

# A Glimpse into Human-Spatial Dialogue through Experience Prototyping

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*Giving the user a tool to control the sensorial qualities of a physical space, can alter the emotional state of individuals.*

## ABSTRACT

This paper will outline the process and result of an experience prototyping exercise carried out by the author and one other design student, as part of the Interaction Design programme at the Umeå Institute of Design, Umeå, Sweden. The design students used the Experience Prototyping course to observe user behavior inside a small, cocooned relaxation space, given that the user had tools to change the emotional and sensorial content of this space, that is the lights and sounds within.

The paper has two primary intentions. One, it aims to illustrate how Experience Prototyping is a valuable sketch tool, to gather rich user feedback in the early stages of an interaction design process. Two, it intends to support the fact that giving the user a certain level of control over sensorial qualities of a physical space, can alter the emotional state of individuals.

## Author Keywords

Space, Environment, Interaction, RFID tags, light, sound, confined space, spatial interaction, experience prototyping.

## INTRODUCTION

### The aim and duration of the Experience Prototyping Course

The Experience Prototyping course was carried out with the intention of actually being able to test a product of interaction design on a group of users by applying suitable and relevant technologies for prototyping interaction. It was a 4-week project carried out by the second year students, between weeks 40-44 during the autumn term of 2006 at the Umeå Institute of Design, as part of the Master Programme Interaction Design. The software used for programming was Adobe Actionscript, and the hardware platform used was Phidgets. Phidgets are an easy to use set of building blocks for low cost sensing and control from a computer. Using the Universal Serial Bus (USB) as the basis for all Phidgets, the complexity is managed behind an easy to use and robust Application Programming Interface (API). Phidgets are simple to program and use. Very little knowledge of hardware, microprocessors, USB, communication protocols, is needed.

## A new problem domain for Interaction Design

Embedded technology and large-scale networking allow integration and augmentation of physical objects with information infrastructure. For example, physical documents, home appliances, office equipment and architectural elements with electronic tags, sensors or smart chips will be able to form a knowledge intensive environment by linking physical space and media space. This opens up a new problem space for interaction design: how to control remotely connected objects, how to interact with intelligent environments, and how to combine physical and media entities to create effective and accessible interfaces for a knowledge intensive environment.[1]

## Experience Prototyping is a Tool to Sketch Interactions

Prototypes and simulations are important parts of the design process. Traditional product design is constantly dealing with mock-ups and rough physical sketches of shapes, pack-ages and mechanisms. In the case of interaction design, physical models aren't enough to fully understand the qualities of what has been designed. Since interaction design is a time based discipline the tools to prototype the results of interaction design are quite different from those traditionally used in product design. At the Interaction design program at Umeå Institute of Design we use a palette of tools to sketch interactions of products, services and environments rather than just the physical aspects of products. One of these tools is Experience Prototyping. An Experience Prototype is any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, system or space we are designing.[2] An experience prototype is a valuable sketch-tool in the initial stages of design because it can be used to gather accurate and rich user feedback, create design conversations and initiate design thoughts. This will be demonstrated by the following project description.

## MIH'ZAZ: THE PROJECT OVERVIEW AND INTENTION

### The Emotional Dimension of Physical Space

The interior space of architectural environments, consist of primarily two dimensions: the physical dimension and the non-physical dimension. The physical dimension within an architectural environment is in a constant dialogue with human beings. Examples of architectural elements that make up the physical dimension of space are walls, doors, windows, stairs, ramps, and passages. These elements generate a dialogue with the user simply by acting as visual clues to guide a user's movement and activity in that space. In the process they create user behavior patterns and activities.

There also exists the non-physical dimension of architectural space. Examples of elements that make up the non-physical dimensions of space are light quality, colors, textures, graphics, sounds, and smells within a space. This dimension can also be referred to as the sensorial or the emotional dimension of space.

The sensorial and emotional dimension of a space plays a large role in shaping the user's emotions. There is now adequate evidence to suggest that certain aspects of the physical environment such as lighting (natural or artificial); colors, and textures; organization; etc. can affect our behavior. Furthermore, Rusell and Snodgrass (1987) demonstrate the role of emotions in the "affective appraisal" of the environment. Some researchers go further to argue that office design, for example, can affect the productivity of its users. [3]

According to J.S Gero [4] the emotional content of the physical environment is also considered as the final dimension. The emotional content of the physical environment stands at the core of the environmental content, since emotional content of a space plays a large role in governing the quality of life and activities of human beings. The emotional content or dimension of space can be said to be a resultant of the quality of lighting, colors, textures, and physical organization of space.

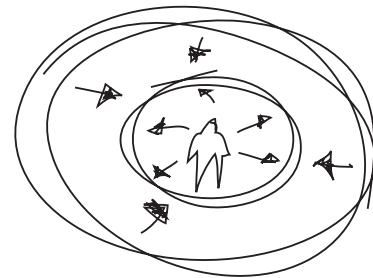
Spatial needs are resolved by the creation of architectural forms, which in turn allow the fulfillment of individual, social and psychological needs in the form of a building. Individuals and social activities within a building are manifest in terms of functions with relevant degrees of performance for the building as a whole or in its parts.[5]

However users of a space don't necessarily always have the tools to *alter or modify* the emotional dimension or the sensorial content of the environment to suit their needs. Instead they are expected to adapt to the sensorial content already provided to them.

*The premise was to test the dialogue between users and spatial media, when in a cocooned space.*

walls, doors, windows, stairs, ramps,  
passages

physical dimension



non-physical dimension

light quality, colors, textures,  
graphics, sounds, and smells

the sensorial dimension or the  
emotional dimension

*Interaction Design is about designing media and about designing tools, but if you put enough of these together, you get more than a bunch of stories and some functionality. You get environments that include users as active players. [10]*

### **Can the user control the Emotional Dimension of a Space?**

*Mih'zaz*, is an intense, intuitive and non-technical word to describe 'mood' in Urdu or Hindi. The name of this project was coined as *Mih'zaz* to define the 'ethos' of emotion or mood, in the place of a technical term for it. The aim of *Mih'zaz* was to support the idea that providing users with a certain level of control over the emotional dimension or the sensorial qualities of a space can alter the emotional state, the mood or the *Mih'zaz* of individuals. For this we decided to provide them with a tool to control these sensorial qualities. This tool would serve as a bridge between the user and the space, to carry out a dialogue between the two. By observing user behavior and interviewing the users after they experienced of *Mih'zaz*, we aimed to explore other possible forms of user-dialogue within the chosen space. The intention was also to make the technology as ubiquitous as possible, such that it would disappear for the users.



*The first tool : the controlling object was chosen to be a solid cube, where each face would contain specific content.*

### **SELECTING THE TOOLS OF EXPERIENCE**

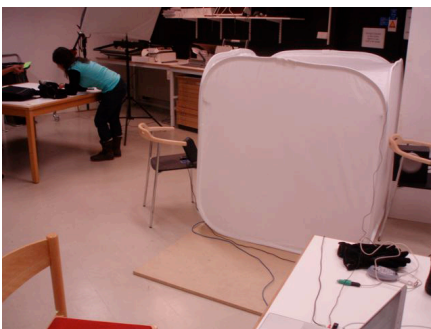
Webster's Dictionary defines tools as 'an implement for manual work; an instrument for achieving any purpose' [7]. The definition of a tool can thus wander beyond the idea of a machine or object. A tool can be looked at in several ways through several definitions.

An artifact with a functional use ([www.modernhumanorigins.com/t.html](http://www.modernhumanorigins.com/t.html)).

A set of specific steps that must be completed in order to perform an operation ([www.davidgould.com/Glossary/Glossary.htm](http://www.davidgould.com/Glossary/Glossary.htm))

A device that aids in accomplishing a task, a form of technology. ([www.nmlites.org/standards/science/glossary\\_6.htm](http://www.nmlites.org/standards/science/glossary_6.htm))

Either an application or a manual process or a person ([nrims.nsw.gov.au/policies/imf/glossary/glossary-terms.html](http://nrims.nsw.gov.au/policies/imf/glossary/glossary-terms.html))



*The second tool: the space to enclose the user in this experience was chosen to be a small cubicle tent made of translucent white polyester.*

Going with the idea that a tool is essentially an instrument for fulfilling a purpose, we classified the controlling-object, the space and the technology under the category of tools and limited ourselves to the following tools of experience. These tools were a result of the needs of our concept and would provide the framework for visualizing the sensorial content within the chosen space.

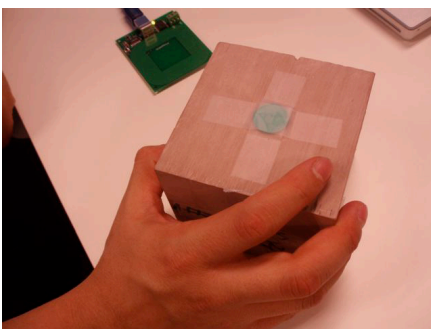
### **The first tool: the object employed by the user to control the content**

The first was *the object* that the user would use to control the content of the environment. In our case it was a cube-form. Some of the reasons that we chose to use this form are as follows:

- 1| it is a basic solid that would be easy to control and manipulate.
- 2| it has faces that make it possible for the user to draw a connection to the content based on which face it is that he is using.

### **The second tool: the environment that would possess the emotional content**

The second tool was *the environment* that the user would control. The environment we chose to use was, a white translucent cubicle tent made of thin polyester. The dimensions of the cube were 120 cm<sup>3</sup>. One reason why we chose this was the fact that we wanted to analyze user behavior in a cocooned space. Another reason we chose this was because we wanted to project light and graphics from outside the space, in a way that the user would not be able to see the source.



*The third tool, the technology: was RFID technology. This simple technology made the interaction remote and intuitive such that the user would not be exposed to the technology in use.*

### **The third tool: the technology in use**

The third tool was *the technology* to be used. Since the intention was to make technology disappear and completely ubiquitous, we chose to use RFID tags, so that the user's interaction with the cube would be more intuitive and less technical. Each face of the cube would have an RFID tag attached to it, which would be programmed with the sensorial content it would contain. An RFID tag reader hidden inside the cubicle tent would read the RFID tag when that particular face of the cube was placed on it.

*Information technology can be used to dynamically modify the appearance and the behavior of spaces and objects: the physical environment becomes an interactive system. [10]*

## BRAINSTORMING AND CONCEPT DEVELOPMENT

The starting point of the concept development was that every face of the cube should represent and contain different content. The content on each face should also be the representation of a different emotion. Each of these emotions must be different and contrasting from the other, and to trigger or reflect the user's mood. Simply by changing the face of the cube and moving the face over the RFID tag reader, the user should be able to change the content of the media in the environment.

### Defining and Visualizing the Sensorial Content

We began by defining each of the different moods or emotions.

For this we used 6 basic emotions and the characteristic qualities associated with these emotions in terms of color, the behavior of graphics, and the nature of sound. The 6 basic emotions and the characteristics associated with them are as follows. The colors were chosen purely on the design students' previously acquired knowledge of basic design. The choice of music was based on what the design students intuitively connected to that particular emotion and what they felt would best reflect that emotion. There could have been better options, but since the purpose was purely for an experience prototype in an early stage of design, the design students did not delve very deep into the academics of the choice.

- 1| joy: warm color | smooth, flowing graphics | tranquil music > Staralfur by Sigur Róss
- 2| sadness: cool color | slow moving, repetitive graphics | melancholic sounds > Tristesse Globale by Royksköp
- 3| fear: darkness | no graphics | only sound > layers of voices, whispers and screams
- 4| anger: warm color, red | throbbing pulsating graphics | loud jarring music > Big Man with a Gun/ March of the Pigs: NIN
- 5| surprise: cool color, blue | slow floating bubbles, controlled by voice input | no ambient sound
- 6| peace: cool color | smooth, interactive, touch-responsive graphics | > track by Telefon Tel Aviv

### User Test Set One

#### Intention

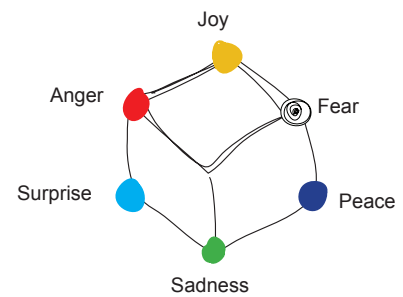
The first set of user tests was carried out with the intention of observing how the users would actually behave inside a confined space and how they would interact with the cube provided to them for changing the sensorial content of the space. In this first user test we exposed the technology to the users, since we only wanted to understand their physical interaction with the space and the controlling object. We explained the idea to the users to make them aware of our project intentions so that they may be comfortable.

#### Setup

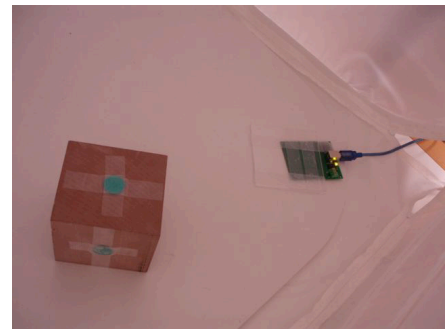
The cubicle-tent was set up inside a dark room, on a table, such that the user would have to climb into the tent. The content triggered by the cube's RFID tags, was projected on to one face of the tent from the outside such that when the users entered the tent, they would be able to see the visual content of the environment projected on the tent. Small speakers were strategically set up on the corners of the cubicle-tent such that it created an effect of surround-sound within the tent and the user would be able to hear the content triggered by a particular face of the cube without really knowing where the sound came from. The entire technical set up was visible to the user.

We used a rough version of the cube that the user would control, which was a heavy block of PU-foam (density 0.7). The cube was 10 cm<sup>3</sup> in dimension. The cube had an RFID tag attached to each of its six faces. At this phase we had already started to programme the 6 RFID tags with visualized content, but in a very rough form. The RFID tag- reader was placed in a corner of the cubicle-tent.

Before the user entered the tent-cubicle, we instructed them to swipe the different faces of the cube over the RFID tag-reader in order to change the content of the environment.



*To start with, each face of the cube was assigned an emotion, going by the 6 basic emotions of human beings.*



*The technology was relatively exposed to the user. The RFID tag reader was placed on the corner of the cubicle and the RFID tags were taped on to the faces of the cube.*



*Video, observation and interviews were used to obtain feedback and conclusions.*



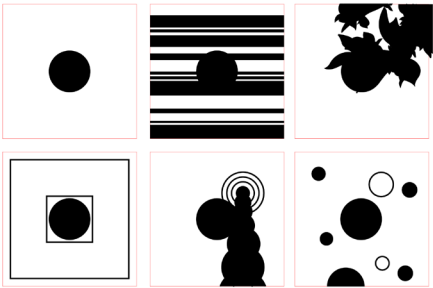
Eventually the users would start to fool around with the cube

### Observation, feedback and conclusions

Our observations led to the conclusion that when the users first entered the empty tent, they were uncomfortable and unsure of what to do. There was nothing inside the tent that acted as a clue or trigger that assigned purpose or instruction to the space or the controlling-cube. The heavy PU-foam cube was not pleasant to use. However, the users were intrigued and curious by the ability to control the content in the confined space in such a simple way. There were no wires or technology visible, which triggered them to play with the cube without bothering about anything technical. Some faces of the cube had content that reflected the users' voice input. This particular function was of special interest to the user, when they saw a visual representation of their voices in terms of graphics, and heard a distorted echo of their own voices. The users eventually tended to relax, lay back and play with the cube.

On interviewing the users they said they would prefer that the controlling-cube be made of a softer and lighter material. They also suggested that the tag reader be placed in a location easy to access, so that they could sit back against the tent and play with the cube. Each user had a particular content that they were more attracted to.

The users expressed the need for visual references on the cube, connected to the content of the media, so that they could return to a particular content if and when they wanted to, without having to check each face by trial and error.



Connecting the graphics to the content

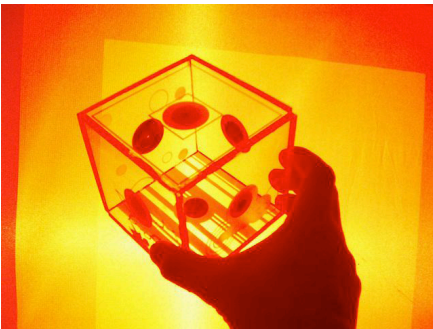
### Technical Difficulties encountered

The RFID tags could only be read if the cube face was brought close to the reader and taken away. This restricted natural interaction by the user with the cube. The user often tended to want to place the cube on the RFID tag reader, which crashed the Action Script programme.

### Visualizing the Cube

Feedback from the first set of user tests indicated that the user wanted to have a visual reference on the cube faces in order to return to content, which was more appealing than others. This we tried to achieve by the creation of simple abstract graphics on each face of the cube. Each graphic illustration was visually connected to the graphics of the media-content. The graphics were also designed in a way that the RFID tags would blend into the illustration.

The material chosen to make the cube was acrylic. There were several reasons for this decision. Firstly, the users, during the first set of user tests, agreed that the cube must be more lightweight, both visually and intuitively. Secondly, in order to be able to easily see the visual reference in a dark space, the material had to be either light reflecting, or light retaining. The graphics on each face of the cube were etched into each face by a laser-cutting machine. Etching the graphics on to the faces of the cube lent two levels of transparency through which light from the environment could pass. One level became the foreground, and the other became the background in the graphics, thus illuminating the illustrations clearly.



The material of the cube was determined by the need for visibility of the graphics on each face of the cube.

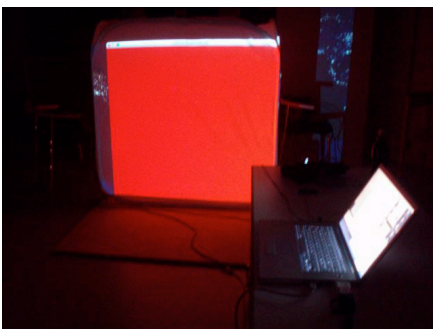
### User Test Set Two

#### Intention

We wanted to understand the emotional interaction with the space. The second set of user tests were carried out with the intention of testing the final version of Mih'zaz, complete with the transparent acrylic cube, on the users and finding out if and how the space and the interaction within it, affected their mood. We wanted to understand the emotional interaction of the user with the space and find out whether control over the sensorial content has any effect on their moods.

#### Setup

In the second user test, unlike the first one, the cubicle-tent was setup on the ground, and in such a way that the rest of the room was not visible at all. As soon as the users entered the room, they would only see an illuminated cubicle tent.



The technology was concealed as much as possible.

The projector that projected the media was placed behind the cube, beyond the view of the user entering the room. All used technology was concealed as much as possible. The speakers were set up on the sides of the cubicle-tent, once again strategically placed to impart an effect of surround-sound.

The RFID tag-reader was concealed underneath a transparent acrylic tray and a visual sign was placed on it. The visual sign was intended to trigger the user to use the tray to place the cube on the tray.

Some of the variations of content had the possibility for user interactions. For instance the users' voice-input might be able to change the nature of graphics displayed in terms of color or motion, or the volume of sounds projected. The users were not given any instructions this time, other than being told that they had the ability to change the sensorial content of the space with the tools provided to them inside the tent-cubicle.

#### Observation, feedback and conclusions

- Spontaneous user inputs: without being given any instructions, the users tried to change the content of the media in other ways, before they started using the acrylic cube to change the content. Some of these methods were voice inputs like shouting or saying 'hello', gestures with hands like waving and clapping, and touching the surface of the tent cubicle inside.
- Positions assumed inside the cubicle tent: the users would at first kneel down or sit cross-legged inside the tent. The light and the sounds inside the cube provided a very cozy atmosphere to the users. Hence the users often tended to lie down right next to the RFID tag reader tray, to play with the acrylic cube.
- Emotional reactions to the content: once the users figured out how to change the content of the media within the space, they would try to experiment with the interaction with the media, by talking, shouting or using gestures. It took very little time for the users to start connecting the content to the graphics on the faces of the acrylic cube, and they would eventually return to the content of their choice.

The users were all design students from the Umeå Institute of Design. It is worth mentioning that most of the users were in a state of exhaustion and stress, due to upcoming presentations that they were working on. It was not a surprise, therefore, that the users eventually completely avoided the content within the face of the cube that expressed anger while playing out music by Nine Inch Nails, and settled for the face of the cube that expressed Joy and played music from Sigur Róss.

After the second set of user tests, the technology and setup was exposed to the users, and they were asked four questions:

- What was your mood like before you entered Mih'zaz?
- What is your mood like now?
- Mention one positive aspect and one negative aspect of your experience
- What physical objects would you like to add to the space?

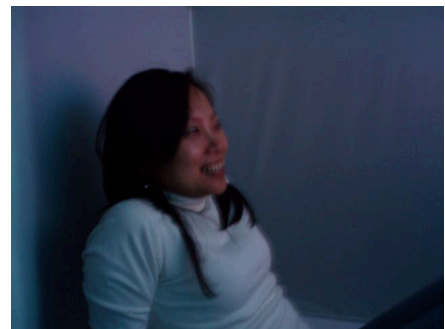
Some of the conclusions inferred from their responses were as follows. The experience of Mih'zaz seemed to *provide relief* from the regular activities of the day, and *took them away from work* for a while into a *world of playful relaxation*. The users were most happy about how the *scale of the space* transferred them into a meditative and relaxed state by shutting them away from their regular environment. They were intrigued by the way *they had the power to change the content of the media* in this environment. They were least happy about how technical problems with the programming, caused *delays in the transitions between the content*, sometimes *making the interaction more compulsive and less intuitive*. A common need for most of the users was to *add pillows and soft surfaces within the cubicle tent*. The users also asked for a *glass of water or juice*, which seemed to suggest that they wanted the space to contain other forms of sensorial interaction to complete the experience of Mih'zaz.



*Before using the cube to change the media content, users spontaneously tried other methods of interaction such as shouting, or arm gestures.*



*Users naturally assumed positions inside this space without being told what to do, such as lying down or relaxing.*





*Because the experience was very close to the real thing, the users' feedback was precise and detailed.*

## CONCLUSION

### **Experience Prototyping is a valuable sketch tool in the process of Interaction Design**

The process of Experience Prototyping, clearly adds an enriching dimension to the design process, by virtue of providing users with the actual experience of interaction with a product. In the process, the users are able to provide far more accurate feedbacks, based on experiences that are closer to the real experience. In the same breath, the design process is also enriched with new ideas and directions.

For example, these first couple of user tests opened up the possibility that being able to control the sensorial and thus, emotional content of a space, effects and alters the mood of the user. One of the main examples of how experience prototyping added new design ideas to our project was that we started by providing a cube as a tool to change the content of the environment, but received feedback of how there could be far more interesting and intuitive methods of human-spatial dialogue such as simply talking or gesturing. Another example of a design idea was that with right knowledge of programming, we could programme not just 6, but several random versions of 'joy' or 'peace' or 'anger', on the faces of the cube, so that there would be more variety in the content.

Mih'zaz was a concise attempt at exploring an environment's dialogue with the user that it interacts with. For example, this short but focused experiment proved that intuitively controlling the emotional content of a space (in our case the media of sound, light and graphics), gives the user a source of entertainment and relaxation outside the realm of information media like television. It seems that the choice of a cocooned space was quite ideal because it literally shut away a user from the regular environment, and made the users focus on the immediate environment that surrounded them. It also appears that human beings' experience of a space becomes more dynamic when they have more control on the non-physical dimension of space, i.e., on the emotional and sensorial content of his environment. In the next few years, emerging practices in interactive architecture are set to transform the built environment. Whereas 'smart design' was once regarded as the preserve of museum exhibits or Jumbotron advertising screens, 'multi-mediated' interaction design has now entered every domain of public and private life. Already today, as a spatial medium, interaction design is revolutionizing and reinventing our homes, as well as our work and leisure spaces.[6] This field of thought, of connecting interaction design to spaces, will open up more, only by throwing the experience of human-spatial dialogue into the lives of users, by letting them use, question and add value to the possibilities.

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