



xCoAx 2021 9th Conference on
Computation, Communication, Aesthetics & X

2021.xCoAx.org

Sonic Imagination: Aural Environments as Speculative Artefacts

Keywords: Imagination, Multimodal Mental Imagery, Speculative Design, Artistic Research, Radio Play, Installation Art, Aural Environment, Binaural Audio

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The human imagination received a discursive gain regarding its societal and economic importance as a cognitive resource in the course of the 20th and 21st century. This situation motivated the emergence of imagination techniques of which we discuss several briefly in this paper. The various formations of 'speculative' strategies within art and design can be seen as a recent extension to this tendency. While such strategies are usually predominantly visual, we suggested in our earlier research and practice ('The Institute of Sonic Epistemologies') that aural techniques might be equally suited to stimulate the human imagination, since such approaches leave the visual senses open for mental imagery in the human mind. We found these early explorations to be fruitful and decided to further our understanding of the aesthetic, fictional and medial factors being at work when aural environments trigger the human imagination. Against this backdrop, the present article is a working paper on 'aurally induced mental imagery' that covers a literature overview of the neuropsychology of the human imagination and discusses an eclectic corpus of sound work, which we query for the above-mentioned factors.

1. The Societal Rise of ‘Applied Imagination’

According to the cultural scientist Jochen Schulte-Sasse, the human imagination was nearly always negatively charged in early philosophical theories for ontological, epistemological and moral reasons, and was fundamentally reassessed only in the course of the Enlightenment and especially in modernity (Schulte-Sasse 2001, 89). Human imagination, as a force that actively adds something to the existing and real, had been disciplined in the course of the modern era in the form of *design*, in the sense of a normative ability or cultural technique that was increasingly directed towards the improvement of our world condition (op. cit., 101). After the Second World War at the latest, the ability to imagine became a kind of cognitive resource of individual self-realisation, which gained importance in the creative industry of the emerging knowledge societies (cf. Reckwitz 2012). Imagination thus plays an important role today not only for the creativity of the design disciplines, but also for areas that depend on the speculative planning of not-yet-existing situations (Reuland 2010). Thus, also in the exact sciences, the ability to imagine and speculate is important for the development of new theories, as has been emphasised by various scholars (e.g. McLeish 2019 and Chico 2019). Among many other consequences, this societal and economic gain of importance of human imagination has led to the emergence of creativity and imagination techniques in the course of the 20th century, in particular after the Second World War (Mareis 2012 and Mareis 2016). Particular motors for this were the innovation-driven economy of modernity and the ‘Cold War’ between the USA and the Soviet Union, which lead military-industrial think tanks to develop ‘imagination techniques’, for example, to imagine the world after a thermonuclear war (cf. Erickson 2013). In the case of the forming creative industries, such ‘techniques of the self’ (cf. Möhring 2006) included morphological (Zwicky 1962) and bisociative (Koestler 1964, 663–666) synthesis methods, based on the systemic recombination of linguistic propositions in order to stimulate the imagination of the resulting entities. Additionally, communicative techniques such as ‘DELPHI’ (Dalkey 1969) or ‘War Gaming’ Kahn and Mann (1957) emerged from the context of military-industrial ‘think tanks’, which were intended to optimise interpersonal communication by means of behavioural rules and thus to promote the joint creation and synchronisation of imaginations.

Fig. 1. 'Three-Room Dwelling' (detail, about 1944–46), from the 'Nutshell Studies of Unexplained Death' by Frances Glessner Lee (Image: Collection of the Harvard Medical School, Harvard University, Cambridge, MA).



Even beyond capitalist value creation and military planning, remarkable methods for stimulating and training human imagination were developed throughout the 20th century. An example is the 'Nutshell Studies of Unexplained Death' – a series of twenty dioramas of murder scenes created by criminologist Frances Glessner Lee for educational purposes in the 1930s and 40s (see figure 1, cf. Lee 1952, Botz and Lee 2004 and Goldfarb and Melinek 2020). From 1945 onwards, these miniatures were analysed at Harvard University in seminars by trainees of criminology in order to discover clues about the course of past deaths and to derive explanations and motives from them (Uebel 2018, 125). However, according to Lee, these are "(...) not presented as crimes to be solved – they are, rather, designed as exercises in observing and evaluating indirect evidence" (Lee 2004, 24). Michael Uebel explains the continuing interest in such dioramas by the fact that the production of suspicious facts – in the sense of 'abductions', i.e. imaginations of plausible explanations – ultimately constitutes an essential aspect of human reason and is applied in a multitude of disciplines, from literary poetry and psychoanalysis to scientific theory formation (Uebel 2018, 125 in reference to Ginzburg 1989, Strowick 2005 and McKaughan 2008). Lee's dollhouses thus enable a 'feeling' for criminalistic situations through the intense imagining of sequences of events, since her models are constructed in a coherent and plausible way at the visual and material level, while nonetheless exhibiting a high degree of ambiguity at the narrative level. As 'atmospheres of imagination', such approaches show the potential of triggering and maintaining imaginations particularly well by offering ambiguous spaces of possibility.

As we can see, imagination is a foundation of all human cognitive activity that we think deserves to be inquired by foundational research from various disciplines. The recent interest in speculative strategies within art and design – probably most prominently so under the umbrella term of ‘speculative design’ (cf. Dunne and Raby 2013 and Zeller 2018) – can be seen as an exploration of new forms of engagement with ‘possible worlds’ by stimulating the human imagination through the creation of ‘speculative artefacts’. While such artifacts usually are created as models, props, prototypes and various types of imagery, we experimented with expanding these speculative approaches into the aural domain, investigating what it means to stimulate the human imagination by the use of various forms of sonic media in the context of speculative thought experiments.

2. ‘The Institute of Sonic Epistemologies’

As an experimental investigation within our earlier research, we inscribed the fictive ‘Institute of Sonic Epistemologies’ in a multi-functional event space in the basement of the House of Electronic Arts (HEK) in Basel, Switzerland in 2016 (see figure 2). The project used binaural techniques to create an augmented auditory space and aimed at exploring the fictional potential of aural environments as a new form of ‘speculative design’. Generally speaking, a two-channel sound reproduction is considered binaural if there are so-called ‘binaural cues’ in both channels, which are related to the anatomical nature of the human skull and which, by differentiating between the left and right channels, allow us to hear in three dimensions (cf. Blauert 1997).

Fig. 2. ‘The Institute of Sonic Epistemologies’ (2016) by Ludwig Zeller and Martin Rumori, installation view at the House of Electronic Arts in Basel, Switzerland (Image: Ludwig Zeller).



Conceptually, the project departed from the thought experiment that our visual forms of knowledge production may have only acquired their dominance as a result of socialisation processes. The project thus explored the following speculative questions: What if visual strategies lost their dominance in scientific analytics? And what if visually impaired people were therefore in advantage to non-disabled people because of their more sophisticated perception of sound?

In this context, two notions of sonic epistemologies were elaborated: firstly, a utilitarian perspective on sound that is common in scientific data sonification and interaction design. In this regard, sound is valued for its specific ability to inform epistemic exploration and reasoning. And secondly, from a fictional perspective, sound is understood as a way to relate to and transcend existing life-world experiences through multisensory storytelling. In relation to the latter, the project aimed to explore ways in which a physical space can be seamlessly overlaid with a fictive one.

The production included a series of impulse response measurements at the venue, binaural recordings of sound elements common to workshop situations, as well as studio recordings of voice actors. The installation staged an educational workshop in statistical data analysis using sonification. The visitors were invited to enter the space and witness the lesson. However, the actual narration was only accessible through listening with headphones. These were installed at five locations in the space, each offering a different spatial perspective combined with a progressing narrative. Using binaural technology and individual acoustic measurements in the exhibition space, visual and auditory elements were related to each other, with the augmented and the real space providing a congruent acoustic impression. The aesthetic experience of this augmented environment was intended to allow both the participation of visitors in a 'radio play'-like narrative and a kind of otherworldly distancing through the uncanny presence of the imaginary workshop participants.

We discussed the narrativity and fictionality of augmented auditory spaces and binaural sound in an earlier research paper Zeller and Rumori (2019). Still, we had more questions and wanted to better our knowledge of what mechanisms are exactly at play within works such as our 'Institute of Sonic Epistemology'. Therefore, the goals of our currently running project are (1) to broaden our understanding of the aesthetic, fictional and medial factors involved and (2) to conduct further lab and field experiments that take the notion of 'augmented auditory spaces' into urban open-air spaces by combining headphone-tracking with ambisonics-based binaural spatialisation. In the second half of this paper,

we will focus on goal (1) by (a) offering a brief literature overview in order to see what neuropsychology has found out about the stimulation of imagination through multimodal cues, and (b) a comparative discussion of three pieces by other authors and artists that make use of aural techniques to a varying degree. Our research aims at contributing to the expanding field of speculative strategies within art and design in specific, and the epistemology and aesthetics of aural environments in general.

3. The Neuropsychology of Imagination

Today's neuroscience and psychology regards imagination as a central aspect of human cognition and information processing (Singer 2011, 19). Through the power of imagination, human beings are able to remember past events (cf. Garry and Polaschek 2000), to anticipate or plan future events (cf. Moulton and Kosslyn 2009 and Gilbert and Wilson 2007), as well as to create entirely fictive worlds (cf. Taylor 2013, 792). According to Buckner et al. (2007, 50), the human imagination of future and counterfactual situations has been increasingly investigated at the intersection of psychology and neuroscience, where it is discussed using terms such as 'episodic future thinking' (Atance and O'Neill 2001), 'memory for the future' (Ingvar 1985), 'pre-experiencing' (D'Argembeau and Van der Linden 2004), 'mental time travel' (Wheeler et al. 1997) or 'simulation' (Decety and Grézes 2006). Wilson & Gilbert (2005) proof that imagining non-existent states can have direct effects in the now, since, for example, moral decisions depend to a large extent on envisioning their consequences in the sense of an 'affective forecasting' (Gaesser and Schacter 2014 and Amit and Greene 2012).

A recurring theme of such research is that imagination in general seems to be highly dependent on prior experience (Byrne et al. 2007) and is sometimes even negotiated as a kind of attenuated form of perception, since imagined entities are represented in brain areas of the early visual cortex (Pearson et al. 2015). Even as early as 1940 Jean-Paul Sartre (2004, 8ff) described imaginations as "quasi-observations" and discussed their similarities and differences to sensory perception in the here and now. Such findings support sensualist theories in the sense of a 'grounded cognition', which regard sensory experience as a prerequisite for any cognition (Barsalou 2010).

Furthermore, the ability to imagine varies from person to person (D'Argembeau and Van der Linden 2006), is generally subject to many different cognitive limits (Beardsmore 1980) and therefore cannot be regarded as completely 'free'. Memories may not be accessible in equal measures and can change or fade over

time while the synthesis of fictive entities regularly eludes our imagination. It is therefore a topical question of neuropsychology to what extent these limitations are also caused, for example, by the circumstance that imagination and vision partly take place in the same brain areas and thus compete for the same cognitive capacities on one hand and underly similar mental limitations on the other (Keogh and Pearson 2018). In a similar vein, phenomenological considerations concluded that seeing and imagining one and the same object are not possible at the same time (Casey 1976: 146). Additionally, the term ‘aphantasia’ has been introduced by Zeman et al. (2015) in order to discuss the phenomenon of having a poor or completely lacking ability of creating voluntary mental imagery in front of one’s ‘inner eye’, whereas ‘hyperphantasia’ oppositely describes the dominance of highly vivid visual imagery in some people (cf. Pearson 2019).

Lastly—and for our interest in aurally induced imagination most relevantly—the concept of ‘multimodal mental imagery’ in neuropsychology and empirical philosophy describes mental imagery “that is not triggered by corresponding sensory stimulation in a given sense modality” (Nanay 2018, 127). This applies to all kinds of sensory combinations, including for instance *smelling* something with your ‘inner nose’, when you merely see something, or—and this is the central interest of this paper—*seeing* something in front of your ‘inner eye’, when you only *hear* something. Bence Nanay gives the example of hearing somebody walking up a staircase, which can trigger olfactory or visual mental imagery depending on which person we identify or expect to approach us, e.g., a “stinky friend” would tend to provoke olfactory mental imagery (op. cit., 129). According to Nanay, multimodal mental imagery differs from ‘synaesthesia’ mostly in regards of the much higher “idiosyncrasy” of the latter: “In the case of synaesthesia, in contrast, the ‘correspondence’ is not based on repeated exposure of any kind of multisensory event (...). We do not encounter, let alone repeatedly encounter colours that have a certain specific pitch (and the same pitch in all contexts). So, synaesthesia is multimodal mental imagery where ‘correspondence’ is unusual” (op. cit., 130f), i.e. while synaesthetic couplings seem statistically odd and somewhat arbitrary, multimodal mental imagery in general activates associations that have been learned and memorised from repeated sensory experiences in the past. In this respect, Nanay appears to account for the currently predominant meaning of ‘synaesthesia’ as a phenomenon of neurodiversity, whereas the phenomenologist Maurice Merleau-Ponty used the term in a broader sense, closer to what Nanay calls multimodal mental imagery.

Nanay proposes that the induction of multimodal mental imagery can be used in certain psychotherapeutic treatments that rely on “imagery rescripting”, i.e. the positive revaluation of traumatic memories and associated imageries. But while evoking such imagery *voluntarily* can be difficult for many, inducing “multimodal mental imagery, on the other hand, could bypass these blocks and it could provide a more efficient way of interfering with the patients’ mental imagery, which is easier to control and to maintain” (op. cit., 131). In a way, we are trying to pursue a similar strategy in the context of speculative design and art, i.e. finding alternative ways to immerse oneself in thought experiments and their respective scenarios that are usually hard to grasp or to imagine and that could therefore benefit from rich, multi-sensory offerings.

4. Aurally Induced Mental Imagery in the Arts

Generally speaking, audio technology enables us to hear sounds that point to places different from the one we are located at or that make the given place appear different. Both effects can be productive to aurally induce mental imagery, but surprisingly this specific combination of sound and imagination has not received a lot of attention so far. A large part of the existing research on imagination in the field of sound concerns ‘listening before the inner ear’, i.e. the imagining of sounds themselves, initially related primarily to musical contexts (Copland 1952, Cook 1990) and closely linked to creativity research (Hargreaves, Miell, and MacDonald 2011). The broader understanding of sound beyond its musical manifestations is ultimately also carried out in this thematic area (see Grimshaw-Aagaard et al. 2019; Street 2019). Nonetheless, the notion of sound as a stimulant of imagination has been given attention in studies on radio plays and cinematic movies (Chion 1994; Verma 2012; Kane 2014; Chattopadhyay 2017) and occasionally in marketing studies regarding the creation of ‘brand imagination’ (Gustafsson 2019). In order to exemplify and clarify our notion of aurally induced mental imagery, we are going to discuss such effects in three works of art and fiction.

Fig. 3. Orson Welles directing a crew performing his radio adaptation of H.G. Wells's novel 'War of the Worlds' at a CBS studio in October 1938, New York City (Image: Bettmann/Corbis).



4.1. 'War of the Worlds'

A famous example of a radio play that is legendarily known for the imaginative effect it had on its audience is Orson Welles's radio adaptation of H.G. Wells's 'War of the Worlds'. The piece had to be performed live at CBS radio in October 1938 (see figure 3), which was common in the early days of popular radio broadcast due to the lack of magnetic tape recording. The roughly one-hour long radio broadcast created the impression that invaders from Mars are launching an actual attack on the United States of America and thus left many of its audience dazed in horror. Therefore, this is an early example for the extraordinary stimulative potential that sonic media can have on the human imagination. The play not only achieved this, because it abused the social institution of live radio news broadcasts that were still relatively new at that time and effectively became a sort of 'fake news' avant la lettre, or because radio was a wondrous new medium in general that the audience had not cultivated a lot of listening experience with yet. Instead, a central reason for its imaginative appeal – that by the way can still be intriguing to listeners today – lies in the use of sound in the absence of visual cues. Like any (fictional) medium, radio plays are co-constructed by their audience. But radio plays make use of sound not only for verbally communicating narrative expressions as it is the case with 'audiobooks' – instead radio plays use tonal qualities and atmospherical, spatial renditions in order to create

immersive, auditory spaces that are highly stimulative to the human imagination. As can be seen in the image, the live performance of ‘War of the Worlds’ actually resembled a theatre play, acoustically presented in front of the audience through the available technology of the 1930s, bridging the aural environment of the audience with both the studio space of CBS and the fictionalised places of the Martians’ attacks. Therefore, the imaginative power of radio plays cannot be fully understood by fictional and narrative studies alone but has to be queried from the perspective of sonic epistemologies and soundscape studies as well.

In contrast to our ‘Institute of Sonic Epistemologies’ project, where we placed an emphasis on approaches of ‘in-situ binaural audio’ that augment the auditory space of a given place by the use of spatial sound techniques, the ‘War of the Worlds’ was a one-channel, monaural production that obviously did not make use of multichannel or even binaural production techniques (although stereophonic and dummy head techniques were subject of vivid research at that time, regular mainstream stereophonic broadcast only started in the 1950s). While the horrifying alien sounds of the play for sure did ‘fill up’ the sitting rooms of the 1940s US-Americans, it did not do so in an encompassing, 360-degree sense of aural environment. We conclude that while technologically more advanced renditions of sound can often be beneficial for fostering immersive intensity, the aesthetic and narrative fictionality of the presented scene is just as important for creating a sense of immersive engagement.

Fig. 4. ‘Touched Echo’ by Markus Kison, Dresden, 2007 (Image: Unknown).



4.2. 'Touched Echo'

Our second example is another one-channel, monophonic audio production that immerses its audience without relying on binaural spatiality: the public space installation 'Touched Echo' by Markus Kison that confronted pedestrians in Dresden, Germany, with the horrors of the airstrikes in that city towards the end of the Second World War in 1945 (see figure 4). Using bone conduction – a way of feeding sonic vibrations directly into the inner ear that is also used for some hearing aid devices – the trespassers of a balustrade were able to listen to the piece simply by resting their elbows while firmly closing their ears, effectively creating a mechanical link between their skull and the electro-magnetic actuators that had been installed on the metal. Because of this acoustic principle the installation is only audible if the mentioned mechanical connection is established, effectively allowing to instantly switch between the actual acoustic environment of the listener standing at the balustrade in the here and now, and a sonic interpretation of the devastating air raid bombings that happened decades ago. Furthermore, the sounds are not rendered in high fidelity, but instead appear muffled and highly resonating because of the acoustical properties of the metal balustrade and the human body. Therefore, the overall impression is highly diffuse and appears as if being carried from a distant past. Sounds of plane motors and exploding bombs are smeared up to the point of being almost incomprehensible, creating an uncanny, dream-like listening situation.

Similar to the above-mentioned 'War of the Worlds', this epistemic ambiguity actually increases the imaginative atmosphere of the piece, allowing to feel empathy with the inhabitants of Dresden who must have been frightened by sounds that appeared just as haunting while bracing in their shelters. Since the audience of the sound installation has to take in a similarly protective posture, it could be argued that they become at the same time protagonists of a historical re-enactment of the Dresden bombings to the surrounding spectators, further increasing the intensity and immersivity of the piece.

But unlike 'War of the Worlds' – where the audience's environment was only augmented emotionally and semantically, but not immediately sensorially – this project is transforming the environment of the visitor in several ways: by covering the ears, the visitor swaps their actual sonic environment against a virtual one. In this context, the sounds of plane motors and exploding bombs can trigger visual mental imagery of military aircrafts, falling bombshells, burning houses and frightened people in shelters. In some cases, this does not only

conjure up sensations before the ‘inner eye’, but might even transform the visual perception of the physical surrounding, i.e. through embeddings of visual mental imagery within the environment of the listener. Presumably, most members of the audience have learned these images from repeated presentations in factual and fictional media such as documentaries and movies, while others might have experienced similar horrors in person and thus will be triggered to relive complex patterns of such experiences. Just as in the case of the ‘War of the Worlds’ this could also raise ethical questions in some situations. And finally, it could be explored in further research whether the specific, protective posture, which the audience has to take in, is eventually yet another multimodal driving factor of mental imagery by offering a mix of tactile (touch), vestibular (sense of balance) and proprioceptive (body perception) stimuli – something that could be studied in further research, since our current project focuses on aurally induced imaginations.

Fig. 5. ‘The Paradise Institute’
by Janet Cardiff & George
Bures Miller, 2001 (Image:
Markus Tretter).



4.3. 'The Paradise Institute'

Our last example is 'The Paradise Institute' by Janet Cardiff and George Bures Miller, a mixed media installation conceived for the Canadian pavilion at the Venice Biennale in 2001 (see figure 5). The visitors entered the reconstruction of a common cinema situation with rows of red velvet seats to sit on. In front of these seats the visitors saw the miniature reconstruction of a cinema hall in an exaggerated perspective as it is common in dioramas, the seats in front of them being sized smaller the further away they are in order to fake the appearance of distance. The miniature cinema screen showed a short film produced by the artists that could be listened to via headphones that were provided for each seat. Unlike commonly expected from situations where movies are watched with headphones on, the headphones used in the installation were not playing the direct audio track of the film, but instead a reproduction of that soundtrack that had been re-recorded in an actual movie theatre using binaural microphones. As a consequence of its binaural encoding and reproduction, the movie appeared to be embedded within a spatial reverberation that sounded correctly like a front seated situation in a cinema, including peripheral sound events that belong to the specific soundscapes of movie theatres, such as people flitting along the aisles, whispering to each or hastily trying to mute ringing cell phones. As a consequence, the visitors might feel the social presence of these invisible people, forcing many of them to adjust their sonic emissions as well. Similar to how restaurants are positive feedback systems that tend to get louder the more people are already talking (Blessner and Salter 2009, 10ff), cinema halls can be seen as negative feedback systems: the members of the audience are actively observing and regulating the sounds they emit, in order to obey a social etiquette that they mutually enforce upon each other. This created a fourfold intersection between the soundscape of the simulated cinema hall, the fictive space of the 'film noir' movie that is displayed within it, the physical cinema mock-up – and the actual gallery space of the Venice Biennale.

We used a similar effect for our 'Institute of Sonic Epistemologies', where a simulated lecture situation afforded an implicit collective constraint of not breaking the silence. The intensity of this situation was further amplified by having the fictive director of the institute stand close to the side of the visitor, whispering quietly in intimate proximity into their ear in order to not disturb the social code of the situation. Generally speaking, such affective impacts can clearly benefit from the presence and immersive intensity that binaural techniques offer in specific circumstances, which are taken to an extreme recently in so-called 'ASMR performances' (autonomous sensory meridian response).

5. Conclusion

We discussed a series of findings from philosophy and neuropsychology that present human imagination as a central faculty of human intelligence. Many of these positions see imagination closely connected to its temporal aspect, as attributions like episodic future thinking, mental time travel, pre-experiencing, or affective forecasting suggest. Another important point is the relation between imagination and sensory perception: both show activations in the same brain areas, imagination is understood as being based on prior empiric knowledge gained by repeated experience and mental imagery can be induced in multimodal ways through the various senses. Consequently, human imagination (and cognition in general) is highly constructivist and relativist in nature.

We elaborated that radio plays are rich in imaginative stimuli, since they present their fictive worlds without using visual cues such as images and instead make use of sonic cues that go far beyond the narrative speech known from audiobooks and fictional literature in general. We stressed the sensory asymmetry that radio plays carry by providing stimuli in mostly one domain, namely the auditory, and by making indexical use of sound while leaving the other senses to the recipient's current surroundings. We propose that addressing the multimodal nature of human perception in such asymmetrical ways may help inform imagery in the minds of an audience.

We expanded this idea to include works that conceptually draw from the artistic form of the environment, mainly installations, and we introduced examples of such 'radio play'-like installative work. Subsequent to our previously made claim we argued that the presence of invisible entities through sonic cues in emphatically spatial, multimodal arrangements has a highly stimulating effect on the human imagination. To conclude our argument, we focussed on the use of binaural audio in these works, a reproduction technique that can match the acoustic properties of the presentation environment, rendering sounds to appear to be 'in-situ' (cf. Barton and Windeyer 2012 and Eckel and Rumori 2014) of the spatial context of the listener. This technique allows to establish auditory spatial entities and phenomena that are plausibly congruent with the recipient's perceived surrounding but at the same time are only incompletely confirmed in the visual and other domains. We hypothesize that experiencing such conflicts in multimodal perception can enhance the human imagination in a special way, up to an almost uncanny sense of presence, immersion and hyper-realism within an augmented auditory space.

Our research aims at contributing to the expanding field of speculative strategies within art and design in specific by offering both new perspectives for further foundational research into the epistemology and aesthetics of speculating by the means of aurally induced mental imagery as well as exciting possibilities for new artistic work. In extension to Bence Nanay's proposal of using multimodally induced mental imagery in therapeutic contexts, we assume that the kind of design work that we outline in our research could potentially also contribute to the field of psychotherapy, if conducted in interdisciplinary settings.

6. Outlook

This paper summarizes some initial research efforts of our current research project, currently carried out at the Academy of Art and Design FHNW in Basel. One of our next steps will put above-mentioned neuroscientific concepts of imagination in a relation with contemporary discourses in aesthetics, namely those on aesthetic experience and atmosphere. Common theories of aesthetic experience (cf. Shusterman 1997) pursue the re-grounding of contemporary aesthetics on sensory perception rather than focussing on ever new theories of art or even callistic aesthetics centering questionable ideals such as 'beauty' or 'truth'. After having been introduced by John Dewey (1934/1980), major motors for the continued discourse about aesthetic experience in the second half of the 20th century are the emergence of conceptual art that cannot be explained by then prevalent art theories, and the observed increasing aestheticisation of everyday life. To us, both appear to be fruitful grounds for further investigating imagination in both applied and artistic contexts. Based on the same driving forces as for debates on aesthetic experience, Böhme (1993) proposed the term atmosphere as a basis for theories of a so-called 'new aesthetics' (not to be confused with James Bridle's 'The New Aesthetic'). Further understanding 'atmospheres of imagination' can be seen as a major goal of our research project. Additionally, we are currently preparing practical field experiments based on binaural auditory environments in order to gain empiric insights into the conditions, catalysts and obstructors of the human faculty of imagination in public urban spaces.

Acknowledgements. Our research is funded by the Swiss National Science Funds (SNSF 195868).

References

- Amit, Emit, and Joshua Greene.**
2012. "You see, the ends don't justify the means: visual imagery and moral judgment." *Psychological Science* 23 (8): 861–868.
- Atance, Cristina, and Daniela O'Neill.**
2001. "Episodic future thinking." *Trends in Cognitive Sciences* 5 (12): 533–539.
- Barsalou, Lawrence.**
2010. "Grounded cognition: past, present, and future." *Topics in Cognitive Science* 2 (4): 716–724.
- Barton, Bruce, and Richard Windeyer.**
2012. Immersive Negotiations: Binaural Perspectives on Site-Specific Sound. In: Birch, Anna, and Joanne Tompkins (Eds). *Performance Site-Specific Theatre. Politics, Place, Practice*. New York: Palgrave MacMillan, 182–199.
- Beardsmore, Richard.**
1980. "The Limits of Imagination." *The British Journal of Aesthetics* 20 (2): 99–114.
- Blauert, Jens.**
1997. *Spatial Hearing. The Psychophysics of Human Sound Localization*. Cambridge: MIT Press.
- Blessner, Barry, and Linda-Ruth Salter.**
2009. "The Other Half of the Soundscape: Aural Architecture". *World Federation Acoustic Ecology*, Nr. March 2009: 1–15.
- Botz, Corinne May, and Frances Glessner Lee.**
2004. *The nutshell studies of unexplained death*. New York: Monacelli Press.
- Buckner, Randy L., and Daniel C. Carroll.**
2007. "Self-Projection and the Brain." *Trends in Cognitive Sciences* 11 (2): 49–57.
- Byrne, Patrick, Suzanna Becker, and Neil Burgess.**
2007. "Remembering the past and imagining the future: A neural model of spatial memory and imagery." *Psychological Review* 114 (2): 340–375.
- Böhme, Gernot.**
1993. "Atmosphere as the Fundamental Concept of a New Aesthetics." *Thesis Eleven* 36 (1): 113–126.
- Casey, Edward S.**
1976. *Imagining: A Phenomenological Study*. Bloomington: Indiana University Press.
- Chattopadhyay, Budhaditya.**
2017. "Reconstructing atmospheres: Ambient sound in film and media production." *Communication and the Public* 2(4): 352–364.
- Chico, Tita.**
2018. *The Experimental Imagination: Literary Knowledge and Science in the British Enlightenment*. Stanford: Stanford University Press.
- Chion, Michel.**
1994. *Audio-Vision. Sound on Screen*. Columbia: Columbia University Press.
- Cook, Nicholas.**
1990. *Music, Imagination, and Culture*. Oxford: Clarendon Press.
- Copland, Aaron.**
1952. *Music and Imagination*. Cambridge: Harvard University Press.
- Dalkey, Norman C.**
1969. *The Delphi method: An experimental study of group opinion*. No. RM-5888-PR. Santa Monica: RAND Corporation.
- Decety, Jean, and Julie Grézes.**
2006. "The power of simulation: imagining one's own and other's behavior". *Brain Research* 1079, 4–14.
- D'Argembeau, Arnaud, and Martial Van der Linden.**
2004. "Phenomenal characteristics associated with projecting oneself back into the past and forward into the future: influence of valence and temporal distance." *Consciousness and cognition* 13(4): 844–858.
- D'Argembeau, Arnaud, and Martial Van der Linden.**
2006. "Individual differences in the phenomenology of mental time travel: The effect of vivid visual imagery and emotion regulation strategies." *Consciousness and Cognition* 15(2): 342–350.
- Dunne, Anthony, and Fiona Raby.**
2013. *Speculative everything: design, fiction, and social dreaming*. MIT Press.
- Eckel, Gerhard, and Martin Rumori.**
2014. "StiffNeck: The Electro-acoustic Music Performance Venue in a Box." In *Proceedings of the International Computer Music Conference*.
- Erickson, Paul, Judy L. Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturm, and Michael D. Gording.**
2013. *How Reason Almost Lost Its Mind. The Strange Career of Cold War Rationality*. Chicago and London: University of Chicago Press.

Gaesser, Brendan, and Daniel L. Schacter.
2014.. "Episodic simulation and episodic memory can increase intentions to help others." *Proceedings of the National Academy of Sciences of the United States of America* 111(12): 4415–4420.

Garry, Marianne, and Devon Polaschek.
2000. *Imagination and memory. Current directions in psychological science* 9(1): 6–10.

Gilbert, Daniel T., and Timothy D. Wilson.
2007. "Prospection: experiencing the future." *Science* 317(5843): 1351–1354.

Ginzburg, Carlo.
1989. "Clues: roots of an evidential paradigm". In *Clues, Myths, and the Historical Method*, 96–125. Johns Hopkins University Press: Baltimore.

Goldfarb, Bruce, and Judy Melinek.
2020. *18 tiny deaths: the untold story of Frances Glessner Lee and the invention of modern forensics*. Endeavour.

Grimshaw-Aagaard, Mark, Mads Walther-Hansen, and Martin Knakkegaard (eds.).
2019. *The Oxford Handbook of Sound and Imagination, Volume 1*. New York: Oxford University Press.

Gustafsson, Clara.
2019. "Sonic Branding: From Brand Image to Brand Imagination." In *The Oxford Handbook of Sound and Imagination*, Volume 1 edited by Mark Grimshaw-Aagaard, Mads Walther-Hansen, and Martin Knakkegaard. 359–376. Oxford: Oxford Handbooks.

Hargreaves, David, Dorothy Miell, and Raymond MacDonald (eds.).
2012. *Musical imaginations: Multidisciplinary perspectives on creativity, performance and perception*. Oxford: Oxford University Press.

Ingvar, David H.
1985. "Memory of the future: an essay on the temporal organization of conscious awareness." *Human Neurobiology* 4: 127–136.

Kahn, Herman, and Irwin Mann.
1957. *War gaming*. No. P-1167. Santa Monica: RAND Corporation.

Kane, Brian.
2014. *Sound unseen: Acoustic Sound in Theory and Practice*. New York: Oxford University Press.

Keogh, Rebecca, and Joel Pearson.
2018. "The perceptual and phenomenal capacity of mental imagery." *Cognition* 162: 124–132.

Koestler, Arthur.
1964. *The Act of Creation*. London 1964.

Lee, Frances Glessner.
2004. "Foreword to the Investigator." In *The Nutshell Studies of Unexplained Death* edited by Corrine May Botz, 47. New York: Monacelli Press.

Lee, Frances Glessner.
1952. "Legal Medicine at Harvard University." *The Journal of Criminal Law, Criminology, and Police Science* 42: 674–678.

Mareis, Claudia.
2016. "Angewandte Imagination und Kreativität um 1960. Eine Einführung." In *Designing Thinking. Angewandte Imagination und Kreativität um 1960* edited by Claudia Mareis. 9–38. Paderborn: Wilhelm Fink.

Mareis, Claudia.
2012. "Methodische Imagination. Kreativitätstechniken, Geschichte und Künstlerische Forschung." In *Kunstforschung als Ästhetische Wissenschaft. Beiträge zur Transdisziplinären Hybridisierung von Wissenschaft und Kunst* edited by Martin Tröndle and Julia Warmers. 203–241 Bielefeld: Transcript.

McKaughan, Daniel J.
2008. "From ugly duckling to swan: Charles S. Peirce, abduction, and the pursuit of scientific theories." *Transactions of the Charles S. Peirce Society: A Quarterly Journal in American Philosophy* 44: 446–468.

McLeish, Tom.
2019. *The poetry and music of science: comparing creativity in science and art*. Oxford: Oxford University Press.

Möhring, Maren.
2006. "Die Regierung der Körper. «Gouvernementalität» und «Techniken des Selbst»" In *Zeithistorische Forschungen* 3(2): 284–290.

Moulton, Samuel T. and Stephen M. Kosslyn.
2009. "Imagining predictions: mental imagery as mental emulation". *Philosophical Transactions of the Royal Society B: Biological Sciences* 364(1521): 1273–1280.

Nanay, Bence.
2018. "Multimodal mental imagery". *Cortex* 105. Elsevier Ltd: 125–34.

Pearson, Joel.
2019. "The human imagination: the cognitive neuroscience of visual mental imagery". *Nature Reviews Neuroscience* 20 (10). Springer US: 624–34.

Pearson, Joel, Thomas Naselaris, Emily A. Holmes, and Stephen M. Kosslyn.

2015. "Mental Imagery: Functional Mechanisms and Clinical Applications." *Trends in Cognitive Sciences* 19(10), 590–602.

Reckwitz, Andreas.

2012. *Die Erfindung der Kreativität: Zum Prozess gesellschaftlicher Ästhetisierung*. Berlin: Suhrkamp.

Reuland, Eric.

2010. "Imagination, Planning, and Working Memory: The Emergence of Language." *Current Anthropology* 51(1): 99–110.

Sartre, Jean-Paul.

1940/2004. *The Imaginary: A Phenomenological Psychology of the Imagination*. New York: Routledge.

Schulte-Sasse, Jochen.

2001. "Einbildungskraft/Imagination." In *Ästhetische Grundbegriffe* edited by Karlheinz Barck, Martin Fontius, Dieter Schlenstedt, Burkhard Steinwachs, and Friedrich Wolfzettel. 88–120. Stuttgart: Metzler.

Shusterman, Richard.

1997. "The End of Aesthetic Experience." *The Journal of Aesthetics and Art Criticism* 55 (1): 29–41.

Singer, Jerome L.

2011. "Imagination." In *Encyclopedia of Creativity* edited by Mark Runco and Steven Pritzker. 13–25. Amsterdam, Boston: Academic Press / Elsevier.

Street, Sean.

2019. *The Sound inside the Silence. Travels in the Sonic Imagination*. London: Palgrave Macmillan.

Strowick, Elisabeth.

2005. "Comparative epistemology of suspicion: psychoanalysis, literature, and the human sciences." *Science in Context* 18: 649–669.

Taylor, Marjorie.

2013. "Imagination." In *The Oxford Handbook of Developmental Psychology*, Volume 1: Body and Mind edited by P. D. Zelazo, 791–830. New York: Oxford University Press.

Uebel, Michael.

2018. "Corpus Delicti: Frances Glessner Lee and the art of suspicion." *Epidemiology and psychiatric sciences* 27(2): 124–126.

Verma, Neil.

2012. *Theater of the Mind: Imagination, Aesthetics and American Radio Drama*. Chicago: University of Chicago Press.

Wheeler, Mark A. et al.

1997. "Toward a theory of episodic memory: the frontal lobes and autonoetic consciousness." *Psychological Bulletin* 121(3): 331–354.

Wilson, Timothy D., and Daniel T. Gilbert.

2005. "Affective forecasting: knowing what to want." *Current directions in psychological science* 14(3): 131–134.

Zeman, Adam, Michala Dewar, and Sergio Della Sala.

(2015). Lives without imagery – Congenital aphasia. *Cortex*, 73, 378–380.

Zwicky, Fritz.

1962. *Morphology of propulsive power*. Pasadena: Society for Morphological Research.

Zeller, Ludwig.

2018. "The B1/B2 Manifesto: Refining Dichotomies in Post-utopian Design Research". In *Unfrozen – a Design Research Reader by the Swiss Design Network*, edited by the Swiss Design Network, 37–62. Zürich: Triest Verlag.

Zeller, Ludwig, and Martin Rumori.

2019. "The Institute of Sonic Epistemologies. Life-world Fiction within Augmented Auditory Space". In: *Acoustic Space Journal 17 - Virtualities and Realities – New Experiences, Art and Ecologies in Immersive Environments*, edited by Rasa Smite and Raitis Smits, 103–120. Riga: RIXC.