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FEEL YOUR DESIGN

exploring the sensorial experience of Architectural space through immersive architecture models

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This paper describes an experiment entitled Experiment 2- ``Feel your Design`', which belongs to a group of experiments undertaken in the context of a PhD in architecture. The goal of the experiment described in this paper was to evaluate the emotional reaction of a viewer to changes in the sensory perception when being stimulated by viewing, listening and smelling immersive architectural models. The Experiment was taken as part of a workshop with students of architecture. The workshop incorporated concepts of ``Sensory Design`' and ``Emotional Design`'. The task assigned to the students proposed that immersive, atmospheric models were built according to a specific narrative and included specific scents and sounds which were supposed to re-enforce such a narrative or induce a certain mood. The results of the Experiment were evaluated through the use of a ``Presence Questionnaire`' and a ``SAM chart`'. The Experiment had the participation of 7 students who produced one model each and served in the Experiment as subjects. Experiment 2 took place on the last day of the ``Feel your Design`' workshop. The host institution was Fachbereich Architektur, Digitale Werkzeuge, TU Kaiserslautern. The experiment had the technical support of the Deutsches Forschungszentrum für Künstliche Intelligenz GmbH (DFKI).

Keywords: *Architecture, Immersion, Emotion Measurement, Sensory Design*

INTRODUCTION

This paper describes an experiment which was taken as part of the research work developed for a PhD thesis dedicated to the topic of the relationship between body and architecture (Ferreira, 2016). Four experiments were done in the context of the aforementioned PhD research. The goal of the experiment described in this paper, called Experiment 2 - "Feel your Design", was to evaluate the emotional reaction of a viewer to changes in the sensory perception when being stimulated by viewing, listening and smelling immersive architectural models. This experiment took place on the last day of a student workshop. The workshop functioned as an elective course for students of architecture and dealt with the physical construction of immersive architectural models and the evaluation of subjects' response to the atmosphere's created by the models. The name of the workshop comes from the assumption that an architectural space can be designed as an experience if the architect takes in consideration sensory aspects such as haptics, sound, and scent in addition to vision (Damásio, 1999). The idea was inspired by Pallasmaa's (2005) work and his proposal that architects should use an embodied, sensorial approach to design as a way of stimulating the body, as a holistic sensory system which is not exclusively dependent on vision, but also on other senses. The workshop also incorporated concepts of "Sensory Design" and "Emotional Design" (Norman, 2004). The task assigned to the students proposed that immersive, atmospheric models were built according to a specific narrative and included specific scents and sounds which were supposed to re-enforce such a narrative or promote a certain mood. The Experiment had the participation of 7 students who produced one model each and served in the Experiment as subjects. Experiment 2 took place on the last day of the "Feel your Design" workshop. The host institution was Fachbereich Architektur, Digitale Werkzeuge, TU Kaiserslautern. The experiment had the technical support of the DFKI.

DESCRIPTION

Each participant was given a cube measuring 50 x 50 x 50 cm and was requested to choose a room type which could be any kind of interior space such as an attic, a bedroom, a working room, a library, a museum, or a hospital room. The students were asked to choose a narrative that described a mood that was to be explored through the model and design an immersive experience through the combined design of an interior space, the choice of a scent which accentuated the narrative (``scentscape`'), and a specifically created sound-loop which re-enforced the desired atmosphere (soundscape). The scale of the interior spaces was left for each student to choose according to her/his idea for the model, as well as the location and dimension of the peeping holes which were meant to condition the viewer's gaze.

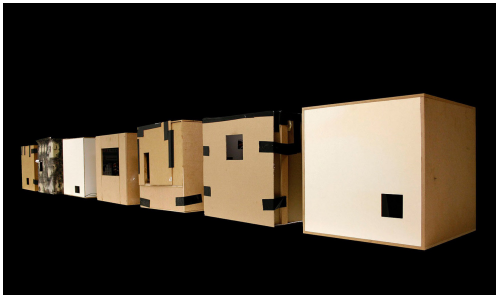

Figure 1
Immersive models with peep-in holes

The setup of the Experiment consisted of Architectural models placed at seating level, installed with peep-holes (Fig.1), scent- and soundscape in the interior of a box with the same dimensions as an old phone booth (Fig.2), with a bench for the viewer to sit and look at the models and a black fabric curtain to keep the booth in the dark. The tools used for the experiment were one laptop with plugged headphones which was set at a table next to the booth where the models were installed. While inside the booth, the viewer was asked to sit on the bench and take a look into the peeping hole of the model, while listening to the soundscape through the headphones connected to the laptop outside of the booth (Fig.3). Students were advised to install, if possible, small vents inside

Figure 2
Setup with focus on model location

the models so that the viewers could feel the chosen "scentscape" more intensely. The students had to define the possible views into the model space on the display side of the cube, to create a soundscape as a loop in mp3-format, and to complete the experience by adding a specific scent to the model. The selected title had to describe the desired mood for the architectural space and provide the viewer with the key to the understanding of the narrative. The goal of the exercise was to explore through these immersive models the multi-sensory experience of architectural space (Pallasmaa, 2011) and evaluate viewer's emotional reactions (Damásio, 1999) to the narrative experienced inside the booth through the analysis of data collected and processed with emotion measurement methodology. To support the design process during the workshop, students were introduced to artwork on the topics related with the task such as cinema, model making, art installations, as well as basic notions of architectural archetypes and Plutchik's (1962) vocabulary of basic emotions. Students were also introduced to the concepts of emotion measurement (Bradley et al., 1994; Kim et al. 2015), immersion, presence (Witmer et al., 1998), sensory design and emotional design (Norman, 2004). Students were encouraged to use CAD/CAM technologies to aid in the process of manufacturing the models. The results of the Experiment were evaluated through the use of a "Presence Questionnaire" (Witmer et al., 1998) and a "SAM chart" (Bradley et al., 1994). Recall that the main goal of this experiment was to qualify users' response to immersive architecture models, by analysing sensory data, having in mind that our main hypothesis was:

H1 - a user's emotional response as ``compelled or not compelled`', ``positive or negative`', ``aroused or not aroused`' and ``dominant or dominated`' to an immersive architecture model can be evaluated through objective measurements of emotion using a Presence Questionnaire (PQ) and a SAM chart.

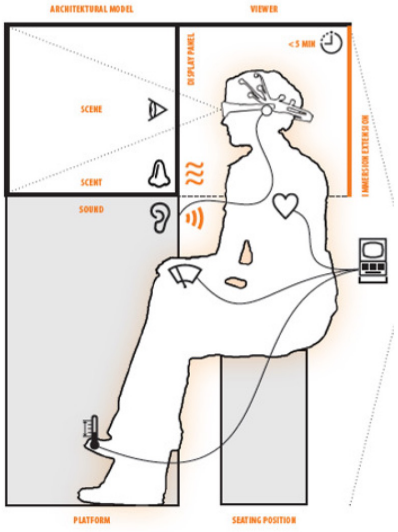

Figure 3
Diagram of ``Feel your Design`' experimental setup

Two secondary hypotheses were then formulated:

H2 - architecture is an immersive experience which can be consciously composed by the architect; the techniques of ``emotional design`' and ``sensory design`' are an effective strategy to compose specific experiences of architectural spaces and develop the sensorial awareness of students and designers;

H3 - the feeling of presence and emotional activation can be induced through the experience of analogical models, in this case, immersive architectural models;

To verify these hypotheses, the experiment was developed considering four stages:

1. Identify the design characteristics that are more suitable to induce certain sensations in the user, such as ``positive, aroused, dominant, compelled`', ``negative, not aroused, dominated, not compelled`', ``joy, sadness, anger, boredom, ecstasy`';
2. Design an immersive model so that those characteristics are the most important aspects of the design;
3. Perform experiments with users interacting with these architectural models and assess their emotional experience through the use of a PQ and a SAM chart;
4. Process and analyse the sensory data collected to understand if significant differences can be found in the classification and differentiation between a ``compelling-positive`' experience and a ``not compelling-negative`' one.

RESULTS

Experiment 2 - ``Feel your Design`' evaluated the emotional experience of architectural models by analysing changes in the sensorial perception of the viewer, while looking at the model, listening to specifically created sounds (soundscape) and inhaling specifically chosen scents (``scentscape`'). The results of this experiment were the answers to the Presence Questionnaire and the SAM chart, where recall of experience and believability of simulation were systematised. Such data describes the subject's physiological response and emotional activation, thereby enabling one to evaluate the model's ability to alter the subject's emotional state. The data is organized according to Presence Questionnaire's ``Factors`' and ``Subscales`', as defined by Witmer and Singer, as well as SAM's parameters of Valence, Activation and Control. The final values considered in the analysis of the PQ results were obtained by averaging the ratings assigned by the subjects to each of the questions, according to Witmer and Singer's (1995) 1-9 point scale. The analysis of the data collected through the SAM chart also followed the same principle, as the three parameters of ``valence`', ``activation`' and ``control`' were rated by the subjects using also a 1-9 point scale. After making these calculations, we obtained values that qualify the subject's individual experience of the ``Feel your Design`' models regarding the parameters of ``presence`', ``emotional response`', ``valence`', ``activation`', and ``con-

trol``. From the data collected, we can also qualify the experience of the group of subjects as a whole, by averaging the results for the same parameters.

DISCUSSION AND CONCLUSIONS

Experiment 2 - ``Feel your Design`` evaluated the emotional experience of architectural models by analysing changes in the sensorial perception of the viewer, while looking at the model, listening to specifically created sounds (soundscape) and inhaling specifically chosen scents (``scentscape``). The experimental results support the main research hypothesis H1 - a user's emotional response as ``compelled or not compelled``, ``positive or negative``, ``aroused or not aroused`` and ``dominant or dominated`` to an immersive architecture model can be evaluated through objective measurements of emotion using Presence Questionnaire and SAM charts. The results collected through these means show that:

Figure 5
Interior of model ``Surfstation``

Figure 4
Interior of model ``Psycho``

- - for the immersive model ``Psycho`` (Fig.4), the majority of subjects experienced a high level of ``Presence``, ``Arousal`` and ``pleasure``;
- - for the immersive model ``Turm``, the majority of subjects experienced a high level of ``Presence``, ``Arousal`` and ``pleasure``;
- - for the immersive model ``Surfstation`` (Fig.5) , the majority of subjects experienced high levels of ``Presence`` and ``pleasure`` and a low level of ``arousal``;
- - for the immersive model ``Spiegel`` (Fig. 6), the majority of subjects experienced high levels of ``Presence`` and ``pleasure`` and a low level of ``arousal``;

Figure 6
Interior of model ``Spiegel``

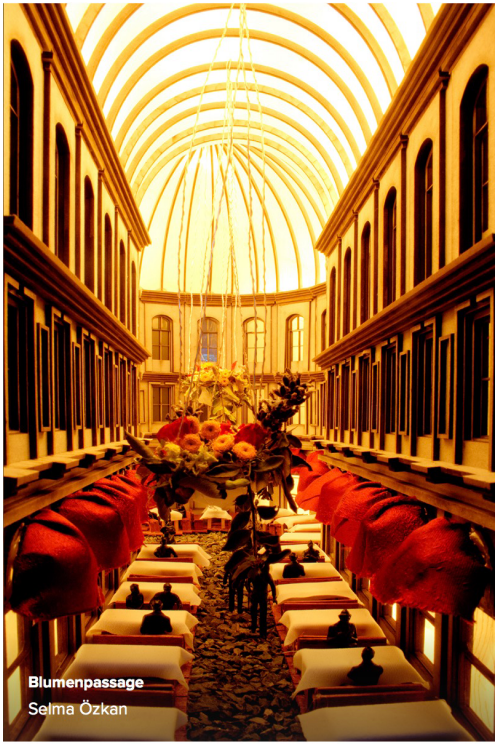

Figure 7
Interior of model ``Blumenpassage``

- - for the immersive model ``Blummenpassage`` (Fig. 7) , the majority of subjects experienced high levels of ``Presence`` and ``pleasure`` and a low level of ``arousal``.

All subjects felt they were able to control their emotional response to the scenes in the models and also described them as a positive experience. Most subjects described the scenes as ``not very dominating``, although the scenes ``Turm`` and ``Surfstation`` were described as ``dominating``. Interestingly enough, these experiments explored opposite atmospheres, anxiety in the case of ``Turm`` and relaxation in the case of ``Surfstation``. All subjects reported to have felt compelled by all the scenes in the experiment, with the scenes ``Psycho``, ``Turm`` and ``Spiegel`` being rated in average as ``very stimulating`` and the remaining two ``Surfstation`` and ``Blummenpassage`` as ``stimulating``. The scenes in the models were unanimously rated by the subjects as ``convincing``, ``engaging`` and ``consistent`` with real life experiences in terms of the sensual information. Most subjects reported to have been visually involved by all the scenes, as well as by the corresponding ``scentscapes``, soundscapes and, surprisingly, by the haptic aspects as well, since the latter was not directly explored in this experiment, but the former three were. This suggests that the models induced a very high level of immersion. All scenes were rated by the subjects as able to trigger the imagination of real actions and the majority of subjects reported to have had their attention dedicated to the scene. This permits us to conclude that Hypothesis H2 is verified - architecture is an immersive experience which can be intentionally composed by the architect and the simulation techniques of ``emotional design`` and ``sensory design`` are an effective strategy to compose specific experiences of architectural spaces and develop the sensorial awareness of students/designers. The majority of subjects reported that they were able to survey inside the models, were not distracted by the quality of their execution and could move inside the booth and manipulate the interface objects without being distracted by them. Subjects also adjusted quickly to the experiment, could concentrate well on the scene and the majority rated it as a good learning experience. Still, except for the case of the scene ``Psycho``, which the final average score shows that the subjects lost track of time, this did not happen in the remaining scenes. This suggests that the experience of the model ``Psycho`` was the most immersive. Finally, it can be concluded that the illusion of presence and arousal situations can be intentionally induced through immersive architectural models, although further research is necessary to understand which specific design elements are responsible for this. Therefore, Hypothesis H3, which suggests that the feeling of ``presence`` and emotional activation of the body of a user can be intentionally induced through the experience of immersive archi-

tectural models, also is confirmed. Experimental results of this experiment show that PQ and SAM are effective in identifying arousal responses related to ``positive`' or ``negative`' emotions, from the neutral condition, when users experience immersive architectural models. On-going research in the fields of IT, psychology and marketing uses an established range of values that also were user used as reference in this experiment. The use of electroencephalogram (EEG) and biometric markers is an additional, interesting method to be used in future experiments to observe how the emotions of a user are triggered while experiencing immersive architectural models. Such technology was unavailable for this experiment, but it was used in other experiments in the context of the aforementioned PhD research (Ferreira, 2016). The experiment described in this paper will be repeated and eye-tracking sensing technology will be incorporated to the experimental setup. We believe this method might be useful to detect which points are of most and least interest for the viewer of a scene and give a more comprehensive analysis of the subjective experience of looking at an architecture scene.

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