[~] The Emotional Space

Interactive Audio-Visual Art Installation

An Exposé by Noah Rachdi

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Supervisor: Johannes Zmölnig

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University of Applied Sciences

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"The Emotional Space describes a room that reacts at least as much to the mood of its visitors as the other way around."

Concept

The Emotional Space should be a room of small to medium size, fully enclosed, rather dark and entered through a door or thick curtain. Before entering, each visitor needs to put on a small wristband, shaped like a watch, that is equipped with at least an accelerometer, a gyro sensor and a wireless module that sends the sensor data in real-time to a host unit. Inside the room, an ambient light installation, together with several design-wise fitting objects to sit or lie on, create a cozy and inviting first visual impression.

At the same time, the almost empty room will be drenched in a calm but immersive soundscape, comparable to a pad, with various scattered noises to create enough listening variety. Each of the worn wristbands will have one or more delicate but distinct influences on the soundscape. This could be a percussive instrument that got introduced with a new visitor, which reacts to the steps and high-acceleration movements of said visitor. Or the movements could control effect parameters of instruments or even the whole soundscape. While it should not be immediately obvious in what way one influences the soundscape, the outcome should be distinct enough for one to be able to figure it out.

Furthermore, the full soundscape will react to the number of visitors and their amount of movement in the room. A full-on dance-session should be as possible to achieve organically as an interactive jam-event or even just a slightly reactive ambient listening sitting with visitors lying around while enjoying the soundscape. While the sound will be developed as a main attraction, the light installation should be just as important for the atmosphere. However, the room should stay free of "Do's and Don'ts" and become the unique experience that visitors make of it.

Method & Scope of Duties

An audio-visual installation like *The Emotional Space* has a wide-ranged area of tasks and provides the opportunity to choose preferred focus points. Below, I provide a short description of the identified components within this project according to my vision. But before discussing the separate elements, I would like to lay out a more general view of my duty during the development of an installation like this.

I think the conceptual design phase was extremely important and will keep its importance throughout the whole project. The installation is supposed to meet a certain artistic vision that I defined, which I need to keep evident over the course of the duration of the project. Now that I am getting into the experimental phase, it is all too easy to get lost in the wonders of sound and technology and drift away from my original vision or goal. While I clearly don't want to artistically limit myself, I will make sure that deviations from my current plan are not made without good cause and always well reflected on.

Wristband Setup

First and foremost, the wristbands should provide a simplistic way to sense visitors' motions with high accuracy but low latency. Additionally, they should not be too big and look at least somewhat aesthetically pleasing, since they make out a big part of the experience. I originally considered building them myself, with small micro controllers, sensors, and a wireless module. However, I was still happy to have found ready-to-buy options that fit perfectly into the concept. My first choice would fall on the SINK2.4 or the SOMI-1 devices of *Instruments of Things*. Therefore, I can direct my focus and resources to other components that I see as more essential.

Host Setup

The host setup refers to the device receiving all the data from the wristbands. The complexity of the setup completely depends on the choice of wristbands and their communication possibilities. Depending on the interfacing possibilities, it might have required a specific wireless module to be able to communicate with the wristbands, while most ready-to-use options come with a module that has a USB interface. Since I will most likely decide for the latter option, also this area of electronics is not one that I plan to spend much time on.

Wristband-Host-Communication

Similarly to the host setup, also this field completely depends on the choice of wristbands. Finding a suited transmission technology and protocol are crucial for *The Emotional Space*, and getting the communication to work perfectly from scratch with low latency is a challenging task that I prefer not to go into deeply during this project.

Sensor Data Processing

As soon as the sensor data from the wristbands arrives safely at the host, it needs to be processed before it can be used in the following steps. This means mapping it to suitable values, but also defining events based on certain sensor data. Tolerances to differentiate slow from fast movements will need to be set, step-detection might need to get coded and various other events that should trigger soundscape changes have to be extracted from the continuous flow of data. The outcome will be a set of data points per wristband that can be directly fed into the generative logic.

Generative Logic

The generative logic will be the heart of the sound installation and one of my big focus points and challenges at the same time. It will control the whole interactive and generative aspect of the soundscape. The goal is to create the logic in such a dynamic way that the chosen effects, sounds and instruments work completely independent by merely getting fed values. In the best case, this should allow me to even hot-swap instruments and sounds.

The logic component will be solely responsible for the arrangement of the soundscape. Its inputs will consist of all the preprocessed sensor data and its outputs will consist of several audio parameters (play/pause, volume, effect 1, effect 2, …) for each track that will be played, which are then fed into the instruments. Certain features I currently have in mind that I would like to explore are rhythm-detection in movements, finding a good way of making any soundscape rhythmical and musical without forcing interactive elements too much into a beat grid, letting the soundscape evolve on its own - even without visitors or interaction and creating a good energy flow based on visitor number and movement activity.

Effect-, Instrument- & Sound-Choices

Choosing the right instruments and sounds and working out which effects to use to which extent will also be a challenging part of the project. Each composition of instruments, sounds and effects must be extremely compatible, so the generative logic can freely mix up each instrument and sound with any other. I am still undecided, if the choice of musical key to play in will happen within the generative logic (and communicated via midi notes) or will be part of the instrument and sound component.

Room/Exhibition Design

The area of designing the room as well as the visitor experience is also a very crucial part to achieve my vision. Visitors should feel comfortable and as unrestrained as possible within the room, which requires much thought on that end.

Decoration & Furniture Design

While I would very much like to be involved in planning the decoration and furniture, I can very well imagine collaborating with someone in this field, since this is neither my expertise, nor a focus point. However, as I imagine the room currently, the walls should be dark and non-attention-grabbing (depending on the light installation). The furniture pieces should not take up too much space and be as much design elements as they provide a comfortable place to sit or lie on.

Light Installation Design

I have no specific vision for the light installation at this point, but I also want to keep it rather subtle - making the sound, other visitors, and oneself the main focus in the experience. However, I am very open for other ideas and see this as a great opportunity for a collaboration. All the available motion and audio data could also pose as great input for interactive lighting.

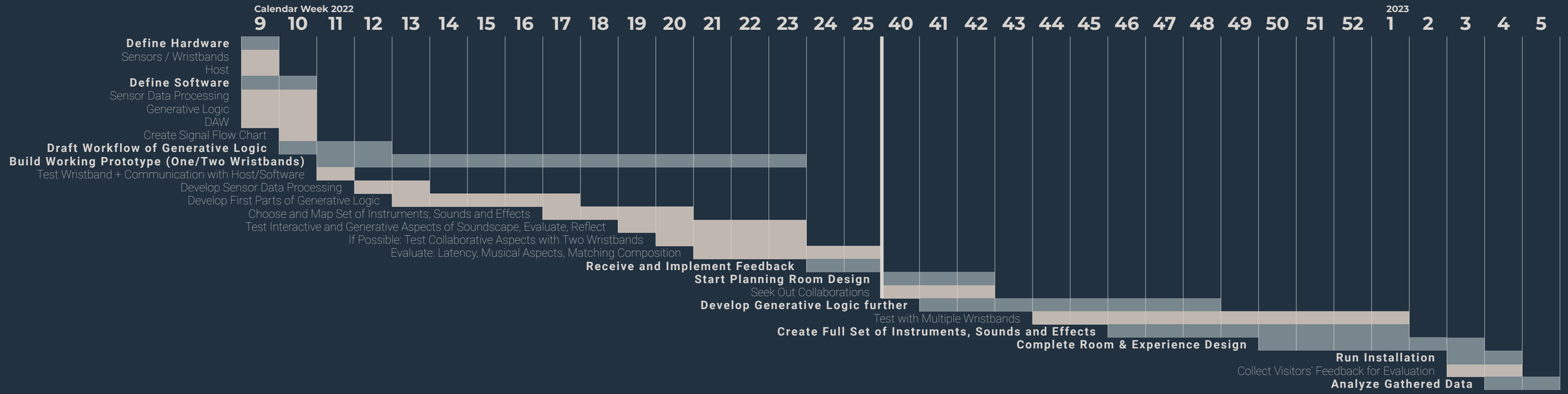
Audio Equipment Choice

The choice of an audio system will largely depend on the available room and the obtainable equipment. I would prefer the room to not have a specific directional alignment, so visitors feel comfortable walking around and facing any direction. An ambisonics system might bring in a little too many additional parameters though, which is why I currently prefer to create a two-channel installation.

Documentation & Post-Research

Scientific documentation is naturally also a substantial part of the project. However, another reason for mentioning this component lies in my interest in the further possibility for social research that this installation provides. Next to the recorded soundscapes, also motion data from all visitors will be available, which might after analysis already lead to interesting insights. Possible questions could be “To what extent does the choice of sounds influence visitors’ movement behavior?” or “How much does controlling a certain instrument increase a visitor’s movement activity?”.

Schedule


Calendar Week 2022
2023
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 40 41 42 43 44 45 46 47 48 49 50 51 52 1 2 3 4 5
Define Hardware
Sensors / Wristbands
Host
Define Software
Sensor Data Processing
Generative Logic
DAW
Create Signal Flow Chart
Draft Workflow of Generative Logic
Build Working Prototype (One/Two Wristbands)
Test Wristband + Communication with Host/Software
Develop Sensor Data Processing
Develop First Parts of Generative Logic
Choose and Map Set of Instruments, Sounds and Effects
Test Interactive and Generative Aspects of Soundscape, Evaluate, Reflect
If Possible: Test Collaborative Aspects with Two Wristbands
Evaluate: Latency, Musical Aspects, Matching Composition
Receive and Implement Feedback
Start Planning Room Design
Seek Out Collaborations
Develop Generative Logic further
Test with Multiple Wristbands
Create Full Set of Instruments, Sounds and Effects
Complete Room & Experience Design
Run Installation
Collect Visitors' Feedback for Evaluation
Analyze Gathered Data

Hypotheses & Evaluation

From my vision for the installation and the scope of duties I discussed above, I derived several working hypotheses which should further guide me in this project.

(H1) The generative and interactive soundscape of the installation *The Emotional Space* is ever changing due to the movement and the number of visitors, among other factors, which contributes to a unique experience for every visitor.

(H2) The soundscape reacts with no noticeable latency to visitors' movements while remaining in a musical and rhythmical domain.

(H3) The different elements within the soundscape feel like a matching composition, even when the maximum number of visitors are actively participating.

(H4) The installation invites its visitors to interact with each other.

(H5) Visitors feel invited to move as little or as much as they want to within the installation.

The defined hypotheses should cover the most important technical and artistic aspects of this project. I additionally defined a scheme to guarantee the verifiability of each hypothesis:

(H1), (H2) and (H3) can be tested through evaluation by a supervisor, as well as visitor feedback. Both will lead to strongly subjective results, but given the hypotheses' framing, this should also suffice in a scientific context.

(H4) and (H5) have to be evaluated through visitors' feedback, using quantitative methods, like a quick survey after participation.

Moreover can (H1) and (H2) be used as an evaluation criteria for the end of the second phase of the project, when the prototype is finished. Also the schedule of the project offers itself as an additional evaluation criteria.

Reference Works

The growing field of interactive installations often explores "social, political and experiential boundaries of digital interfaces [while it] manage[s] to break traditions, ask new questions and explore new venues", according to Nam & Nitsche (2014). During my literature research, I used several connection points on which base I compared my concept and reference works. Among those connection points were the implemented technology, the interactive aspect, the collaborative aspect, the musical goal, and the artistic vision. I will discuss the similarities of four of the discovered works in more detail below.

The installation "Cross-Pollination" by Tom Davis (2008) consists of inherently different technology and strives to create "real-world manifestations of computer based simulations". Even though there is no direct topical relationship recognizable between his installation and my concept, I can clearly sympathize with his striving to create a system that is not isolated from the complex nature of reality. He also makes a point about the individuality of art installations and how the meaning of a medium in that frame does not lie in the installation or the medium itself, but rather in the relationship between the installation, the visitor and the environmental context. I can draw parallels to this statement in my wish to create unique experiences, more than creating an object.

"HUM" is an interactive and collaborative art installation by Filatriau & Zajéga (2009). It uses motion tracking with a camera to create sounds and visual images in real time. While it focuses on different timescales and creating long-time trends by collecting data from visitors, there are several points that clearly align very well with visions and goals of *The*

Emotional Space. In the artistic vision of "HUM", Filatriau & Zajéga (2009) state that the "aim, and unique criteria of quality, is to increase the energy freed by the visitor by encouraging him to go out of standard behavioral schemes. […] The visitor is thus both creator and spectator, guiding and guided by HUM". While in *The Emotional Space*, I do not necessarily want to encourage the visitor to do anything she does not want to, energy is still a major factor within the concept. The sound rendering for "HUM" was done in several layers, where some were modulated by the number of visitors and their movements, similarly to what I plan to implement in this installation.

"LoopJam" is the name of an installation by Frisson et al. (2010), that allows participants to create a collaborative musical composition by interacting with a sound map through their movements, which are tracked by a vision tracking system. While this could rather be classified as a collaborative music instrument, there are still some aspects that *The Emotional Space* could draw inspiration from. Specifically, the tempo adjustment based on the participants' movements, the synchronization of sounds to a common tempo and the automatic alignment of sounds with the rhythmic pattern.

Another installation that I draw inspiration from is the "Sound Forest" by Bresin et al. (2016), which consists of room-high light-emitting strings that can be plucked and lead to electronically played sounds. What I like to take away from this installation is its collaborative aspect, as well as the non-requirement for prior knowledge to participate in it (Frid et al., 2019). It also serves as a long-term installation, which introduced the need to create an installation that encourages visitors to come back for further exploration.

Whether or not those works are technically closely related to *The Emotional Space*, I clearly can draw much inspiration from various aspects of them while also my choice of reference works might clarify my vision for this project.

Conclusion

The Emotional Space represents an interdisciplinary project with a focus on sound design. Next to the technical challenges of working with wearable wireless sensors during an audio-visual installation, also the artistic vision and the possibilities for additional psychological research promise not only a personally interesting project, but hopefully also a scientifically valuable outcome.

References

Bresin, R., Elblaus, L., Frid, E., Favero, F., Annersten, L., Berner, D., & Morreale, F. (2016). Sound Forest/Ljudskogen: A Large-Scale String-Based Interactive Musical Instrument. Sound and Music Computing 2016, 79–84.

Davis, T. (2008). Cross-Pollination: Towards an aesthetics of the real.

Filatriau, J. J., & Zajéga, F. (2010). HUM, an interactive and collaborative art installation. In Proceedings of the 18th ACM international conference on Multimedia (pp. 1429-1432).

Frid, E., Lindetorp, H., Hansen, K. F., Elblaus, L., & Bresin, R. (2019). Sound Forest: Evaluation of an accessible multisensory music installation. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-12).

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An Exposé by Noah Rachdi

Frisson, Christian, Dupont, Stéphane, Leroy, Julien, Moinet, Alexis, Ravet, Thierry, Siebert, Xavier, & Dutoit, Thierry. (2012). LoopJam: turning the dance floor into a collaborative instrumental map. Proceedings of the International Conference on New Interfaces for Musical Expression. https://doi.org/10.5281/zenodo.1178255.

Nam, H. Y., & Nitsche, M. (2014). Interactive installations as performance: inspiration for HCI. In Proceedings of the 8th International Conference on Tangible, Embedded and Embodied Interaction (pp. 189-196).

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