To Touch or not to Touch?
Differences in Affordance Resonating with Materialities. Hard and Soft Sensors embedded in an Artistic Research Setting

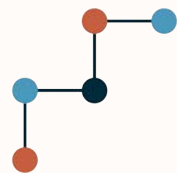Jonas Kellermeyer, Jan Torpus, Sophie Kellner, Cedric Spindler

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Based on the artistic research project *"Paradigm of Ubiquitous Computing"*

Project type: Humanities, Fine arts. Project duration: 2019-2023

Website: www.ubicombs.ch

Interdisciplinary Team:
Jonas Kellermeyer: media theory, concept
Sophie Kellner: concept, artistic implementation, HW development
José Navarro: HW/SW development and management, audio design, interaction design
Thomas Ryser: evaluation design
Cedric Spindler: SW/HW development, evaluation design, data analysis
Jan Torpus: project management, concept, interaction design, grant application
Christiane Heibach: project partner (Uni Regensburg), grant application

Research Questions – Research Approach

To Touch or not to Touch?
Differences in Affordance Resonating with Materialities. Hard and Soft
Sensors embedded in an Artistic Research Setting

"What impact do furniture, dramaturgy, and interaction design have when it comes to investigating human appropriation processes and attitudes in unknown staged responsive spaces?"

"What appropriation strategies are afforded and what cognitive and emotional impact can be observed?"

"In which situations do the participants feel either in control of or controlled by the environment and how does this influence their judgment?"

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Theory and Related Work

Our research is situated in a theoretical field of tension between:

Science & Technology Studies (HCI, Ubiquitous Computing, Techno-Social Hybridity),

Design Research (User Experience, Critical and Speculative Design, Sense-Making),

cognitive ventures (Environmental Psychology, Conceptual Metaphorology), as well as

(post)structuralist philosophical endeavors (e.g. Deleuzo-Guattarian notions of Smoothness vs. Straitedness)

experimental encounters with aesthetics (e.g. Theories of Atmospheres).

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Material Setup, Dramaturgy and Interaction Design

The installation *"Ubicombs"* introduces the visitors to the techno-social hybrid state that is assumed to be a central pillar of our contemporary state of existence.

By designing and implementing technological sensor-actor-systems that allow for a situative coupling with the respective users, *"Ubicombs"* offers a playful gateway to the deeply mediatized realm of hybridity.

It is an immersive journey that translates between a curious user and a vigilant technological system and that, just like any other journey, may be perceived as an end in itself.
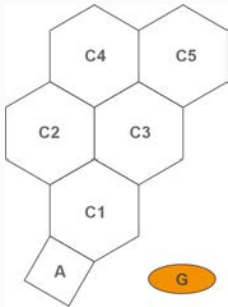
In order to go in depth and answer the specific research questions of this paper, we decided to focus on the garment and only two of the five spaces that were most suitable: *"SciFi"* and *"Mycelium"*.
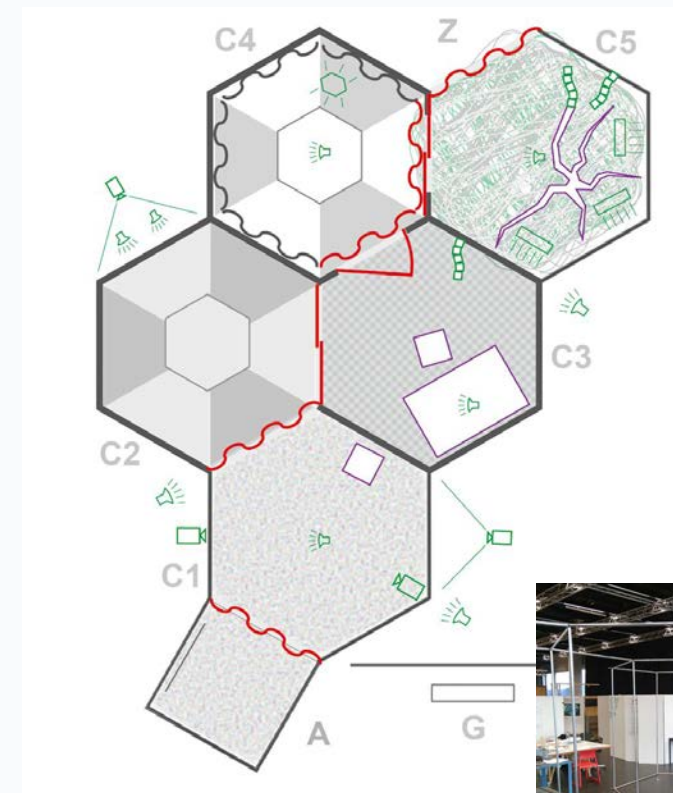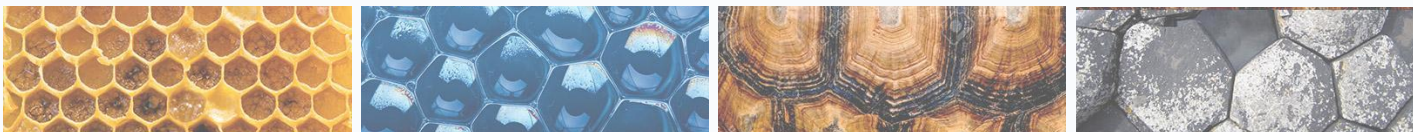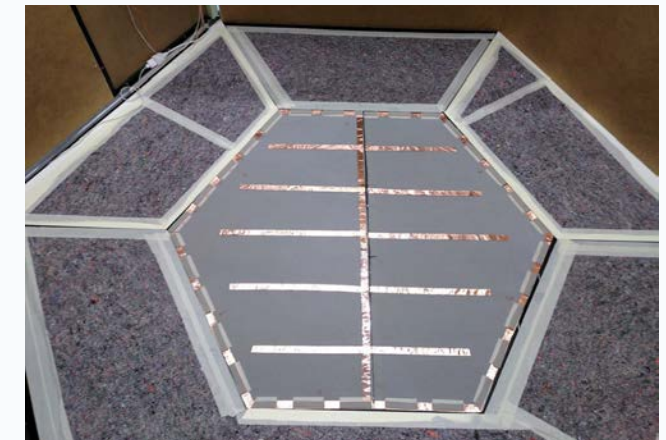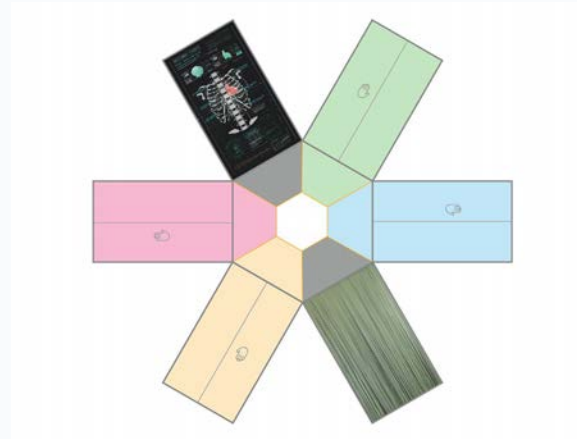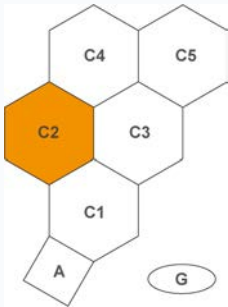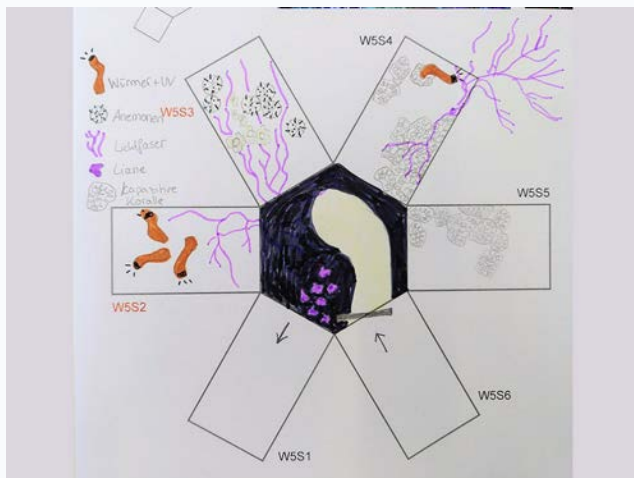
360° walkthrough

The Garment

Room *"SciFi"*

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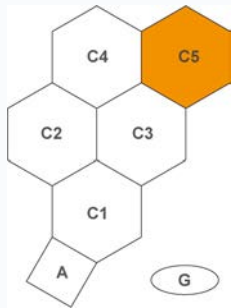
Room *"Mycelium"*

Sensor-actuator system

We developed a sensor-actuator system (Max/MSP).

Sensory measurement (technical perspective)

A position and motion tracking system (UWB, "Pozyx") was setup to capture the visitors' position, velocity and inertial data like head movement and direction of view.

Various sensors are integrated into the scenes: capacitive, pressure, distance, weight, etc.

Galvanic Skin Response (GSR): a finger ring is integrated into the garment that the subjects put on for the evaluation. It measures the skin conductivity and thereby psychophysiological reactions (arousal) of the subjects during the entire run.

Sensor-actuator system

<u>Processing</u> (technical perspective):
- Cybernetic circuits, energy source, network (WiFi, ethernet), processors (Arduino), …
- Data filtering and cleaning
- Rule-based decision making (AI in second experiment)
- Data collection
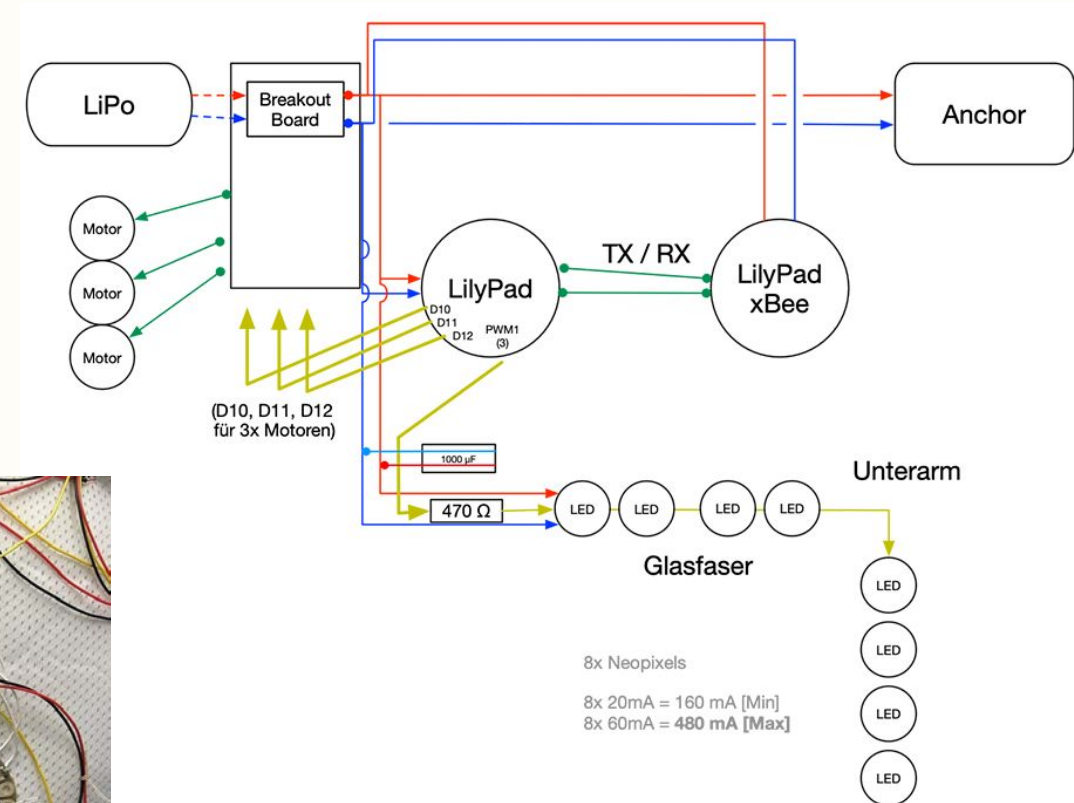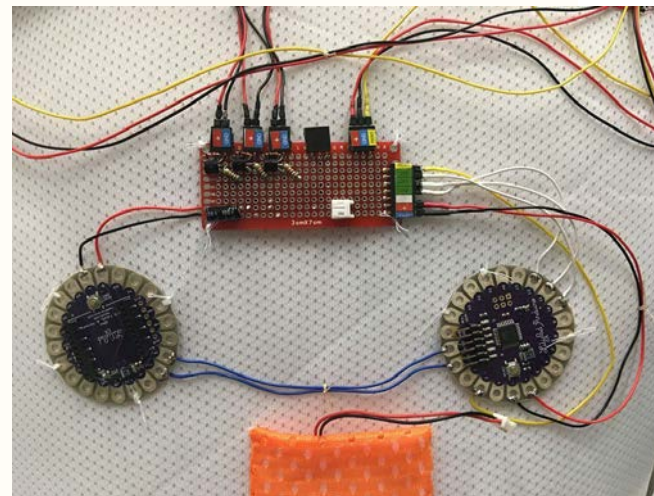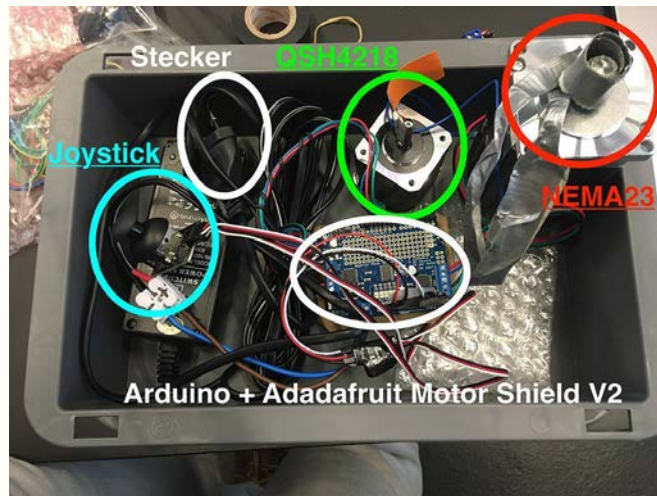
Sensor-actuator system

Data collection and representation (<u>actuators</u>):

- collecting sensor data for analysis

- feeding the processed data back into the installation, by mapping it
  to distinct parameters of the actuators (e.g. light, sound, video,
  motors) converting the installation into a responsive environment.
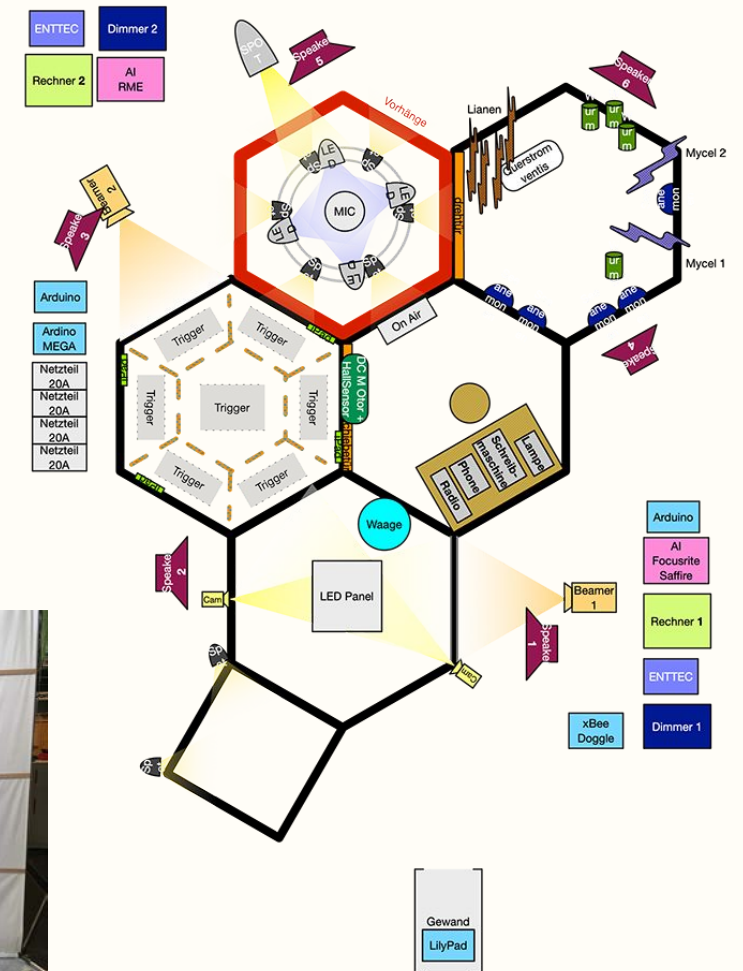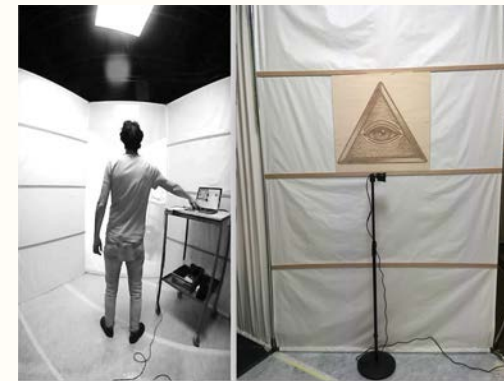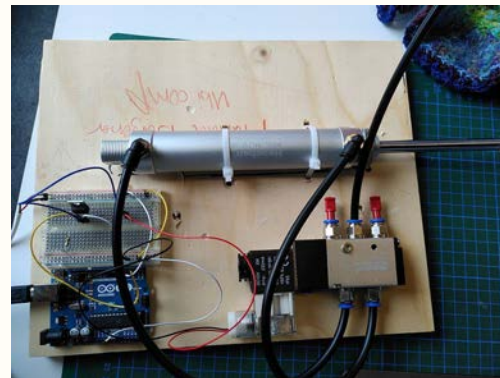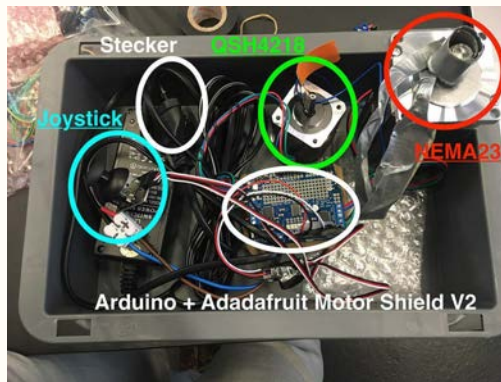
Soft Sensors

The emergence of soft technology that appears snug and that resembles something you actually want to touch is nothing short of a _paradigm shift_. (BodyMedia's SenseWear Patch, Burton X Motorola's Amp Jacket)

The soft sensors applied in the research project, shall invite people through their softness to curiously interact with them. The data gathering these sensors primarily serve, is somewhat camoufaged, hidden from the naked eye.

They are soft, yet inherently networked/wired, entities distributed to the environment; they come in diferent forms: _anemones_, _corals_, and _lianas_. By means of lighting, material softness, and initial cautious movements on their part, they invite participants to play and touch and thus afford close investigations via haptic interaction.

→ It is closely linked to what Deleuze and Guattari define as a "_close vision-haptic space_".

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Hard Sensors

Most technical systems are still imagined to be made out of hard materials such as various metals and plastics. Media literacy often comes from the film industry and its somewhat historicized SciFi aesthetics.

The hard sensors applied in the research project, are smooth surfaces of touch screens, made out of cool and reasonably hard glass slabs, pressure sensitive floorboards, compulsively hiding their functional parts: everything about these entities pronounces/highlights a clean surface, while at the same time hiding a mostly messy flip side.

→ Deleuze and Guattari would qualify it as *"optical space"*.

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Evaluation Design – Participants and Protocol

We wanted to <u>investigate the effects of material furnishing</u> choices more experimentally, thus shining a different, yet consecutive, light on the seemingly important link between basic perception and design practices in close connection with technologically enhanced (smart) surroundings.

We invited <u>50 participants</u> to explore the artistic installation, taking into account diversity as much as possible (age, gender, and professional background). They were asked to do the walk-through, that lasted approx. <u>20 minutes</u>, and thereafter conduct the interview, during which the video recordings and data visualizations could already be viewed and discussed.

Findings

We analyzed and compared the two rooms *"SciFi"* and *"Mycelium"*:

"SciFi":
- Atmosphere: perceived as dystopian and patronizing, associated with Hollywood science-fiction movies
- Interpretations and judgments: Motivated to solve the riddle, sometimes frustrated after a while
- Extracted SD adjectives: "tense, anxious, <u>motiviated</u>, consenting, <u>self-determined</u>"
- Interaction and agency: felt controlled, barely experiment with alternative forms of interaction
- Design aspects: unbelievable, pre-produced, clichéd and often compared to an escape room

"*Mycelium*":
- Atmosphere: Perceived as pleasurable, playful, and inviting and associated underwater settings and fantasy world in the interviews
- Interpretations and judgments: Relaxed, <u>restrained</u> exploration
- Extracted SD adjectives: "relaxed, amused, calm, <u>motiviated</u>"
- Interaction and Agency: felt in control (although being in a technically similar system), were experimental
- Design aspects: beautiful, impressively designed.

Conclusions and Discussion

Participants had varying degrees of awareness of the embedded actuators in the <u>garment</u>:

- The causality of vibrator activation during error messages or unwanted interactions was recognized.
- The LEDs on the sleeve, which were designed to fuse the participants with the pulsating space, were barely noticed, because of its positioning.
- The pulsating fiber optics, which were designed to fuse the participants with the pulsating space, were located in the chest area and were rarely seen or interpreted.

The rather poor perception of the garment is probably due to the fact that the participants were very busy with the exploration of the eventful environment and would have needed more time to also become attentive to the correlations with the wearable.

Final Conclusions

[360° walkthrough](#)