KIDS AND NEW MEDIA

How young people act within virtual architecture

S. ZEDLACHER, AND A. WILTSCHE
Institute of Architecture and Media,
University of Technology, Graz, Austria
zedlacher@tugraz.at, wiltsche@tugraz.at

Abstract. Today’s children are familiar with many fields of new media. They can’t even resist. Even more they have a more natural approach to new technologies than many of the grown-ups. In several workshops we tried to test how these young students would interact within a virtual environment configured for architectural needs. Providing a special setup equipped with a tracking system and sensors we investigated the children’s behaviour and the robustness of our system with regard to the education of elder students and further research.

Keywords. Virtual environment; tracking system; digitised rooms; space sensing.

1. Introduction

These days modern houses consist no longer of bricks, wood, concrete and wallpaper. In fact we find a great deal of large and small computers, controls, electrical devices and small machines, which perform their work mostly unnoticed. These devices change the climate, so that we feel well or produce new acoustic and visual experiences with music and projections. Hence new media already occupied for quite some time our apartments and working environment. Extending Mark Weiser’s ideas about ubiquitous computing (Weiser, 1991) even less gadgets like tabs, pads and board-sized writing and displays fill up our spaces (Weiser, 1993). Moreover the “material” (= walls, carpets, furniture, doors, etc.) itself that spaces consist of got intelligent.
But what happens if these areas develop their own life? If a wall isn’t any more a wall but a music device? If the floor becomes a meadow? If there grow trees and flowers instead of wallpaper?

We wanted all these fantasies and future experiments to be investigated by children. Our university offers the possibility to invite children of elementary schools to explore everyday life at the faculties in the course of a so called “children’s university.” So we asked groups of pupils at the age of about 10 years to explore the matter and to try to design virtual rooms and atmospheres. The children came without special preliminaries and were motivated to free up their ideas and fantasies and to think about what future will bring.

Together we tried to explore and investigate rooms and spaces with invisible bricks made out of air, wallpapers made from light and three-dimensional, invisible sculptures one could only hear. Additionally we programmed a kind of a simple space computer using sensors which interacted with our guests to explore how young people react on this matter. Within this environment future humans perhaps may feel just as well as we do these days on a flowering meadow.

Although such environments are still discussed and exist (Greenfield, 2006) we wanted a combination of an interacting room and a kind of independent space computer which enables a creative design of itself. In our opinion this setup is the ideal approach for a future architect and designer to his matter and design needs. One vision is to create a tool wherein he can design with his whole body and bodily expressions. Also setups like this should no longer be reserved for artists and dancers (Zedlacher, 2007).

We adapted and reprogrammed our lab setup (see section 2) which is usually used by grown-ups to meet the requirements of the children, i.e., the ease of handling, understanding, motion and development of creativity. Course after course we adjusted the settings to the findings learned before. In order to draw better conclusions and to keep a better overview of the very complex theme, we divided our investigations into several modules (see section 3), although it is an ongoing and integrated development.

The answer to the question why we invited children to carry out experiments in a highly sensitive and digital world is justified in the nature of young humans. They have a natural and impartial approach to the matter of space and spatial qualities, and they don’t distinguish much between analogue and digital media. We discovered that architecture students are already rather fixed in their thinking and prospect of virtual and media environments. They are excellent users and designers within completed modules. But they are not that creative in developing and adapting them to their special needs. In most
cases they “only” use the modules just as tools. They hardly invent or develop “design tools.” Human and space are separate identities.

Finally we wanted the outcome (see section 4) to give us more information about virtual and media environments especially how people live and act within. The outcome should also be a benefit for our further research and the teachings with grown-ups (Pan, 2006).

2. Equipment

Our experimentation laboratory “noLAB” is equipped with a Vicon Tracking system consisting of six tracking cameras (figure 1). The experiment space is about 6m × 5m = 30 square meters. For complex tracking setups we can borrow six more cameras from our neighbouring institute which uses them primarily for the tracking of motion in combination with music.

Our cameras track spherically shaped tracking points which can be placed almost everywhere, for instance on a body for full-body motion capturing or simply on a small target just to get the information of one single point in space. The latter we used for the young people. After recording, the tracking data were edited mainly by the software packages “Maya” and “Processing.” We wrote a converting tool to format the received Vicon data for our special needs and to facilitate the processing in our desired software. No need to say that the geometry data of the physical room was recorded first and then modeled by CAD software in order to overlap tracked with physical information and to establish an augmented reality setup. This setup enables the use of a head-mounted display (HMD), which we did in fact with undergraduates (at the age of 20). We hold courses with great success and outcome, whereas the practice of an HDM in combination with children at the age of about ten...
turned out to be very exhausting. They are hindered in such a way that they are limited in practicing their creativity. And this wasn’t our goal. We wanted to create a setup where everyone could interact in a relatively natural way by using gestures, movements of the body, drawing with hands, making own noise, etc.

Further we equipped our lab with canvases on three sides and beamers in order to visualise the interaction of our young “probands.” Therefore the canvases were a very important reference tool. They served on the one hand as a kind of walls to give the feeling of a room. On the other hand they served as great windows and offered a virtual view to the environment or nature (fig. 2).

For audio interaction we used microphones and loudspeakers linked with the tracking system and controlled via MaxMSP.

To take measurements of the physical room conditions we worked with Arduino boards and sensors for humidity, temperature, brightness and loudness. Controlled and analysed was the data by Processing (Fry and Reas, 2007).

3. Modules

We divided our workshops into several modules because on the one hand the interactions could not be yet integrated in one big software package. On the other hand we did not want to mix the various room interactions so that the senses could not be diluted. The level of interaction provided by the system should be related to the experience level of the people using the system (Lidwell, 2003). We started by darkening the room and asked the kids what they would do as future architects to create and enhance their environment. The answers were of course bringing light.
3.1. LIGHT

After discussing what light consists of and how it is produced (of course in a still darkened room) we offered two different possibilities. First we generated “artificial” light by using three tracking targets (figure 3). Each target acted as a kind of virtual pocket lamp emanating red, green or blue light respectively. If two targets came together new diverse colours occurred. All three lamps generated white, which was pretty new for the kids. This was our first approach in creating a mood in the common room.

The next step was to cut virtual windows into the walls (canvases) and to fill the room with “natural” light. Two kids with one target each had to cooperate together and to position the lower left and the upper right vertices of a rectangle in front of the wall (figure 4). They could walk along the wall with the targets and “look through” their window and they stopped as they were satisfied with their choice. To visualise the feeling of looking through a window and to see out we put pictures of famous towns behind. We used this as a kind of riddle to guess what is behind.

Figure 3. Artificial light composed by the fundamental colours red, green and blue.

3.2. SCULPTURES

3.2.1. 2D forms

The next step was to design virtual walls, wallpapers and furniture. The targets were used as brushes and the children painted their own nurseries (figure 5). Very important – as for all workshops – was the possibility for them to act in motion. Almost all creations they built were an expression of their motions. Besides ordinary lines they drew their names, their contours and so on. Surprisingly for us, they started to use their body shapes to form new 2D figures. Although the painted figures looked clumsy, the children started to produce a sort of 3D imagination (see section 3.3.2). To allow more interaction we combined the brushes with sliders which influenced the thickness of the lines and their colours. So the kids had to cooperate again and to adjust their handling on each other (figure 6).
Figure 4. Cutting windows into the walls.

Figure 5. Line sculptures and contours.

Figure 6. Line sculptures influenced by thickness and colour sliders.

Figure 7. The canvases serve as reference media (left). Creating a virtual space sculpture.
3.2.2. 3D forms

We were animating the children to create three-dimensional forms with the targets in our workspace. The basic idea was to draw fantastic virtual furniture in space. The projections on the canvases served again as reference media. Additionally we partially mirrored the workspace on the canvases or showed them the whole room setup on a projection (figure 7, left). It turned out that this three-dimensional task was hard to perform. Although they tried hard they could not get a feeling for the virtual three-dimensionality. This is due to the fact that human space perception is not completely developed at this age (Thurstone, 1938; Anderson, 2009). However nice sculptures were produced by recording the targets paths during interacting between the children (figure 7, right).

3.3. SENSORS

We applied the following sensors in our lab: sensors for humidity, temperature, brightness and loudness. We combined the sensors with our setup in order to facilitate an interaction between the room and the young humans.

3.3.1. Temperature

Space perception is fundamentally connected to temperature which is one of the major tasks a room fulfills. Connecting the temperature that rose with the presence of children in the lab to projected color and patterns was one task to understand the connections between physical space conditions and digital remastered output that ends once more in a physical appearance. More over this opens the possibility for linear and recursive loops, e.g., connecting the temperature sensors through the software with fans and room climate systems. The children learned how the possible interconnections in the noLAb worked.
3.3.2. **Humidity**

To understand the relationship between humidity and mold-infested walls we created “digital mould.” While the children were interacting somehow in the lab the humidity factor rose and starting from the corners of the walls some (painted and projected) mould scrambled along (figure 8). As the walls were filled with the mould the question “What shall we do?” came up and was (fortunately) answered with “Let’s open the doors and windows!” The humidity factor fell and the walls got white again.

3.3.3. **Brightness**

According to the example mixing light with physical output (section 3.1) we wanted also to do it vice versa. What about physical light that produces a digital output? We equipped the pupils with pocket lamps and asked them to look for some animals in the darkened room. When the light beam got into the range of one of the brightness sensors a swarm of digital flies started to “swarm” round that point (like they do in real world).

3.3.4. **Loudness**

The loudness sensor was coupled with nature sound and worked converse to the rough sound level of the room. The more the children were quiet the merrier and louder they could hear the sound samples. In addition we hid the samples in the room so that they had to find and locate them first. Somehow we created dreams for our room that came out if everything else is quiet. In addition to “androids that dream of electric sheep” (Dick, 1968) our space dreamt of electric birds, digital trees and virtual creeks.

3.4. **AUDIO**

Besides the visual interactions and room reactions we also established also an audible setup. Mankind is such flooded with pictures and videos that the sense for hearing is sometimes forgotten.

3.4.1. **Labyrinth**

We put “virtual invisible” walls and boxes in form of a labyrinth in our workspace. Kids were divided in groups and had to find the right way through. The targets which they held in their hands served as reference tools. Every time when they got into an invisible wall they heard a sound. By and by they developed a feeling of the labyrinth.
3.4.2. Melody

The second audible interaction used a melody. We divided a popular song for children into several parts and put them somewhere “invisible” in the room. With the help of our targets they could be found which means that if one target was within a special position in the room a melody part could be heard. This was the first goal. The second and more difficult one was to put the parts in the right order so that one could hear the whole song in a correct way. This was possible only if the right target was positioned within its special position and all other targets produced no sound.

4. Outcome and conclusion

After the children got accustomed to the setup they pushed the envelope and the technical equipment operated at full capacity. A new space experience and feeling was developed mainly by motion and interaction. Finally, we drew the following conclusions:

- Children need a short time to become familiar with it, most likely due to their acquaintance with computers, internet, game consoles, etc.
- They accept the digital transformation process which takes place within the environment and let their imagination run wild.
- We realised that they are more capable than grown-ups in accepting the environment as an interacting tool within they can act and “live.”
- Children accept a kind of “soul” which is inherent in the environment although they of course know and see that all is virtual.
- While they do not have troubles to interact with 2D worlds, they still have problems with the 3D space. But the use of virtual environments seems to be a good tool to enhance the situation (Duenser, 2006).
- It turned out that the children also have problems with the real scale of interaction. Although they were in motion they could not use their whole bodies to interact. The targets were still foreign objects for them. This we recognised also in various other courses with grown-ups. They seem to be disabled when they should use their bodies to interact.
- We suggest that some kind of “body rituals” must be developed to accustom people to the use of their bodies inside such an environment unless dancers are available (Zedlacher, 2007). We think that it is necessary for architectural students to use their body as a “design tool”.
- Plug-and-play quality and perfect operation of the all components – equipment and setup – are indispensable.
- One drawback is still the enormous technical effort including real-time visualisation, cabling, network, beamers, computers, cameras, etc.
And finally: Why these investigations? Because we want to identify our needs and detect the reasons which make a room special and extraordinary. By means of digital media we want to discover why we feel comfortable in a room. Eventually we want to find out how the digital architectural space changes the human being. We think that the help of children is an appropriate way to solve these questions because of their impartial view and approach. In any way one benefit is the use of the developed modules in courses for students, mainly for “Digital form and sculpting motion.”

5. Future work

Future questions which we will investigate in a similar way are the followings: How can we communicate with the room in a better way? How can we communicate with other rooms? How can we stash walls? How can the room act more autonomously and react better to our needs? Will the integration of game engines enhance the setup? And finally pushing the architectural students to a new work around: Building the tools they use instead of using the tools non-architects built for other purpose.

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References