The moodCave - An immersive interactive environment to create Mood Boards

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Abstract

Virtual environments are objects of research in many different areas to fathom advantages and posibilites. We used the approach of virtual environments and adapted it to the Mood Board creation method which is often used during the design process. We conceived, designed, developed and built an immersive interactive environment which can be used to create Mood Boards in a new way. The goal of our concept was to support the appearance of flow.

Keywords: Augemnted Reality, Flow-Experience, Immersion

1. Introduction

Design is closely related to emotions and feelings. It is not only about how a design looks, but also what it communicates. To get an idea what a design should state and reveal designers are using different approaches and methods. Mood Boards are one of these methods where artificial compositions are created to describe a visual language and define emotional associations.

Human beings tend to be more emotional the more they are involved. Multi-sensory immersive attraction evokes high emotional affiliation. Therefore virtual environments are an important approach in psychology, behavioral science as well as entertainment industry. But also design research can benefit from the findings and results of studies with immersive interactive environments.

2. Hypothesis

The moodCave - Does an immersive interactive environment support the appearance of flow during the creation of a Mood Board?

3. Definitions

3.1 Mood Boards
During the design process a lot of different methods are established and used. In the early stages of this process, the generating of ideas, framing the design space and getting a grip of the driving idea are the main goals. In manifold previous researches about this topic, the design process is broken down in different sections of a defined sequence.

Koberg and Bagnall (1982) divided the design process into four different steps: Input, Analysis, Synthesis and Output. This approach questioned the predominant concept of a "black box model" in which it wouldn't be possible to see and understand what happens inside the human mind. Since then a lot more research has been done and different models have been developed. Roozenburg and Eekels defined the "Basic Design Cycle" in 1995. This model includes eleven single steps - function, analysis, criteria, synthesis, provisional design, simulation, expected properties, evaluation, value of the design, decision, approved design - as well as iterative loops and interconnections among the different steps.

But this is just one example of a variety of different design process definitions. "There seem to be as many kinds of design process as there are writers about it. [There is] little support to the idea that designing is the same under all circumstances, [...] the methods proposed by design theorists are just as diverse as are their descriptions of the design process" (Jones, 1992 in Buxton, 2007; p. 231).

One method which is widely used during the early phases of the design process is the creation of Mood Boards. They are an essential part in the design process and work as an idea generating tool that can be used to illustrate an idea in an abstract way (Edwards et al., 2009). They are compositions of images, texts or samples of certain materials, e.g. fabrics or paper. It serves different purposes:

- gathering resources

- inspiring the designer

- visualizing associations and semantics

- illustrating a look and feel as well as values (Key-Visuals)

- connecting words with images

- reflecting the results.

The benefits for the designer are, that Mood Boards can help to understand and accept an idea while building it. Edwards et al. (2009) characterizes Mood Boards as an essential and efficient tool to carve out emotions and sentiments for a product. Furthermore a Mood Board can be used as a foundation for discussion with colleagues or customers. Lucero defines five different approaches for Mood Boards. The approaches can be applied singularly as well as more than one method at once (Lucero, 2012).

- Framing: To understand what is behind an idea, designers have to frame the scope of the design. This can be done with Mood Boards, which can be seen as the basis for questions and discussions. The Mood Board works as a first draft in the design process.

- Aligning: The aligning works related to the framing process. Often clients don't have the ability to express their ideas right. The Mood Board can here be useful to get everyone on the same wavelength.

- Paradoxing: Paradoxing works in the opposite direction than aligning. Here the Mood Board is used to illustrate objection, antagonism and meanings in general.

- Abstracting: If ideas are getting already too precise, you can use Mood Boards to create more abstract ideas. The degree of abstraction can be adapted to the particular need.

- Directing: A Mood Board can be used to direct a design from it. For this case everyone who is looking at the Mood Board should have the same understanding of the Mood Board.

3.2 Realities

In general linguistic usage „reality" means the totality of things, which are actually existing, and is referring to an exclusive, unique singularity. From a philosophical point of view there can exist either none, one or multiple realities next to each other. Technological progress is creating new kinds of reality persistently. There is a range of various kinds of realities with different characteristics of reality and virtuality. The most well-known are Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). To distinguish artificial realities from the „real" reality, the term „pure reality" is used to contrast in this paper.

VR: Howard Rheingold (1991) is describing a "Virtual Reality" in his book as an experience in which a person is "surrounded by a three-dimensional computer-generated representation, and is able to move around in the virtual world and see it from different angels, to reach into it, grab it and reshape it." (Cruz-Neira et. al, 1993). Therefore a VR is a self-contained environment which is existing alongside the pure reality, but isolated from it. Inside a virtual environment there is no obvious or intended connection to the pure reality.

AR: The Term "Augmented Reality" is describing the connection between pure reality and Virtual Reality. In the beginning Augmented Reality was limited to transparent see-through
head-mounted displays. But with increasing technological progress the term is now part of a broader concept (Milgram, 1994). "AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it" (Azuma, 1997). AR is extending and enriching the pure reality with additional information without pulling you out of it.

MR: "Paul Milgram described in 1994 the "Reality-Virtuality-Continuum" since he spotted that both VR and AR are related. In this model real environment, (the pure reality) and virtual environment are two separate entities. They are building the end-points of the continuum. He called the spectrum between the the two poles "Mixed Reality" (Milgram, 1994).
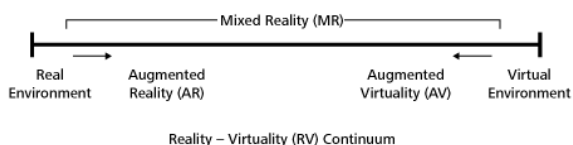

Fig. 1: Reality Virtuality Continuum (qt. Milgram, 1994)

According to the parameter-value of reality and virtuality a system or environment can be seen as more virtual, augmented or real. If an environment consists solely of real world object it will be seen at the left end of the model. An environment is set on the right end of the model, if every single element within this environment is virtual. Everything between these two hypothetical extremes is considered as Mixed Reality. Markus Schaefer holds that the space we perceive and experience, is a mix between real and virtual elements. He sees virtuality as an interplay between real space and virtual structures which is providing a variety of new possibilities (Schaefer, 2011).

3.3 Flow Experience

"Being in the Flow" is described as a straining but also engaging and satisfying experience. It can be defined as a state of mind with a total focus on the execution of a task (Ritter, 2013). It seems that the work is carried out automatically. Psychology has studied human behavior in task fulfillment and observed that with certain predominant conditions people are able to push themselves to the limits and beyond them. Interviewed test person have described this experience as one of the best of their lives.

To experience the phenomenon of the Flow, the user has to achieve the so-called Flow Channel and stay in there during the execution of the work. The Flow Channel is an abstract area affected by challenges and skills, where both parameters are in perfect balance. The Flow Channel is accompanied from anxiety and boredom, which can occur if the parameters are not in balance.
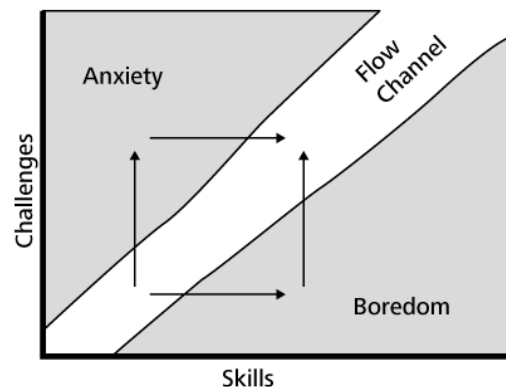

Fig. 2: Flow Channel (qt. Csikstentmihalyhi, 1996)

Mihaly Csikstentmihalyi has stated nine requirements for the so called "Flow experience".

1. Each phase of the process is characterized by precise goals
2. The user is given immediate feedback for their own actions
3. Tasks and skills are in balance
4. Action and consciousness form a unit
5. Distractions are excluded from consciousness
6. There is no fear of failure
7. Self-forgetfulness
8. The sense of time is canceled
9. The activity is autotelic

He describes that these aspects are crucial requirements to evoke the Flow experience (Csikstentmihalyi, 1996).

4. Methods

4.1 Brainwriting

The Brainwriting method was used to come up with ideas for a digital Mood Board tool. This contains considerations about functions, approaches, limitations and drawbacks. The Brainwriting method is a modification of the Brainstorming method which was developed by Aley Faickney Osborn in 1939. The difference between the Brainstorming and the Brainwriting method is the recording of the upcoming ideas. Instead of just just speaking out the ideas, which are coming to mind, with the Brainwriting method these ideas are written down. After the idea-generation phase the ideas get clustered semantically.

4.2 Brainstorming

Furthermore we used the Brainstorming method for an requirement analysis (Rosson & Carroll, 2002, p. 37). One important aspect to what the concept should focus on, was the experience of the Mood Board creation. It was crucial to step back from the functional point of view and focus on the user and the experience during the use of the tool to create a joy of use. We started to formulate values and attributes in simple, plain words to describe and frame our approach. As mentioned, one key point for the tool should be the experience.

4.3 Scenario Based Design

The Scenario Based Design (SBD) approach by Rosson & Carroll built the foundation for the further and more detailed development. Scenarios can be very useful to encounter possible tradeoffs (Rosson & Carroll, 2002, p. 20). Scenarios are written down narratives, trying to describe the goals of an actor. "Scenarios [...] include sequences of actions and events, things that actors do, things that happen to them, changes in the setting and so forth (Rosson & Carroll, 2002, p. 18). Each actor within a scenario has a more or less important goal. These goals are the changes, which the actor is trying to achieve (Rosson & Carroll, 2002, p. 17). We used the SBD approach to define a target group and corresponding use cases, where a user - the actor - is trying to accomplish a goal - changes.

"The basic argument behind scenario-based methods is that descriptions of people using technology are essential in discussing and analyzing how the technology is (or could be) reshaping their activities. A secondary advantage is that scenario descriptions can be created before a system is build and its impacts felt (Rosson, Maass & Kellogg, 1989; Weidenhaupt, et al., 1998). We developed Activity Scenarios according to our target group to frame the approach of our Mood Board tool. These Activity Scenarios were refined into Information- and Interaction Scenarios corresponding to our requirement analysis and assessed against our key points.

We also sketched storyboards for our narrative scenarios to describe and visualize certain aspects of our scenarios. We were geared to the storyboarding methods described in Sketching User Experiences (Greenberg et al., 2012). Marco Spies states in his book "Branded Interactions - Digitale Markenerlebnisse planen und gestalten", that storyboards have a special issue when it comes to interactions in space. They should describe and show, what kind of interactions (e.g. gestures) the user is executing to interact with the environment (Spies, 2012, p. 202).

5. Concept

5.1 Deduction of requirements leading to the cave

Creating Mood Boards is a technique which is located in the early stages of the design process. It can be seen as an idea-generating tool as well as a collecting basin for thoughts, ideas and more. As a Mood Board tries to visualize a certain mood, impression, value or reception, the following keywords emerged after our Brainwriting and Brainstorming sessions:

- mood
- inspiration
- fun
- fast
- immersive

It became apparent quite fast that we wanted to move away from familiar tools of Mood Board creation. It seemed obvious to us, that previous developed concepts wouldn't fulfill
our requirements. Therefore we used our keywords as starting points to develop as many ideas as possible. We looked for semantical connections between the different keywords to find solutions which would meet more than one requirement at once. For instance emerged from the connection of the keywords „mood" and „immersive" the idea of an surrounding environment. The keywords "fun" and "fast" had significant impact on the user interface design. We focused on the user experience of the whole interface, since it is proven that the "joy of use" has significant input on acceptance and satisfaction for the user while using the system (Burmester et al., 2002).

Due to our demand that experience should be the central element of our tool, we wanted to develop something that is more than a simple touch interaction. During the idea generation process it exposed that an immersive interactive environment matched our predefined goals and requirements more than any other. We called it the moodCave. The idea behind the moodCave is to engage the user in the most possible way - to set the user into the mood, that the Mood Board is communicating and to arouse emotions. Emotions are an important part since they affect the attention and perception of the user (Beale & Peter, 2008, p.2). Therefore we developed a multimodal and multi-sensory approach. McDonagh & Denton state that „multiple channels are needed within any on-going design process if effectiveness of communication is to be maximized (McDonagh, D. & Denton, H., 2004, p.2).

The moodCave is applied in the actual Mood Board creation process. The concept we developed is focusing on the interaction with the moodCave as well as the perception from the moodCave while it is used. According to Lucero the moodCave serves mostly the purposes of Framing and Aligning (Lucero, 2012). The tool can be used to frame the scope of a design. While interacting with the moodCave the user will carve out a design language, semantics and key-visuals. Furthermore the moodCave can also be used to align ideas and visions with colleagues or clients. Bederson bridges in his paper "Interfaces for staying in the flow" (2003) the concept of flow, or „optimal human

behavior" of Csikszentmihalyi to the field of interface design. He describes that five of the nine requirements can be adapted and how they should be applied in a interactive system to support the appearance of flow. These five characteristics are:

- challenge and require skill

- concentrate and avoid interruption

- maintain control

- speed and feedback

- transformation of time

We derived challenge and required skill from our target group. Since the format of an actual space as an interactive environment comes with a lot of effort and complexity, it should be used pro rata. Therefore we defined our main target group as designers which are designing actual space in their profession. For instance Exhibition Designers, Product Designers and Architects. Other related professions aren't excluded of course, but due to the high costs we didn't include them into our primal target-group description. It is assumed that professional designers bring the necessary skills of the Mood Board creation process to fulfill this requirement. On the other hand is the continuous interaction with the moodCave and the perception of the displayed results keeping the designers in a permanent challenge (Bederson, 2003, p.2).

A movie theater analogy acted as a makeshift for us. If you are watching a movie in a movie theater, you are more or less forced to focus on the screen. The sound, the light and the screen attract your attention. There is a transmission of emotions from the movie to the viewer. The environment of a movie theater is build to reduce distraction. The cave concept is using the same kind of phenomenon. The user is focused on what is happening inside the cave. We used the idea of "sensory deprivation" to concentrate the users focus on the work she is executing. The elimination of distraction from outside the cave of as much as possible is one important aspect to encourage flow (Bederson, 2003, p.3).

"The third characteristic of activities that frequently result in flow is that the person must be able to maintain control over the activity. Lack of control, such as when driving in traffic is a sure way to destroy flow" (Bederson, 2003, p.4). Keeping this in mind, we tried to build a simple mental model for the use of the moodCave. We used swipe-gestures with no, or at least very little latency to establish the model of sliding images from one place to another (Ritter, 2013, p.102). We decided to use this animated transition since we believe that this animation can help the user to understand how the interface behaves and changes (Bederson, 2003, p.3).
However, in general we kept the interface clean and simple. In our point of view a too complex and hard to learn interface is hazardous to disturb the Flow experience. Heufler describes in his Book "Design Basics" (2004) that the formal degree of freedom is declining, if technical complexity is increasing and vice versa. Since we don't want to confine the user in the execution of the task, we decided to avoid complexity and possibly confusing functions. The goal should be clear and straightforward.

Correlating with this decisions we also met the requirement of speed and feedback (Bederson, 2003. p.5). Novak, Hoffman and Yung (2000) have found that speed has a direct impact on the user experience. Because of the simple and easy to use interface the execution of the task can be done very quickly. The transmission of the images is taking place almost in real-time and provides visual feedback. To support this understanding of the interaction, the perfect counterpart of the sliding-interaction takes place on the device.

The last characteristic Bederson is describing is the transformation of time (Bederson, 2003, p.5). Although the transformation of time is something that can't be easily affected. It arises together with the appearance of flow but is hard to measure or verify. Bederson is referring to a study by Czerwinski, Horvitz and Cutrell (2001) where they discovered that the difficulty of a task is having an effect on the time-perception in relation to the actual task time. They called this Relative Subjective Duration (RSD) (Bederson, 2003, p.5). Because of the loose connection of the RSD and the Flow-Experience this characteristic is not considered any further in this paper.

5.3 Technical setup
During the designing we thought about different concepts for the interactive environment. These ideas ranged from curved screens over dual screen projections to the point of Geodesic domes. Some of the set ups didn't meet our requirements we had for our environment and others weren't possible to build in the limited time we had. We had to go back to the origins of immersive environment.

Due to various issues we couldn't copy the CAVE installation of Cruz-Neira et. al (1993) one to one. But the detailed description they had made, worked as a construction manual where we had to replace certain parts with substitutes.

The basic construction of the moodCave was build with a ordinary camping pavilion. The size of 3 x 3 x 2,40 meters met our requirements perfectly. It was big enough to serve as an actual immersive environment. It was possible to move inside the pavilion, without losing the immersive effect of an surrounding environment, though.
We draped the walls with white, translucent fabrics to set up three walls for the cave. It was important that the material was dense enough to work as a segregative divider between the inside of the cave and the surrounding, but also to be translucent enough that we could use rear projection for the screens.

The projection was done with three projectors. They were arranged in necessary distance to each wall to use the whole side of the moodCave as a screen. We wanted to build the screen-surface as big as possible to support an immersive effect. Every projector was connected with a standalone laptop where our developed desktop application was running.

Since our concept had a multi-sensory approach we also connected speakers for auditive stimuli as well as an LED strip to use the effects of color for increasing emotional encouragement. The LED strip was connected via an Arduino board to one of the laptops to transmit color-values.

As our "working device" we used a Smartphone where our developed Android application was running.

6. Realisation

6.1 The moodCave environment

The goal of a Virtual Environment is to generate the highest possible degree of immersion and thereby achieve coalescence between human cognition and computer-generated simulation (Hemmerling, 2011, p.17). There is always a transition taking place between pure reality and virtual reality in where the interaction between perception and action has significant impact (König, 2011, p.190).

Therefore the actual cave is just providing a framework for the whole moodCave concept. We used the immersive nature of a cave as a foundation for our Mood Board creation tool. All technical equipment is being just part of the big picture
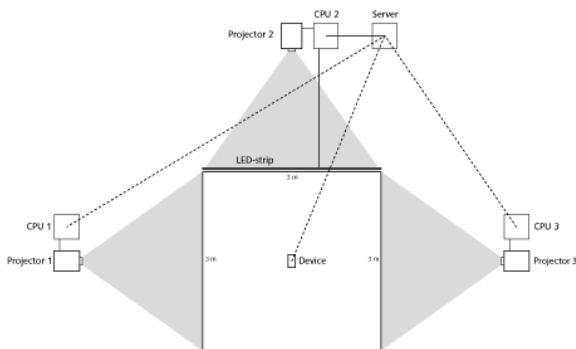

Fig. 3: moodCave setup

6.2 Desktop application

We developed our desktop application, like we also did with our mobile application in Adobe Flash CS6. The desktop application serves two purposes.

At first the application is loading the called images from our picture database and forward them to the connected projector. Therefore the desktop application changes its value every time you start the application. Possible values are Screen 1, Screen 2 or Screen 3. This feature allowed us to work with the same desktop application on every computer. We simply had to start the application on every computer in the right order.
Every application is connected to a running Java Socket-Server which serves as a distributer for the data. The Java Server is running on CPU 2 since this is our main computer where the input and output of the data is taking place.

Secondly the desktop application is sending back an array of the actual displayed images to the mobile device. This array is used to save the current composition, as well as to display the moodBoard during the "edit-mode" on the device.

6.3 Mobile application

Our mobile application was developed in Adobe Flash CS6 and published via Adobe AIR as an Android application. Since we tried to support the appearance of flow, we wanted to keep the actual interactive part of the moodCave -

the mobile application interface - as simple as possible. We also considered our key-values of "fast" and "fun" while we were designing the interface. In favor for this approach we used the metaphor of a stack of images. The most prominent element of the interface is a big square image which is representing the top image of the stack. The intention is, that the user has the least possible distraction from the interface and can focus solely on the image and whether she can use it for the Mood Board or not.

We thought about different ideas of how the transmission between the mobile device and the cave screen should take place, e. g. a throwing metaphor where the user would conduct a throwing gesture with the device to bash the image to the screen. But we decided to use swipe gestures as interaction-patterns for the transmission. In our opinion this gesture is the best matching to the task (Saffer, 2010, p.167). The swipe-direction is corresponding to the screen, to which the image should be moved. If the user is swiping the image to the right, the image will appear in the right wall of the cave. If the user swipes forward the image is moving to the screen in front of him. The same goes for a swipe to the left. Even though transformations and animated transitions can disrupt a users orientation, smooth animations can help the user to establish a mental model (Tidwell, 2011, p.84). We used constant polling to locate the position of the image and to animate a smooth sliding effect from the device to the screen. This instant feedback can be seen as instant gratification (Tidwell, 2011, p.11). The user is seeing immediate results for the action she just took.

Since we only built a three wall cave, we leveraged this fact for another function in the mobile application. It should be possible to browse through the stack of images very quickly. Therefore we used the swipe-direction „down" to discard an image if it doesn't fit to the current Mood Board project.

Below the big image we placed the control elements in a horizontal row. The position of the arrangement on the screen is on an easy-to-reach area for mobile devices. All buttons can be reached with the thumb if the device is used with one hand.
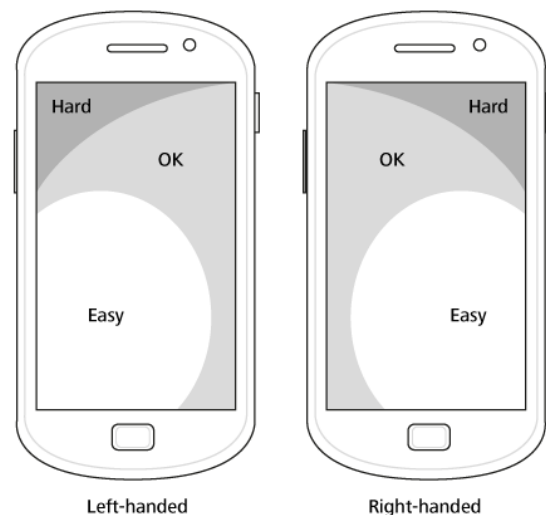

Fig. 4: Touch areas (qt. Hodgekiss, 2013)

According to Zwick et al. (2005) it is important to consider natural mapping for the position of control elements. The buttons are arranged in the following order: Restart, Options, Load and Save. This follows the logical expectations of the user since the reading direction from the left to the right is taken into account. Furthermore the buttons are also arranged in an chronological order. The user is likely to first start a project before she saves it or opens a new one. The options are placed in a more neutral position related to the screen (Zwick et al., 2005, p.61).

The buttons we developed have two states to make it easy for the user to identify if a button is currently used or not. During the standard, inactive state the buttons is white. We chose the color white to avoid distraction to the user. Eva Heller stated in her book "Wie Farben wirken", that white is the color cleanness and purity (Heller, 2001, p.148). This association met our requirements for the user interface. If a button is pressed it changes its state into active as long as it is pressed. The change of state is visualized with simultaneous change of color to blue to attract the eye (Saffer, 2010, p.171). According to Stapelkamp (2007, p.84) blue is semantically associated with sympathy, harmony and trustworthiness. Heller also describes blue as the color of loyalty, trust and trustwortiness (Heller, 2011, p.25). These attributes match with our approach to give the user the impression she is maintaining the control of the interaction. We also minded that the position of the button should not change constantly. Tidwell states that "[...] rearranging existing controls can disrupt spatial memory and things harder to find (Tidwell, 2010, p.15). Therefore the buttons are staying in their position almost the entire time. Only if the device it turned into landscape-view the "edit-mode" is called. The buttons are turning 90° clockwise around their center and are moving to the right side of the screen.

The "edit-mode" enables the user to edit the Mood Board she has built. While turning the device into the landscape mode, the create-interface disappears and the edit-view is appearing. In the edit mode the complete Mood Board is displayed on the device. We divided the screens on the device the same way we did for the cave walls. Due to screen sizes there is always just one screen-representation visible on the screen of the device. Via swipe gestures, the use can switch between the different screens. For consistency the button row, which is now displayed from top to bottom on the right side of the screen is staying in place during the swipes.

At the bottom of the "create-mode"-interface we placed three preview-images which are representing the next three images from the stack. The images are smaller than the big picture on top of the screen since they are illustrating choices for the user (Tidwell, 2011, p.233). If the user recognizes, that there is already an image in the preview which might fit perfectly into the Mood Board she is creating, she can use this preview to select the image directly. The preview-image will then appear as the main-image.

6.4 LED-strip control with Arduino
Since light has an enormous impact on human emotions, we decided to implement a light source into our concept. We used an LED-strip to illuminate the moodCave, which we placed at the bottom of screen 2. We connected the LED-strip to an Arduino board, because it was an easy possibility to control light input and output. Therefore we had to upload the Standard Firmata sketch to the Arduino board. "Firmata is a generic protocol for communicating with microcontrollers from software on a host computer (http://firmata.org/ wiki/Main_Page). Due to the fact that our development environment Adobe Flash is a proprietary system we needed to break the sandbox in which Flash is putting our application. Therefore we used a proxy-server and the as3glue-library to act as a bridge to the Arduino board. In our Desktop application we used color-analysis for each new added image to the Mood Board and sent the color value via the Arduino Board to the LED-strip.

7. Delimitation

It should be always kept in mind that this work is just a conceptional and partly prototyped project. In fact we built the moodCave with high definition prototypes of the dektop- application as well as the mobile application. Although the implementation is far from finished. We had to face some drawbacks and limitation we had to knuckle down to. Our idea of using a camping pavilion and simple white fabrics where sufficient to proof our concept but not the ideal solution. Also the representation of just square images implies some disadvantages. Uniform size and a grid based layout is generates a too tidy and regular presentation of the Mood Board. Especially for Mood Boards different sizes, sections and various focuses are important and help to establish relationship and emphasis. (Buxton, 2007, p.163).

We also hadn't the time conduct serious evaluation or research studies of the moodCave. The whole concept went through many iterations but we hadn't the chance to test it with real users. Since evaluation and reiteration is an important part of the design process it is necessary to test our prototype with users from our target group. Because we want to to test whether the phenomenon of flow during the use of the moodCave can be supported or not, research studies are necessary (Dumas & Redish, 1999, p.36).

8. Future Work

Besides the already mentioned research studies there are also some technical improvements which could be part of future work with the moodCave. E. g. the "edit-mode" was not very elaborated in the prototype, this could be a possibility for improved functionality. It would be possible to connect motion controllers like the Microsoft Kinect or the LEAP Motion Controller to make use of hand motions. The controllers could be adjusted to the three different screen and scan the surface for motion. The idea is to move, scale and rotate the images on the screen with hand-gestures. Further functions are possible as well. This even more active integration of the user could support the immersive effect of the moodCave even more.

Another feature that could be helpful would be the use of the cardinal direction of the device. It appeared that since the user is able to move inside the moodCave, she was sometimes confused while using the mobile application. If she turned herself towards the left screen and conducted a forward-swipe, the image appeared to her right. This happend because she still triggered Screen 2 which now was on the right side of her. It could be useful to make the app aware if the cardinal direction to affect the swipe gestures and target screens. But this has to be testes, as well.

9. Conclusion

The concept of the moodCave is designed and developed to serve as an immersive interactive environment for the creation of Mood Boards. It should provide a fertile atmosphere to support the appearance of flow. The actual set up of a walk-in environment with full screen projection constitutes an interesting first draft. The implementation and combination of visual and auditive stimuli as well as active engagement of the user turns the moodCave to an well-founded start for further research on this topic.

There are limitations and drawbacks in the current concept which are partly crucial for the appearance of flow as well as for absolute engagement of the user. Despite these circumstances it is possible to execute user tests with participants from the defined target- group with the actual prototype.

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