Sentire: A Participative Interactive Sound Performance

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Sentire is both an artwork and a research project in which proximity and touch are sonified with the aim to enhance body perception and social interaction. *Sentire* uses a digital system that mediates body movements and musical sounds, using a Body-Machine-Interface that allows two (or more) people to interact with one another in a physical environment—rather than in a virtual environment. The artwork consists of a participatory performance, which has been presented at numerous events since 2016. Distance and touch between the users can be measured and mapped to an algorithmic sound environment in real time. Through this multimodal experience, the awareness of the self and the other is enhanced on bodily, especially kinaesthetic levels, i.e. movement perception. Since 2019, *Sentire* has been also a research project at the Humboldt University of Berlin[1], with the aim to develop the system for therapeutic purposes.

Keywords Interactive sound, sound synthesis, real-time performance, algorithmic

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1. https://www.musikundmedien.hu-berlin.de/de/musikwissenschaft/systematik/projekte/sentire-soziale-interaktion-durch-klang-feedback

Background and Current State of the Project

Sentire is both an artwork and a research project in which proximity and touch are sonified to enhance body perception and social interaction. The artwork consists of a participatory performance, which has been presented at numerous events since 2016. A guiding performer invites the spectators (one at a time) to interact with her while wearing the bracelets for 6-10 minutes. The interaction develops either standing (with eyes open) or sitting (with eyes closed), but always in a non-verbal context.

Sentire uses a digital system that mediates body movements and musical sounds, using a Body-Machine-Interface that allows two (or more) people to interact with one another in a physical environment—rather than in a virtual environment (Rizzonelli et al. 2022). Distance and touch between the users can be measured and mapped to an algorithmic sound environment in real time (Hunt and Wanderley 2002). Through this multimodal experience, the awareness of the self and the other is enhanced on bodily, especially kinaesthetic levels, i.e. movement perception (Sigrist et al. 2013; Effenberg et al. 2016). *Sentire* makes it possible to experience proxemics in a dyadic nonverbal interaction through a multimodal system (space and sound).

The sensor system is based on capacitive coupling (Nath et al. 2021). Both participants are attached to the same electrical circuit through a bracelet and a cable each. This allows whole body proximity detection that overcomes the problems of other proximity detection systems (e.g. camera or infrared) dependent on sensor positioning and orientation. The detected distance is mapped to a specific set of sound parameters affecting the sound generation and sound design and it is called sound environment. The available sound environments offer different algorithmic sound configurations, ranging from spacey and atmospheric to percussive and rhythmic. The main aim of *Sentire* is to enhance the experience of getting close and touching another person (Rizzonelli et al. 2022, 9).

Since 2019 *Sentire* has been also a research project at the Humboldt University of Berlin[2], with the aim to develop the system for therapeutic purposes. Embodiment-based research serves as a conceptual framework to understand the relationship between attention towards one's own body and states of consciousness. Furthermore, the notion of musical social entrainment (Kim, Reifgerst, and Rizzonelli 2019) serves as a tool to interpret social interactive behaviours mediated by *Sentire*.

The effectiveness of the system is assessed with the methods of structured observation[3] (Robson and McCartan 2016; Bakeman and Quera 2011) and the micro-phenomenological interview technique[4] (Petitmengin 2006; Petitmengin, Remillieux, and Valenzuela-Moguillansky 2019). Between 2019 and 2020 we conducted some preliminary tests and a controlled experiment to investigate *Sentire*'s baseline effect compared to recorded sound and no sound. Since 2021

2. https://www.musikundmedien.hu-berlin.de/de/musikwissenschaft/systematik/projekte/sentire-soziale-interaktion-durch-klang-feedback

3. https://www.musikundmedien.hu-berlin.de/de/musikwissenschaft/systematik/projekte/sentire-soziale-interaktion-durch-klang-feedback/structured-observation-method-application-in-the-real-world-context-1

4. https://www.musikundmedien.hu-berlin.de/de/musikwissenschaft/systematik/projekte/sentire-soziale-interaktion-durch-klang-feedback/the-microphenomenological-interview-technique

a real-world study for couple therapy has been investigating how *Sentire* can be effectively used for such a purpose.

In the field of *Human-Computer Interaction (HCI) research*, incremental and iterative development of the *Sentire* software and hardware is currently being carried out. This includes a wireless version of *Sentire* that allows more freedom of movement for the participants and therefore increases the usability in different contexts.

Performance

Sentire goes beyond one-way performance insofar as the participant does not carry out pre-specified actions but can freely engage physically and emotionally with his or her interaction partner. Previous participants reported (in microphenomenological interviews conducted by the first author[5]) an intimate connectedness to the partner, to touch, hearing and proprioception (i.e., the awareness of one's body in space). The empathetic possibilities of touch, in particular, often go unnoticed in our attention-poor world concerned with images and screens.

Participants become playfully attuned to their gestures and somatic rhythms because they directly cause unplanned variations in the sound environment as they unfold within the performance space and in relation to the other participant.

The sound environments are designed to immerse the interacting persons smoothly and naturally in the sound, while also giving them agency and control over the rhythmic, harmonic and timbral dimensions of the audio output. Each performance becomes, therefore, a unique improvisational event that emerges from the singular somatic states stimulated by the relations to another body, specific space and the responsive sound environment.

The interaction design focuses on awareness of closeness and touch between participants. At a distance of about three metres, the sound becomes hearable. The closer the participants are, the more intense (e.g. louder, higher in pitch) the sound becomes, enhancing the act of approaching each other. When the participants touch each other, an extra percussive sound—which has a similar sound quality to the proximity sound—is triggered.

This interactive sound system creates a so-called perception-action loop (Tajadura-Jiménez et al. 2018). The participants are influenced by the external reality, including the generated sound; simultaneously, they are affecting the sound through their interaction. What is specific to the *Sentire* system is 1. the fact that the generated sound is affected by the behaviour of both participants and 2. the possibility to digitally design real-world proxemics (McArthur 2016) based on how the detected proximity signal is mapped to the sound generation.

5. Some relevant quotes: "There was a moment when I could not distinguish anymore who does what. It became a melting experience.", "This is about what is happening here and now."

Outlook

In 2022, the team of *Sentire* is focusing on two main tasks: the research about how *Sentire* affects human interaction and the hardware and software development of the system.

Understanding the effects of *Sentire* on human interaction can give insights on how to change the design of *Sentire* for both therapeutic and artistic usage. This information is valuable for the actual use of the system (for performers, therapists, users) and for extending the features of *Sentire*. We are currently investigating the use of neural networks to recognize interaction gestures and sonify them accordingly. Another relevant future development is the recognition of the so-called quality of touch, as it would allow to sonify different kinds of touch events, such as multiple fingers touching and pressure.

Finally, artistic development is underway, together with the project *pop-up institute*[6], which aims to reduce the stigma of mental illness through art therapy. Different kinds of artists (visual, performative, and sound artists) are involved in this project to create an exhibition and performance space in June 2022 with different media. A specific sound environment for *Sentire* is currently being developed using pre-recorded voices from neuro-diverse persons.

6. https://www.kunsthochzwei.com/en/the-pop-up-institute/

Website: https://sentire.me/
Video: https://vimeo.com/317080128

References

Bakeman, Roger, and Vicenç Quera. 2011. *Sequential Analysis and Observational Methods for the Behavioral Sciences.* Cambridge University Press.

Effenberg, Alfred O., Ursula Fehse, Gerd Schmitz, Bjoern Krueger, and Heinz Mechling. 2016. *"Movement Sonification: Effects on Motor Learning beyond Rhythmic Adjustments." Frontiers in Neuroscience* 10. https://doi.org/10.3389/fnins.2016.00219

Hunt, Andy, and Marcelo M. Wanderley. 2002. "Mapping Performer Parameters to Synthesis Engines." *Organised Sound 7* (2): 97–108. https://doi.org/10.1017/S1355771802002030

Kim, Jin Hyun, Andres Reifgerst, and Marta Rizzonelli. 2019. "Musical Social Entrainment." *Music & Science* 2 (January): 2059204319848991. https://doi.org/10.1177/2059204319848991

McArthur, John A. 2016. *Digital Proxemics.* Bern, Switzerland: Peter Lang. https://www.peterlang.com/view/title/23055

Nath, Mayukh, Shovan Maity, Shitij Avlani, Scott Weigand, and Shreyas Sen. 2021. "Inter-Body Coupling in Electro-Quasistatic Human Body Communication: Theory and Analysis of Security and Interference Properties." *Scientific Reports* 11 (1): 4378. https://doi.org/10.1038/s41598-020-79788-9

Petitmengin, Claire. 2006. “Describing One’s Subjective Experience in the Second Person: An Interview Method for the Science of Consciousness.” *Phenomenology and the Cognitive Sciences* 5 (3): 229–69. https://doi.org/10.1007/s11097-006-9022-2

Petitmengin, Claire, Anne Remillieux, and Camila Valenzuela-Moguillansky. 2019. “Discovering the Structures of Lived Experience.” *Phenomenology and the Cognitive Sciences* 18 (4): 691–730. https://doi.org/10.1007/s11097-018-9597-4

Rizzonelli, Marta, Jin Hyun Kim, Pascal Staudt, and Marcello Lussana. 2022. “Fostering Social Interaction Through Sound Feedback: Sentire.” *Organised Sound*, February, 1–13. https://doi.org/10.1017/S1355771822000024

Robson, Colin, and Kieran McCartan. 2016. *Real World Research*. 4th Edition. https://www.wiley.com/en-va/Real+World+Research%2C+4th+Edition-p-9781118745236

Sigrist, Roland, Georg Rauter, Robert Riener, and Peter Wolf. 2013. “Augmented Visual, Auditory, Haptic, and Multimodal Feedback in Motor Learning: A Review.” *Psychonomic Bulletin & Review* 20 (1): 21–53. https://doi.org/10.3758/s13423-012-0333-8

Tajadura-Jiménez, Ana, Aleksander Väljamäe, Frédéric Bevilacqua, and Nadia Bianchi-Berthouze. 2018. “Principles for Designing Body-Centered Auditory Feedback.” *In The Wiley Handbook of Human Computer Interaction*, 371–403. John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118976005.ch18