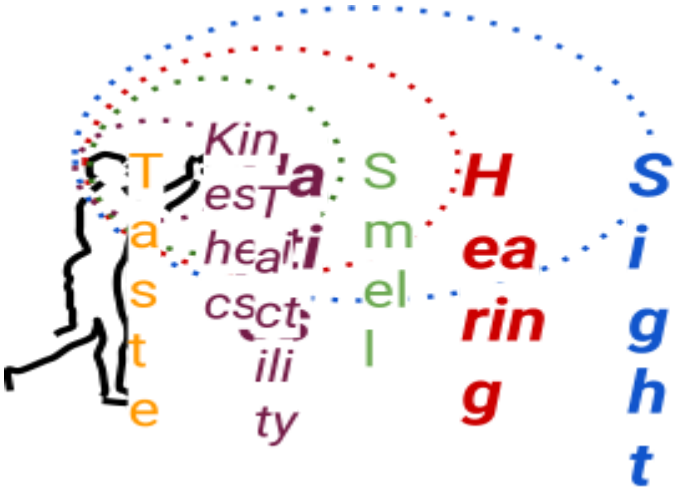


*Illustration 3: Conceptual visualisation of the range of the senses in relation to the human body*

Any aesthetic experience can be said to arise from a compilation of a multitude of sensory impressions. However, sight, hearing and smell are mainly caused by objects and events that originate outside the body. Much the same can be said about taste. One can thus argue that the haptic sense is in a special position, because these sensory impressions are not only something that comes to the person who senses, but the haptic sensory impressions are dependent on the body, its position and movement in order to exist at all.

There are some significant differences between haptic, visual and auditory impressions. Audible sound has wavelengths from a few metres down to a few centimetres, while visible light has wavelengths between 380–750 nanometers. This means that even relatively small physical objects will be able to block light and sight. Sound waves, on the other hand, will find their way around relatively large objects, due to diffraction and reflection. For most practical purposes we can only see what reflects light, which then reaches our eyes in a direct line – making something either visible or hidden. Where physical objects or the absence of light can prevent the reflection of light, we will in many cases be able to hear a sound source, also when it is hidden from view, like behind other objects. On the other hand, many simultaneous sounds will easily appear indistinguishable and chaotic, while we are able to perceive and interpret very complex visual impressions.

Wavelengths are also important for our ability to determine direction and distance to sound sources. If the wavelengths become greater than the distance between the ears, i.e. at relatively low frequencies, it gradually becomes more difficult to determine the direction a sound is coming from. Furthermore, the position of the ears means that we can determine the direction of sounds in the horizontal plane, while we have more difficulty placing sounds vertically. In addition, there are many other conditions, especially the composition of frequencies and transients (short sound pulses at the beginning of a waveform - think of the impact on a string before it begins to vibrate fairly evenly - which affect whether we are able to determine where a sound is coming from.

The experience of high frequencies also weakens much faster with increased distance to the sound source, compared to low frequencies. The latter contains much more energy, and at low frequencies sound has physical properties that we can sense haptically – sound is literally moving. If sound waves propagate in solid materials, we will be able to perceive frequencies of a few hundred Hertz as vibrations through the skin, tactilely, while frequencies of a few Hertz can be perceived as movement, kinesthetically. These different conditions, linked to wavelengths, from the visible, via the audible, to

the palpable, are important conditions when designing a haptic sound sculpture like Auditomotion. Frequencies, sound sources, choice of materials that surround the sound sources literally play together, and affect what the users can hear, touch and see.

## Immersion and play – Design rationale

The term immersion can be understood as the users' experience of mediated expressions. Björk and Holopainen distinguish between four forms of immersion (Björk & Holopainen, 2004 p. 206): Sensory-motor immersion concerns interaction with and emotional closeness to objects through touching and movement (cf. haptics). Cognitive immersion concerns whether an experience is perceived as engaging and stimulates attention. Emotional immersion is about emotional empathy, which is both subjective and highly dependent on context. Finally comes spatial immersion, which concerns the experience of being physically surrounded by the mediated representations. Björk and Holopainen developed their categories in relation to simulated worlds, typically computer games. However, all these dimensions of immersion are relevant, and have influenced the thinking around the design of Auditomotion.

Another important influence has been Malcolm Ross' The Creative Arts (Ross, 1978) and a model that frames creative activity around play. Play is in this context understood as an open approach, where the process of creating and exploring is most important. Through play, the actors who participate build a symbolic set of actions with a representative relationship to a world outside the activity.

In Ross' model, what initiates a creative process is an impulse, a desire to create and change, caused by a form of imbalance. This imbalance, which leads to the impulse, can come as a result of external conditions, but also from the individual's inner (ideal) world. The defining feature of the impulse is that it motivates creation. A creator can then work with the impulse through four related competence areas: active use and development of the senses ("Senses"), imagination ("Imaging"), knowledge of media ("Media") and the techniques ("Craftsmanship") that can be used to make expressions through the individual media.

From the perspective of an artist / designer I have tried to use Ross' model as a starting point, to think about the creative process in reverse: How do "Senses", "Imaging", "Media" and "Craftsmanship" influence the user experience, and how can these be seen as aspects of immersion. I do find some similarities between Ross' model and how Björk and Holopainen categorise immersion. After playing with these concepts for a few years the result becomes a model (Illustration 4.), which I find useful when conceptualising and designing for an experience that one wants users to engage in. When using the terms "design" and "experience" it must be noted that this is not limited to "user experience" (UX) that tends to focus on more technical aspects, like ease of use and efficiency. Designing for experience, experience design, on the other hand, can be understood as "the practice of designing products, processes, services, events, and environments with a focus placed on the quality and enjoyment of the total experience" (Norman, 2013, p. 5).

When making an art installation like Auditomotion, the artistic intention is to make the users engage in a total experience, first and foremost the immediate experiences ("Erlebnis"), but also with the hope of engaging past and future experiences ("Erfahrung"). This will happen in a constant interplay between individual levels of experience, and collective ones.

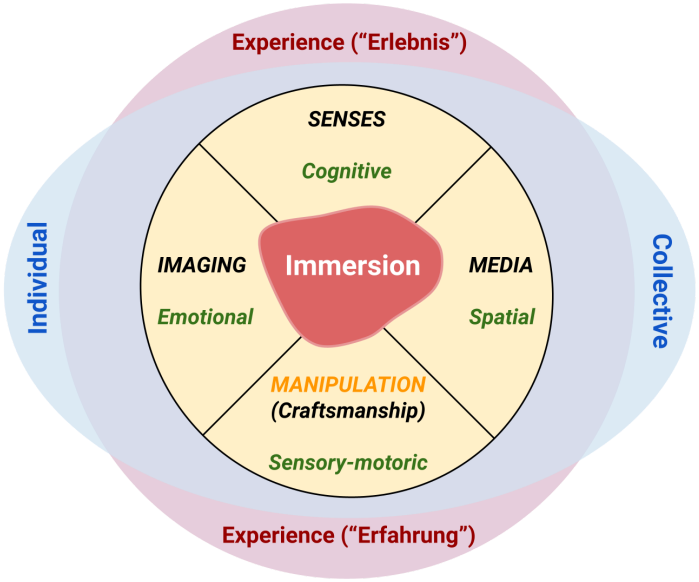


*Illustration 4: A model for immersive design. Written in green, are the four categories of immersion, from Björk and Holopainen. Written in black are from Malcolm Ross' model, but where "manipulation" is used as a more general term than Ross' "craftsmanship".*

The model presented in illustration 4. has been used as a tool, when thinking about how to realise Auditomotion, in the various points of interference between design purposes and artistic intent. The model is combining a vocabulary used in aesthetic processes with the four categories of immersion, as laid out by Björk and Holopainen. Where Ross uses "Craftsmanship" with reference to the skills needed to create, I have chosen to use the term "Manipulation". This is to better include various situations where an audience engages in and changes an ongoing activity, also without the need of any specific skills.

## Design process

The decisions that were made during the prototyping and design of Auditomotion are linked to haptic design, here kinesthetic and tactile design considerations are discussed separately, further visual design and auditory design.

The visual dominates in our culture and the first manifestations of an idea are therefore often about what we are able to visualise, and briefly describe how the final work can appear in a visual form. To illustrate ideas and the project sketches were therefore made, particularly with the aim of highlighting the size relationships between the textile objects, adult audiences and children (see Illustration 5).

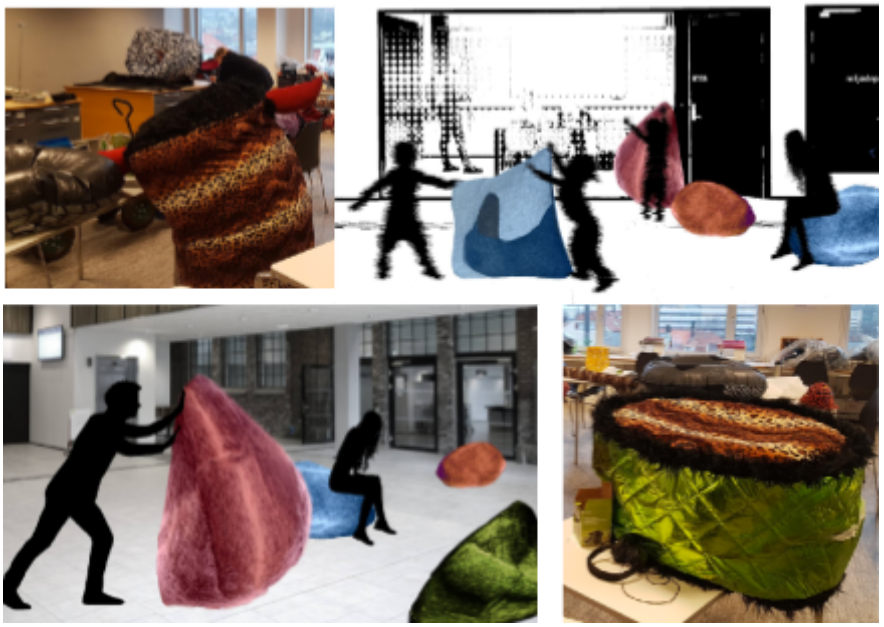

*Illustration 5: Two early sketches from the idea phase and two photographs from the actual production of the outer "skin" of the sound creatures.*

### Kinesthetic design

Regarding kinesthetic design, emphasis was on the relationship between the objects' size and mass. The idea was that the sound creatures should be so large that they are experienced as almost overwhelming (for a small child), at the same time that the sound creatures must be light, to be possible to move by all users. A further premise was that each individual sound creature must be able to contain a battery-powered unit with a speaker and control system for sound playback. All must be well protected, so no one is harmed by movement of the sound creatures.

For Auditomotion, it was also a requirement that the user experiences an almost immediate response when an object is set in motion. The technical solution for sound playback, developed by Johannes Ringheim, uses an accelerometer connected to a small computer. The machine receives power via a USB outlet from a battery-powered speaker, and the computer plays sounds according to movement. The sounds are sent back to the speaker via an AUX input. The same technical setup is used in all 15 sound creatures, but with different sounds and rhythms.

There were thus a number of fairly specific premises for the design, which ended up with a concept built around inflatable snow toys, inflatable chairs, etc. These can be easily deflated and pressed together, while at the same time being solid that they can protect a heavy speaker and a small computer. This way, a large volume is achieved in relation to the sound creatures' total weight.

### Tactile design

We wanted a design that invited touch, which draws in the direction of using soft materials. Furthermore, we wanted to give associations to something living, almost zoomorphic properties  This is reflected in the fact that from an early design phase we referred to the objects as creatures. In dialogue with the producer, at Bergen International Festival, the whole was eventually referred to as a playground, and with that a connection was made to various toy animals.

Partly for ethical reasons, partly for practical and financial reasons it was not possible to use natural materials. A necessary solution was artificially produced materials that give clear associations to the animal's appearance and how fur is to be touched. Here we (Hoem and Enger) spent significant time selecting materials, with regard to the tactile properties and that the sound creatures had to be made strong, to literally be lifted by the hair.

Despite the necessary compromises in relation to the choice of materials, the final design was something that satisfied the various design specifications. The inflatable objects give the sound creatures an internal rigidity and flexibility that helps make up for the lack of properties of the textiles. Without drawing this comparison too far, one can say that the structure of the sound creatures reflect bodies, where an inner core is protected by surrounding tissue and an outer, robust layer.

## Spatial and visual design

The visual design is partly related to how the sound creatures are intended to be experienced. They are three dimensional sculptures, and the spatial and visual look function in isolation from the sounds that each individual sound creature carries with it.

Auditomotion is primarily designed for children, and in that context it becomes relevant to think through how children develop in relation to understanding space in relation to their own body, the child's ability to move and move external objects. Much of this thinking is based on Jean Piaget's theories about child development, especially the book The Child's Conception of Space (Piaget & Inhelder, 1967 [1948]). Piaget and Inhelder developed a theory that explains stages of spatial understanding and the ability for spatial representation as a development through topological, projective and Euclidean representation: Topological relations refer to qualitative relationships about closeness and separation, order or spatial order, relative positions, closed form and continuity. Projective connections are about being able to perceive perspective and spatial connections. Euclidean relationships involve proportions and distances, as well as coordinates, scale, relative distances and sizes, where this is part of an overall system, as we can for example find it represented in a map.

In relation to a very physical installation, such as Auditomotion, it becomes a design consideration that the children have sufficient strength, while the haptic properties presuppose an awareness of and ability to coordinate between movement and the other senses. It was an important design objective that the three dimensional format was adapted to the children's physical characteristics. One can expect the children to increasingly explore the possibilities that the installation provides in terms of being able to hide, climb onto the sound creatures, turn and stack them, etc.

## Auditive design

The term sound objects (Schaeffer) describes recorded everyday sounds that are isolated from their original context, while at the same time making connections between sounds, physical objects and space. Such sound objects can be compiled and listened to in many different ways. Based on Pierre Schaeffer, Michel Chion distinguishes between causal, semantic and reduced listening (1994, pp. 19-29): Causal listening denotes a search for causal relationships where the listener looks for the sources of the sounds. Semantic listening, referring to how sound can be interpreted, e.g. verbal language meaning, and how sounds can thus be added to a message and function as symbolic signs. Finally comes reduced listening, a term that is linked to the characteristic of the sound itself, the aesthetic properties of the sound, regardless of what is the source of the sound or the meaning that can be attributed to it (Chion, 1994 p. 29).

All of this has significance for the design of an interactive sound installation such as Auditomotion, where a central idea is to contribute to and increase attention to the sounds that surround us in everyday life. In this case, the sound design is based on a methodology developed for locative sound media, which combines background sounds, zone sounds and point sounds (Hoem et.al. 2017). In the case of Auditomotion, composition and sound playback are based on this principle, but here we use the terms background sound, effect sound and rhythm sound, which have a clearer link to the concrete way Auditomotion works.

In the case of Auditomotion, a background sound is included with each individual sound creature. This background sound plays in a continuous loop, regardless of whether the sound creature is at rest or whether it is set in motion. Background sounds are mostly calm nature sounds, but also machines and more unpleasant sounds. At irregular intervals the sound creatures also emit short effect sounds. The effect sound is one way the sound creature can attract the audience's attention. The sound effect is also played once at the moment a user chooses to set the sound creature in motion. Basic sound and effect sounds together form a sound image that can be compared to background sound, roughly as you know this from listening to music. When all the sound creatures are at rest, background sounds and effect sounds create a relatively ambient soundscape that the audience can explore, just by moving between the sound creatures. On top of this come the rhythm sounds, which are played as soon as the sound creatures are in motion, and continue as long as movement is maintained and for a while after the sound creature is again put to rest.

The rhythm sounds are divided into five "families" with respectively 3/32, 4/32, 5/32, 6/32 and 7/32 beats. The rhythms are algorithmic, in the sense that the beats are distributed according to Euclid's first theorem[3], a principle that characterises the vast majority of the world's rhythmic music (Toussaint, 2005). Each sound creature keeps its own rhythm at all times, but the rhythmic sounds vary in tonality depending on the orientation of the sound creature. The users can thus put together different or syncopated rhythms at the same time as they can somehow play on the sound creatures by turning them over.

The auditory design is made to make all the sound creatures form a form of wholeness where a number of sound objects form a soundscape of natural sounds and composed loops. In this sense, this is a mixture of rhythmic and concrete music. The idea is that this in sum forms a form of complex choir or collective instrument, which allows the audience to take part in a collective performance with plenty of room for individual experiences.

## Auditomotion in use

Auditomotion is based on a complex interplay of functions, which are quite simple when each is examined in isolation. Together these functions enable the audience to influence sound and playback in complex ways. No user will ever encounter the same expression. A consequence is that it might be difficult to get insight into common features, across the individual users' experiences.

Some users (mostly adults) have given information about their experiences via a questionnaire, which supplements more general observation of activity in the installation. Children's experiences were mapped through participatory observation, where the observer was partly inside the installation, partly

[3] Euclid's Algorithm –https://www.math.ntnu.no/emner/MA1301/2017h/forelesninger/06-euklids-algoritme.pdf

placed on the outside. The observations were stored as field notes, as well as material collected using drawings, also as a supplement to participatory observations.

An interpretation of the collected material can be summarised through Illustration 6, which shows different ways of use that occur in parallel and as part of a collective experience.This picture represents the essence of the observations, and at the same time demonstrates three forms of using and being immersed by Auditomotion. The picture also shows users in the core target group, around five years old:

*Illustration 6: various ways of listening and moving inside Auditomotion.*

## Individual and collective experience

Down to the far left (Illustration 6.) we find a child standing, listening to and looking at the whole. The child has positioned herself at a distance from the sound creatures and the other children, which gives her a better view and an opportunity to distinguish visually between the sound objects. There is a high probability that this child engages in causal listening (Chion, 1994 p. 25), which denotes a search for causal relationships where the listener looks for the sources of the sounds.

Since all the sound creatures always play their own background sound, and several sounds as soon as they are in motion, the total soundscape can at times be felt as overwhelming. A user can thus get a strong auditory experience just by listening and observing, before choosing to take more active action.

The above picture represents a situation with few simultaneous users inside the installation. The use of Auditomotion did vary. In 2021, considerations for infection prevention meant that only a smaller number of users were active at the same time. Somewhat paradoxically this resulted in conditions that enabled focused sound experiences. During Bergen International Festival in 2022 and 2023 the situation a was at times completely different, with up to 40 people inside the installation at the same time. Under such conditions all considerations related to sound design and thoughts about rhythmic composition are greatly reduced, and the mere physical qualities of the sound creatures become

dominant. The installation changes character and its use is strongly influenced by what can be characterised as collectivity (Hoem, 2021 p. 104). Collectivity can partly be about the individual audience's experience of taking part in something bigger, like how individual actions affect a whole and contribute to collective experiences. The result is procedural - unpredictable and context-dependent. In the case of Auditomotion, more constructive forms of collectivity can also arise when fewer users are active, while at the same time they form part of a form of cooperation, where they almost play Auditomotion together.

A limited number of users spent most of their time running around, diving into and pushing as many sound creatures in the shortest possible time. However, quite a few in the audience (both children and adults) stood still at various times, and as an observer one could see that the first, exploratory phase was often replaced by a use where the children were calmer and began to listen more actively to the various sounds.

## Experience – “Erlebnis” and “Erfahrung”

At the top right (Illustration 6.), two children are actively listening. The two seem to have reached a point and the kind of sound experience that Auditomotion is designed for, where the user becomes a conscious listener and takes interest in the sounds themselves. Even from this still image, one can sense the two children's curiosity in relation to what is hidden in the sound creature they engage. The curiosity leads to associations in the direction of Marcel Duchamp's À bruit secret (With Hidden Noise) (Duchamps, 1916), an object that can be heard, but where the source of the sound itself is hidden - hence the title. The two children partly engage in semantic listening (Chion, 1994 p. 28), referring to how sound can be interpreted, and how sounds can convey meaning and function as symbolic signs.

This and similar situations proved to be quite typical for those of the audience who spent some time inside the installation. Some groups spent less than 10 minutes, and in such cases relatively few children reached the stage of active listening. If active listening occurred in a short time, most often this was a result of direct encouragement from an adult. Far more interesting was when we were able to observe children who were able to spend more time inside Auditomotion. They too often rambled around the first three to five minutes, but eventually most of these children became more focused and began to explore the sounds. This led to a form of reduced listening (Chion, 1994 p. 29). Reduced listening is linked to the characteristic of the sound itself, the aesthetic properties of the sound, regardless of what is the source of the sound or the meaning that can be attributed to it (Chion, 1994 p. 29).

Some children naturally got bored and left the installation after a few minutes, but the one could repeatedly observe how active listening did spread in the somewhat smaller groups. As soon as one child starts listening actively, several of the others become curious. They either copy the behaviour, they come over and take part in the shared listening experience, and this spreads in the group. At this point in the listening process it also seemed as if many of the children became aware that they could initiate and influence the rhythms from the individual sound creatures. A recurring tactic was to push a sound creature and then quickly put the ear close, as we see the two in the picture.

The interplay between an environment and individual behaviour can be understood in relation to Gadamer’s view on aesthetic experiences, where the audience are active in the meaning making (Gadamer, 1986, p. 12). The audience developing their listening strategies inside Auditomotion can be

understood as an enhancement of the children's meaning making, in addition to giving them the experience of taking part in the creation of the work through collectivity. Gadamer distinguishes between Erlebnis and Erfahrung. ‘Erlebnis’ is something one experiences in the moment, like an event. ‘Erfahrung’, on the other hand, refers to an experience that leads to gained physical and/or intellectual knowledge (Gadamer, 1993, p. 353). Developing listening strategies in conjunction with physical movement within Auditomotion, and in interplay with others, the children can be said to develop their listening experience (Erfahrung) during continuous play and more immediate experience of the sounds (Erlebnins).

## Immersive experiences

Down to the right (Illustration 6.) we see a child who has spent some time inside Auditomotion, and this child has possibly found hir favourite sound creature. This particular creature, which we gave the nickname "Red Devil" because of the horns, was significantly larger than most of the children. The background sound is the sound of a frantic engine (a V8 engine revving up with an automatic transmission) that increases and decreases in strength. When the sound creature is moved it plays a relatively slow rhythm, at times a lot of bass. By virtue of the creature’s size, this sound creature invites to be climbed. The children who enter this sound creature can thus clearly feel the sound in the form of vibrations.

There is a clear interplay between haptic (tactile and movement) qualities, and the visual and the auditory, and the child can be seen to be immersed in the activity along all the four dimensions in the model presented in Illustration 4. Signs of cognitive and emotional immersion will be related to the observer's interpretations, but the children show clear signs of joy and active engagement. It seems evident that they use their senses and imagination when exploring the physical landscape created by the sound creatures. It is somewhat easier to be conclusive when it comes to the spatial and sensory-motoric parts of the immersive experience, as presented in the model. When it comes to spatial immersion, most of the children using Auditomotion were significantly smaller than the physical sound creatures, and the complete landscape of objects must be overwhelming from a small child’s visual and auditory perspective. Small children also need to acquire some physical skills and related tactics, to be able to manipulate the sound creatures.

How the body and the movement of the body affect the experience of sound has been central to the design of Auditomotion. One way of characterising how touch and movement affect the experience of sound can be described as haptic listening. This comes as an extension to Chions three categories (Chion, 1994), and haptic listening refers both to how sound creates movement and how movement affects sound. Michael Gallagher refers to these affective qualities of sound (Gallagher, 2015):

> Sound is often referred to as activating feelings and emotions /../, but I want to argue that sound itself is also a kind of affect – an oscillating difference, an intensity that moves bodies, a vibration physically pushing and pulling their material fabric.

The "playground"-metaphor proved to be fulfilling. But, as with any other play those who participate must be given time to let the play develop freely. The most interesting experiences were probably those children who came outside of a set timetable, together with grownups who had made a conscious decision that they wanted to visit Auditomotion. In such cases we observed children spending more than 30 minutes inside the installation and going through several phases of play and more systematic exploration.

## Concluding remarks

The design rationale that underlies Auditomotion, and the techniques used to produce the sound creatures, as well as compositional strategies and playback technology, all strive to create a direct and immediate auditive response as sound creatures are physically moved. The intention was open for transformational activities, and the potential connections between three-dimensional objects, touch and movements, both at a physical and a cognitive level. This also makes it more likely that unexpected situations and creations occur. This way the designers give some control to the audience, and the children become involved in the creational process through play, where the expressions that the children participate in creating can form a close relationship to the artistic work. Going through and taking part of an experience changes the participants' horizon of understanding. In Gadamer's words: "The experiencer has become aware of his experience: he is 'experienced.' He has acquired a new horizon" (Gadamer, 1993, p. 354). The dialogic interplay between those who have designed and created the Auditomotion, the work itself and the recipients, is important, as these elements communicate with and constitute each other.

I hope to have shown that the haptic interfaces of Auditomostion have the potential to expand the user's immersive experiences. Haptic listening, as physical movement of and with bodies, can be understood as an interdisciplinary foundation for creating and experiencing the immersive potential of sound. Other experiences are activated by haptic listening, compared to more distanced listening. Hopefully Auditomotion is a telling example of how sound installations can connect different levels of the physical vibrations, from what we can listen to, to the movement of objects and the body's perception of vibrations in matter.

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