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Experiential Qualities of Reactive Environments

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Abstract. *Our living ambiances are about to change their structural character in a decisive way: Intelligent technologies are increasingly invading our traditionally stable and static habitats and turn them into responsive environments with additional technology driven dynamcis – such intelligent ambiences seem to be the future of our everyday life environment. Their design and their impact on our bodily experience is still an open research field, in which 'atmosphere' and 'ambience' seem to become core notions that demand new models of the human-environment relationship. Our current artistic research project tries to model a responsive environment in which people can explore and experience the epistemological and behavioural impact of new technologies.*

Keywords: atmosphere, ambient intelligence, ubiComp, internet of things

Ambiances and Atmosphere: The (possible) relevant factors

The notion of 'ambiance' is like the notion of 'atmosphere' closely related to a certain epistemological approach that just recently unfolded increasing meaning in different fields that have to do with design in the broadest sense. To deal with ambiances demands similar concepts of experiencing which Hermann Schmitz and Gernot Böhme have claimed for atmospheres and which relate to spatial conditions and to affective as well as pre-conscious ways of human experience. But despite this similarity, there also seems to be a difference between atmospheres and ambiances, although current approaches from philosophy and/or architectural theory treat ambiances and atmospheres in most cases as synonyms (see for instance Schmitz 2016, Pallasmaa 2014). The phenomenon of atmosphere seems to have a strong *temporal* implication as atmospheres of a place/space can change throughout shorter or longer periods of time due to varying factors, e.g. when the dynamic interplay of the involved elements alters. In contrast, 'ambiance' is usually used to describe the certain characteristics of a specific *spatial* design.

Taking into account that due to current technological developments the qualities of our everyday environments become increasingly volatile, procedural and more and

more independent from our intentional action, we have to generally question our approach to spatial and temporal perception, and therefore will also have do re-define the notions of atmosphere and ambiance. Referring to our artistic research project on atmospheres and new technologies we will try to sharpen the conditions of atmospheric experience and its relation to a notion of ambiance, which is bound to a dynamic understanding of space.

Intelligent Ambiances: The designerly potential of ubiquitous computing for architecture and entertainment

Our current artistic research project turns to contemporary technological developments of ambient intelligence - a term which in computing refers to electronic environments that are sensitive and responsive to the presence of people. This mainly counts for technologies that currently are discussed under the keywords of 'ubiquitous computing' (UbiComp) and 'internet of things'. In the architectural engineering industries these developments are commonly applied to improve automation, energy conservation, cost reduction, surveillance and comfort. The most prominent example is the smart home, which reacts and acts according to the needs of its inhabitants (or to needs which are defined by others as the needs of their inhabitants, e.g. the reduction of energy consumption).

The inhabitant of the future UbiComp-prepared room does not consciously address computational intelligence via computer interfaces anymore but experiences a caring, sensitive environment with embedded calm technologies that detect her/his needs and wishes. The technical networked components are invisibly hidden in common everyday objects and dissolved with the ambient. The interface merges with the background, technical equipment becomes material and new immersive media formats for entertainment have to be developed. Considering this, our project is based on the main thesis that such ambient intelligence obviously has consequences for our bodily experience as it decisively changes the sensing of our everyday-environments.

Designing the project's space

To be able to approach these changes of our living ambiances we decided to start our research not from the engineer-perspective of cognitive empowerment through technology, but from the perspective of a holistic notion of bodily experience. This means that we wanted to design an environment which is able to unfold strong atmospheric impact through the interplay of technical devices, but also of non-technical elements. One of the initial motivations for this research project was the question, if it is possible to build a responsive environment that makes an immersed person interpret it as part of her/his own body, as an extended organ or a second skin. We therefore built a *human-in-the-loop-system* with biofeedback sensors to attach physical parametrical changes directly to human affective reactions. The feedback of the first evaluation participants and our observations of their behaviour led to an austere room design: initial ideas of a surprising playground for sensual discovery or innovative challenging furniture vanished and made room for a deprivation situation. The resulting environment of about 4 m wide, 8 m long and 5 m high is composed of a single type of white, semi-transparent, non-woven textile with interesting texture and tactility, hanging loosely from the ceiling, shaping a cocoon-like isolated space resembling natural organic structures. The main criterion

of the design approach became to create something new and foreign, offering no affordance. The probands should be able to completely concentrate on their situation and their bodily experience in close connection with the technology in use.

Figure 6. The abstract room with the non-woven textile

The technical part of the system consists of three consecutive modules: input sensors, processing and output media (actuators). The human being – as human-in-the-loop – can close the loop between the actuators and the sensors by being exposed to the media and by influencing the parameters of the output media through the biofeedback data that are processed in real time.
The measuring of the heart and breathing rates makes it possible to record the human psycho-physiological reactions to external stimuli emanating from the artistic medial orchestration, which in turn is subject to atmospheric changes due to the human reactions. In addition to elements of spatial design, the reactive environment includes specific compositional elements, i.e. light (parameters: brightness, colour, duration, number, spatial arrangement), sound (parameters: type, volume, duration, spatial arrangement) and wind (parameters: intensity, duration, position, direction), and it allows the test person to touch different materials, to choose various positions within the setting and to interactively influence its appearance through his/her biofeedback.

Examining the experience of a dynamic, but reduced space

In this environment we have conducted a series of experiments with 17 participants. We briefly inform participants about the procedure without explaining technical details or the goal of the evaluation. We ask them to take off their shoes and to put on socks which improves the sense of tactility and serves as a ‘rite de passage’. They put on an elastic chest belt with a breathing sensor, motion sensor and a wireless transponder. A pulse sensor is attached to the index finger of the right hand.
Participants were told that there was nothing they had to achieve or that could go wrong. A visit lasted between 7 and 12 minutes. We recorded video and the bio-

physiological signals as data tracks. After exposure we conducted 10 to 15 minute semi-structured interviews, asking participants to recount their experience

The space we created proved to be a hybrid construction of non-technical and technical elements which are connected to the human probands via sensors. Although most persons did not realise this close relation to the space, they developed strong affective reactions towards some of the technical effects: The dynamic change of light (related to the pulse and the bodily activity), the abstract wind-like noises that are reactive to the heart beat, to the intensity of breathing and to the movement alike, and which are dynamically displayed on surrounding speakers, and finally the wind, which became the stronger the deeper the persons breathed, were subject to strong affective reactions, also caused by intense associations.

Spatial Qualities

In the interviews participants assign various experiential qualities to the space of the installation. Most of these qualities are specifically positive and are commonly associated with personal and safe spaces: 'cosy', 'relaxed', 'airy', 'small' - however there are some exceptions, signifying more ambivalent, interesting qualities: 'artificial', 'fragile', 'unknown'. Participants would also associate other spaces to characterise their experience. These further emphasise the closed, safe nature, in many cases focusing on the boundary between inside and outside, calm and action - an enclosed, safe space with something dynamic happening around. One association was of a beach chair in front of the sea, others described the experience as a trip to the cold arctic emptiness and wideness. Some associated the light white tissue with its dense but fluffy folding as a uterus-like shelter, while others were feeling insecure by the dynamic changes of the coloured light and the sound. Other common associations were of meditation spaces, bedrooms or of a (pleasant) cave. An interesting remark by one participant was the idea of the space as a parcours that is open for exploration.

These associations - although referring to rather diverse scenarios - nevertheless show some patterns: The main element that forms the space and defines its borders, the white non-woven textile, triggered the association of a room providing shelter and security, while the dynamic, changing elements, especially sound and light, elicited the feeling of insecurity - at least as long as the participants didn't realise their power to control these changes. The homogeneous design of the white textile emphasised elements which seemed to interrupt this harmony, especially when the people caught glimpses of the area outside the room they were irritated and felt disturbed.

Although the activities in the room were rather reduced, the interviews showed intense internal experiences which were described by most of the test persons. Consequently, there was a mismatch between video recorded behaviour and reported (internal) activities in the following interviews. It led us to conclusions about how perception of ambiance might emerge. Because the room did not give the visitors any hint of what they should do, they became very attentive to details and personal associations and started to develop mental concepts and missions. The memory of their minimal activities merged with the emotional experience and interpretation of the situation. It seemed that the intention to recognise patterns

and to generate cognitive explanations was very influential, maybe even prior to the emotional reaction and perception of ambiance.

Behaviour and Exploration

From an analysis of the chronological order of the experience, reconstructed from the interviews and the video recordings, specific patterns of activities across participants, with discernable phases of encounter and exploration emerge: When participants enter the space they express a situative distance from the space, immediately followed by the formulation of an explorative strategy. They go on to identify familiar elements in the environment and very often immediately rate or classify the identified objects. At a later stage they introduce and describe ideas of systems, functional or formulated as antagonisms (nature vs. technology) followed by an appraisal of the overall experience, often with an element of self-reflection. In the end most participants formulate concrete goals, make plans and reflect the installation. This chronological order (in contrast to the original, narrative structure of the interviews) enables us to see the early adaptation of the participants to the environment and the strong influence of such a process on the experience. We can match the phases and specific passages from the interview to two models that describe strategies of experience and action in dynamic situations: Situation Awareness and Sensemaking (Simon/Torpus/Heibach/Navarro 2016). In particular the model formulated by McCarthy and Wright (2007) to describe experience as engagement with a designed environment matches the behaviour of the participants and the statements from the interviews. The coordinated effort the participants make to understand and structure novel environments points to a (higher than expected) cognitive engagement that in our setting is directed at the underlying, behavioural structure of the environment.

Besides the perception and interpretation of the spatial situation, the altered feeling of time was mentioned in context of being on one's own in the decoupled environment: 'Temporal perception is definitely different in there. May be being on one's own intensifies the feeling of decoupling and makes the self-perception very intense. […] If you experience something so intensely it feels like a long time span […] as in psychedelic states.' (extract of one interview) But not only this suspension of 'normal' temporal experience appeared. It also became quite clear throughout some of the interviews, that the atmospheric experience changed immediately when the test persons realised that they could influence the environment. These persons felt uncomfortable first, then - after discovering their power to control at least partly the behaviour of the space- and ambience-constructing elements - the experienced atmosphere changed: they felt far more comfortable and were able to enjoy and play with the technological features. These rather abrupt changes support the thesis of cognitive processes unfolding prior or at least parallel to un- or preconscious affective reactions. Additionally, these observations also possibly justify a differentiation between atmospheres as phenomena of space and time, and ambiences as dynamic, but mainly spatial phenomena.

Outlook

The observations resulting from the rather simple artistic setting are surprisingly complex. They can serve as starting points for further research on the difficult relation between technology, space, time and human experience. It seems that a differentiation between the notions of atmosphere and ambience helps to grasp the complexity of dynamic relations between non-human and human agents in a way that allows to sketch not only momentary situations but longer interactions and changes of perception and behaviour. But there is still a lot of research to do in these fields to shed further light on the different constellations that constitute future ambiances.

For our project this means first of all to change the parameters of the setting. The next step will be to build in factors that disturb the harmony between the space and the human probands - for example 'responses' of the environment that seem to be autonomous and that therefore raise the question of power. Furthermore, we want to explore the relation between intelligent ambiences and humans in everyday-life situations - and that means long-time observations to be able to understand processes of habituation and alienation.

All of these tasks are rather new and will ask for creative methodological and theoretical approaches - the integration of the notions of atmosphere and ambience to explain the implications of future technological developments seems to be a promising starting point for this challenge.

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