Exploring the Aesthetics in Mixed Interaction Spaces

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ABSTRACT
In this position paper I will try to address the workshop topic named: Interaction design aesthetics - the experimental practice. The focus of my recent research work has not been consciously directed towards aesthetics, but I wish to reflect more upon this in my future work. I believe I can contribute to the discussion in the field of aesthetic interaction through reflecting on my practical experience. I wish to participate in the workshop to join the discussions in the emerging field of aesthetic interaction both for my research work and for my teaching.

Based on my research I wish to present aspects of interaction that I consider important when designing for the aesthetic experience.

Author Keywords
Aesthetic interaction, design, interaction spaces, MIXIS.

INTRODUCTION
The discussion within the field of aesthetic interaction often contains very intimate and strong words, sometimes perhaps difficult to fit together with the design of technology. The challenge is to combine the “soft” aspects of interaction with the “hard” aspects of technology, and perhaps at some point consider them equally important. When discussing the question what compromises an aesthetic experience, then these strong words easily appear. Fels suggest that it is intimacy [3], Khaslavski and Sherdoff suggest it to be seductive and Gaver et al claim the importance of provocation [4] to induce the aesthetic experience. The question is, how does one achieve an intimate, seductive and provocative experience?

Hallnas and Redstrom [8] argues that the expression of things are central for accepting them as present in our lives, and thereby places aesthetics in the centre of design. While still being a student I was in involved in a project based on this thinking. In developing the project we wished to investigate how the aesthetics of the artifact should be designed to join two such separated things as a specific feeling with technology [1]. The aim was to try if an IT artifact with the focus on expression by starting from a specific feeling. In the initial phases we were inspired by a method developed by Philips named “Sensuality in product design – a structured approach” [9]. The final prototype became something that carried the qualities and attributes of this specific feeling, and its aesthetic is recognized by the cooperation of computational power and a specific feeling. The key characteristic of the artifact is the changeability both in information but also its physical qualities, and the choice of IT in combination of traditional materials created this dynamic cooperation. Because of the conscious abstractness of the result of the interaction, the experience relied solely on the interpretation of the user. The experience was therefore very personal, and perhaps intimate, seductive and provocative, but how do you measure or evaluate that?

In this paper I wish to shortly introduce some of the recent projects within the children’s library and mobile technology as main domains that I have been involved in, and through them argue for some design and evaluation aspects important for the aesthetic experience.

MOVEMENT BASED INTERACTION TECHNIQUES
The projects presented in this paper all use video tracking to capture movement. One of the properties of using a video camera to track an object is that the camera is only able to track the object as long as the object is within sight, but instead of seeing this as a limitation we explore the space that arise and is bounded by the cameras ability to see the object being tracked.

The space has the shape of an inverse pyramid. Close to the object the space is small and the space expands the further away from the object the camera get until it blurs out when an object gets to far away from the camera. We call this space a Mixed Interaction Space because it is both a physical space you can move around in, but at the same time the movement in the space can be mapped to the digital domain and can therefore be seen as a mixed space.
We have worked with two different kinds of Mixed Interaction Spaces. A *Fixed Mixed Interaction Space* is a space where the camera is mounted and the space is static. In the project *StorySurfer* briefly described below we use this kind of space for the interaction.

Dynamic Mixed Interaction Space is the second type of space and describes spaces that are dynamic due to the camera being mobile. A further subdivision can be made between what is being tracked. Is the camera moving and tracking a fixed-point or is both the tracked object and the camera dynamic? We have in the MIXIS Fixed Point (fixed-point) and MIXIS Face Tracking (dynamic camera and object) projects used this type of dynamic space.

**StorySurfer - floor**

StorySurfer is a prototype that facilitates children in browsing a library collection of books by displaying projected covers on an interactive floor surface [13]. The covers of the books are evoked by stepping on buttons on the rim of the floor. Each button is associated with a keyword, and hitting a keyword button will evoke a cloud-like shape on the floor containing materials associated to the word. Stepping on to the floor enables one to examine the displayed covers. Each person entering is provided with a cursor in the shape of a “magnifying lens”; the "lens" is controlled by your bodily movements. Holding the lens still over a projected book cover causes it to enlarge for better inspection and maintaining the position even a bit longer will cause the image to move across the floor to the interactive table top also being a part of the prototype.

![Figure 1: Interaction space of the StorySurfer Floor](image1)

**MIXIS – fixed point**

The concept behind MIXIS is that instead of limiting the interaction with mobile devices to the device we use the space around the mobile device as input and we are thereby able to create mixed reality applications where the space is used to interact with programs running on the mobile device or on a nearby PC.

The MIXIS interaction technique uses the mobile device’s camera to track a fixed-point and use the distance and rotation of the device from this fixed-point as input vector to a set of different applications. Depending on how the different movements of the device are mapped to the applications the device can be a 1-4 D input device. In MIXIS – fixed point we track a circle that can be printed out or drawn by hand.

Based on the MIXIS mobile tracking technique we have built a set of applications e.g. the ImageZoomViewer, an application where the user can pan and zoom on a map or image by moving the device in the interaction space, DrawME, is an application where the user can call a person by drawing a symbol on a piece of paper and associate this symbol with a phone number or BlueMix where several users can use their personal mobile device to get a course on a shared display or play games on shared displays. The MIXIS concept and some other applications are further described in [6][7].

(Mixed Interaction Space with Face Tracking)

![Figure 2: Interaction gestures and a diagram of the mixed interaction space.](image2)

**MIXIS – face tracking**

In a newer version of MIXIS we track the users face instead of a circle. We use a mobile phone with a camera facing towards the user as our platform and have a new situation where both the camera and the tracked object are mobile. Figure 4 shows the concept and the different degrees of freedom we are able to use as input to our applications. We have re-implemented several of the applications from the original MIXIS with the face tracking technique and designed some novel applications. The MIXIS face tracking project is further described in [5].

![Figure 4: The Mixed Interaction Space with face tracking](image4)
DISCUSSION

Learning new interaction techniques
Since movement and sensor based interfaces differ a lot from traditional user interfaces, a challenge for movement and other sensor based interaction techniques is to tell the user how to use this new interaction technique and how it maps to the different applications. A keyboard and a mouse seems intuitive to use, but watching a new computer user try to figure out how to use the mouse or getting access to some of the special characters on a keyboard, points to some of the tacit knowledge that is required for using a computer.

Some of the interfaces we have worked with are easy to learn, but not self explanatory. E.g. first time a user see the floor of the Story Surfer it is not clear that you can interact with it by just walking into it. However, as soon as one user gets hold of the concept it is easy for this person to tell other users how they should use the interface and help him or her cooperate in the interaction. One way to learn a new interface is by having someone around to tell you how to do it and use social interaction to learn about novel interfaces. I would like to think of this social element of the interaction as an aesthetic aspect of interaction.

Another way of exploring the possibilities of a new interface is through play. Letting the user play with the interface and learn what kinds of possibilities the interface has to offer. However, there is a thin line between learning by playing and being frustrated and abandon the interface. E.g. having a problem finding the sensor that turns on the water tap in a public bathroom is normally a frustrating experience and the hidden and transparent interface is not considered a playful and exploratory interface.

In [11] the concept Playful interaction is discussed as a provocation towards existing interaction paradigms, and states that aesthetic interaction, in opposite to tangible interaction, recognizes that man is capable of working with complex and abstract models for interaction. I agree with this, but I consider that the aspect of learnability should be considered in designing for an aesthetic experience with new interaction techniques.

Constraints
Another approach to learnability in sensor based interfaces is to build constraints into the interface. An example is tangible user interfaces. The tangible objects can be shaped in forms that only allow them to be manipulated in a certain way and constraint some unwanted interaction. E.g. a tangible object can be designed as a block in a tray to allow sliding in one dimension, but not free movement in 2D. Ulmer’s paper about constraints explores tangible object and constraints in details [12].

However, when using cameras and especially dynamic cameras it is really hard to constrain the interaction and prevent people or objects from moving away from the camera’s field of sight. Another option is therefore to visualize the interaction space for the user.

Visualizing the space
Visualization becomes important with sensor interfaces as pointed out by Bellotti et al. [2] in their discussion on sensor interfaces. Visualization is highly important when working with mixed interaction spaces since the boundary of the space, and thereby the interaction, depend on what the camera sees and not what the user sees.

With fixed mixed interaction spaces we can use the architecture to visualize the space. In the floor of the StorySurfer we use a white mat to show where the interaction space starts and ends.

With dynamic mixed interaction spaces we cannot use the architecture to signal the presence of a mixed interaction space and we therefore use digital feedback. In MIXIS projects we use the display to overlay information about the position of the device in the space. E.g. in the ImageZoomViewer we draw a thin line from the center to the position of the face or circle in the interaction space on top of the map to help the user in determining where in the interaction space the device is. We found that finding good ways of visualizing the interaction space was crucial for a smooth and easy interaction in the application we build, which are “soft” aspects crucial to the full experience of our interaction technique.

Mapping
Mapping is a term that refers to how the data captured by the camera or sensor is mapped to the different applications that relies on the technique.

In applications with tight couplings between the physical movement and the movement in the application natural mapping is accomplished, which is a term suggested by Norman [10]. Natural mapping uses physical analogies or cultural meanings to bring about immediate understanding of the relationship between the physical and digital movement. An example of this is the application for map navigation with MIXIS on a mobile device, where moving the device to the left, right, up, or down pans an image, and moving the device closer or further away from a fix point zooms in and out. With StorySurfer moving the body to the right moves the cursor to the right. This resembles Norman’s example of natural mapping in which turning a steering wheel to the right make a car turn right [10]. I believe that the stronger feeling the user possess that the interaction is “natural” in relation to the artefact and interface, the greater success in reaching the aesthetic experience.

Evaluation
A serious problem related to the projects described here is the evaluation of them. Most technology has traditionally been evaluated through measuring its effectiveness and performance, especially in the field of traditional HCI. When working with new interaction techniques and especially in the domain of children’s technology, then
aspects such as fun, entertainment, sociality and aesthetic experience might sometimes be more relevant to measure. To evaluate this, there is a need for a common language and framework, which is hard to achieve with such individual aspects. The question is also what the academic community considers about the relevance and contribution of an evaluation of the “soft” aspects. My guess is that there are more people in the workshop that are involved in this complex of problems, and I suggest this as a subject of discussion.

CONCLUSION
In this position paper some of the latest research projects that I have been involved in has been presented in short. The intention with this is to present what areas I have been experimented in and have practical experience from, and to present the aspects I consider being relevant in the design of the aesthetic experience. I have argued for that learnability of new interaction techniques, constrains, visualization and mapping should be considered in the design, and I have pointed out the problem of evaluating the “soft” aspects that the aesthetic experience consists of.

REFERENCES

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