Experiential and Respectful

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Abstract

Many electronic products show little respect for the user, which results in poor experiences. We will argue that the user is interested in the experience rather than the product. To achieve rich experiences, design should respect all of man's skills, including his perceptual-motor and emotional skills, instead of focusing only on his cognitive skills. We will give examples from both our research and teaching programmes which reflect our ideas and the challenges in creating contexts for experience, aesthetics of interaction, rich action-based interaction and emotionally-aware products.

Introduction

Technology is blind, or at least neutral (Saul, 1992; Nardy & O'Day, 1999). The technology push has no direction. So what about industrial design, which is so heavily dependent on technology? These days design is said to take man, not technology, as its starting point. The talk is all about user-centred design. But what does this mean? In this paper we will give our views on these issues by sketching a theoretical framework and illustrating it with examples from our research and the work of our students.

Theoretical Framework

A CONTEXT FOR EXPERIENCE

The shop assistant threw the biscuit at my feet. I bent down and subserviently began to pick up the crumbs. After some fiddling, I managed to get my change out of his clenched fist.

Just imagine you were treated like this in a shop. No doubt you would be most offended. But this is, in fact, the way in which a vending machine treats us when we buy something from it. Somehow we have come to accept a standard of respect in human-machine interaction which is very different from that in human-human interaction. Let us see what this example might tell us and what the role of the designer is in this.

Naturally, the user is in search of a positive experience. Therefore the designer needs to create a context for experience, rather than just a product. He offers the user a context in which he may enjoy a film, dinner, cleaning, playing, working … with all his senses. It is his task to make the product's function accessible to the user whilst allowing for interaction with the product in a beautiful way. Aesthetics of interaction is his goal. The user should experience the access to the product's function as aesthetically pleasing as possible. A prerequisite for this is that the user should at the very least not be frustrated. However, we are not promoting "ease of use" as a design goal. Interfaces should be surprising, seductive, smart, rewarding, tempting, even moody, and thereby exhilarating to use. The interaction with the product should contribute to the overall pleasure found in the function of the product itself.

The following example should clarify what we mean. Suppose the user wants to watch a movie for his enjoyment. He has to program his VCR in order to get it working at a later date. VCR manufacturers certainly give the impression of having done everything in their power to make the user as frustrated as possible. Why not make a machine that is a joy to use? We are not saying that "technical" design with a large number of functions and buttons should be avoided; some people actually like it that way. We call for diversity in product design. Not all

VCRs should look the same. Why is there such a diversity in car design, and not in VCR design?

HOW CAN THIS BE DONE?

We believe that respect for man as a whole should be the starting-point for design. For the sake of analysis, man's skills, which are used when interacting with products, may be considered on three levels: cognitive skills, perceptual-motor skills and emotional skills. In other words, knowing, doing and feeling.

Research on human-product interaction, however, has shifted to cognitive skills. This shift is easily understood, as there is no electronic counterpart for the mechanical world-view that still dominates Western thinking. We understand the world of moving machines, since we consider, to a certain extent, our bodies to be mechanical machines. The electronic world is more opaque to us. What happens inside electronic products is intangible: it neither fits the mechanics of our body nor the mechanical view of the world. In contrast with mechanical components, electronic components do not impose specific forms or interactions for a design. Products have become "intelligent", and intelligence has no form. Design research, quite naturally, turned to the intelligent part of humans and thus to the science of cognition to find answers. This has resulted in interface design placing a heavy burden on human intellect, mostly in the form of manuals. To get rid of these interfaces, the ultimate goal of human-product interaction seems to be communicating by speaking to the machine. But why?

We all have senses and a body with which we can respond to what our environment affords (Gibson, 1989). Why, then, do designers not use these bodily skills more often and make electronic interaction more tangible? And, as humans are emotional beings, why not make interaction more fun and beautiful? Therefore it is necessary to include the other two levels of human-product interaction into the picture: perceptual-motor skills and emotional skills.

Perceptual-motor skills require physical interaction, i.e. handling objects instead of icons on a screen. On CHI'99 several speakers, including Bill Buxton (Alias/Wavefront), Don Norman (Nielsen Norman Group) and Bill Gaver (Royal College of Art, London) insisted that computer-human interaction should benefit from physical interfacing. Furthermore, they advised the CHI community to turn to specialists in this field, i.e., product designers. We firmly believe that design research and education should be designer-driven in a multi-disciplinary context. Design research has been dominated by non-designers for far too long.

Emphasis on emotional skills is growing. The Media Lab at MIT is making a study of "affective computing" (Picard, 1997). Damasio's book (Damasio, 1994) has shown that pure logic alone, without emotional value, leaves a person, or a machine for that matter, indecisive. And emotion has entered the stage not only in academic circles but also in industry. At our faculty, Mitsubishi is funding the "Designing Emotion" project in which an instrument is developed to measure people's emotional reactions to cars. This again will help to develop a design tool (Desmet et al., 1999).

In the rest of this paper we will give examples of how to create a context for experience. These examples taken from our research and teaching concentrate on perceptual-motor and emotional skills.

About doing

We will give two examples from our research programme of how the problem of intangibility manifests itself in products and how we approach it. The first example is a video deck, the second example concerns 3D human-computer interaction. Then we will show the results of an exam question, which we set our second year students, concerning physical interaction in the context of a photocopier.

RESEARCH: VIDEO DECK CONCEPT

The status quo

Hiding informative components

It is often said that, since electronic components do not impose forms or interactions in the way in which mechanical components do, it follows that the workings of electronic products have become completely abstracted. This is only partly true. A digital camera still has a lens. Video recorders still work with tape. Even digital video still works with tape. The workings of lenses and tapes are not abstract. There may be developments which will lead to the eventual elimination of lenses and tapes, but for the time being they form essential parts of the most modern equipment. As the workings of these physical components are not of an abstract nature, many functions related to them do have concrete physical manifestations. Current product design has, however, a tendency to hide the physical manifestations, even those which are highly informative to a product's operation. A choice is made in favour of an alternative representation rather than its physical manifestation.

Consider the videorecorder, a prime example of how informative components are hidden. Often the housing of the video tape prevents the user from seeing most of the tape reels. Figure 1 shows a photograph of a tape being inserted into a video recorder. Now that all direct visual access has become impossible through the 'nested toy' approach, it is necessary to represent the information on a display (Figure 2). In fact, here the designers have chosen faithfully to represent by means of animation what they have just hidden: the tape itself. While this high-end videorecorder illustrates the hiding and representing issue very well, the situation with the average videorecorder, which lacks the sophisticated display, is usually even worse. On many video recorders the tape counter does not show absolute elapsed time in minutes and seconds. Instead it shows elapsed time in meaningless units and runs on without considering which tape is in the recorder, in which case the counter is also useless without rewinding and zeroing the tape. The excuse for leaving the user in the dark is that current tape technology does not allow time code to be encoded on the tape. This focus on technology completely ignores the fact that an approximate answer to the user's question "is there enough tape left to make the recording?" is in fact available. After all, the window in the tape housing could show how much tape is on one spool and how much on the other. However, the tape has been hidden inside the recorder, thus barring access to this perfectly useful information. If the tape housing showed an approximate guide to elapsed time, the user's question could be answered without having to wait for the latest time-coding technology.

Figure 1(left): The tape is hidden. Figure 2 (right) The tape represented on a display.

Lack of richness in actions

With the current approach to the design of electronic devices, the concept of affordances (Gibson, 1989) is not of much help. Multiple issues are at play here. We will cover those which are directly related to perceptual-motor skills here and others in the 'About Feeling' section. One issue is that each control may have the right affordance, ie. pushability, but as dozens of controls equally afford pressing, this does not help the user with navigation. The interaction suffers when the interface is dissected and affordances are considered separately for each control, rather than in the context of the whole interaction.

A related issue is that most controls require similar actions. The current treatment of affordances emphasizes the perception side—does the form invite the correct action?—while neglecting the action side. In terms of the required actions, electronic products are rather poor. We think that, if the interaction is made richer than just pushing buttons, actions will more easily be remembered and controls can more easily express what purpose they serve.

Our approach

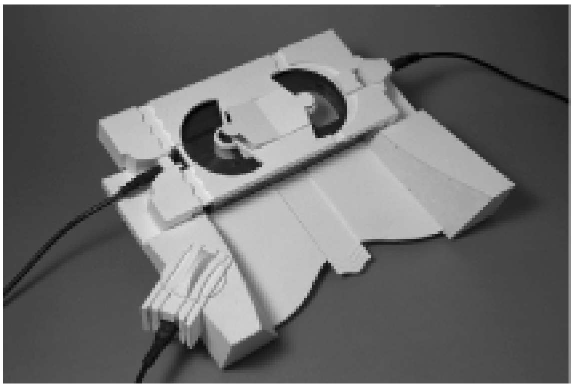
In the following design concept for a video deck the opposite approach was taken [1]. A combination is used of exposing important components and controls which are clearly differentiated in both form and action. The tape which is considered to be an informative and tangible component takes centre stage and is made clearly visible. Now that the tape is clearly visible, the controls which operate it can be visually related to it. This will be illustrated with a number of functions.

Tape compartment (Figure 3)

The tape compartment clearly shows the tape and its reels when present and echoes the form of the tape when it is not. Curving and converging lines indicate the insertion path for the video tape.

Eject (Figure 4)

The eject is a ribbon coming out of the tape compartment, suggesting a link. The ribs at the end of the ribbon suggest movement towards the user. Because of its ribbon-like nature, only pulling is meaningful, while pushing is not.



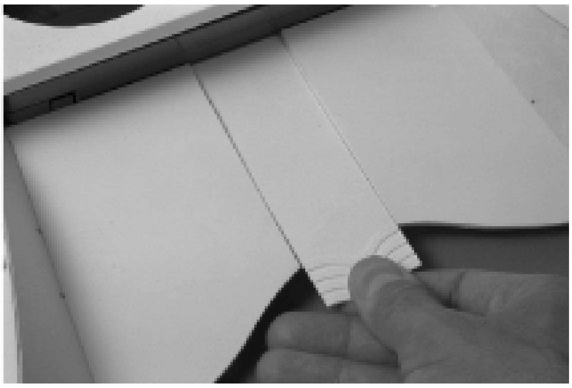


Figure 3 (left): Video deck overview. Figure 4 (right): Eject.

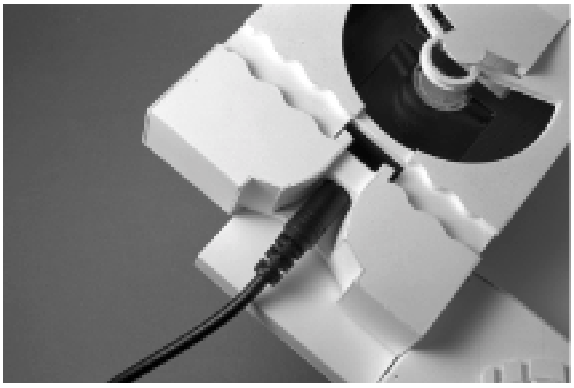
Inputs/outputs (Figure 5 and Figure 6)

Here an attempt is made to distinguish video-in and video-out connectors through formgiving. In both cases the connectors are the same, but the context in which they are placed is different and says something about their functionality.

Record/Play (Figure 5 and Figure 6)

The play slider is situated to the right of the tape compartment. The wave-like shape indicates that the play slider can mate with the central part of the tape compartment. By pushing the play slider inwards, the play function is activated. The play slider houses the video-out socket. This is to emphasize that by sliding the play control inwards, information will flow out of the video-socket to the television.

The record slider is placed to the left of the tape compartment. Again a wave-like shape indicates that the record slider can mate with the central part of the tape compartment. Pushing the record slider inwards activates the record stand-by mode. The record slider houses the video-in socket. This way it is emphasized that by sliding the record control inwards, information flows in through the video-in socket from another video deck.



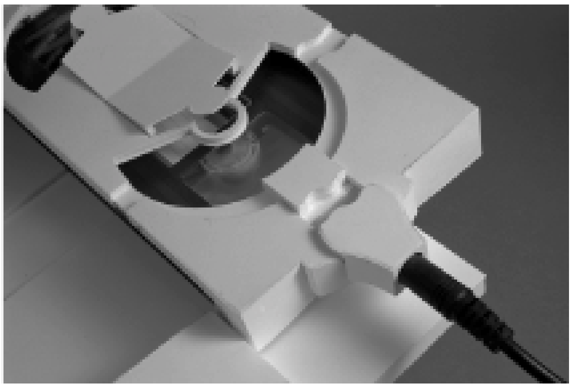


Figure 5 (left): Record slider. Figure 6 (right): Play slider.

Reverse and fast-forward (Figure 7 and Figure 8)

The reverse and fast forward control is a toggle, emphasizing its ‘either/or’ nature. Through the shape of the windows in the tape compartment which reveal the tape, the toggle control assumes a two headed arrow-like shape. It is positioned in-between the tape reels, whereby the finger-sized buttons form part of the control and act in the centre of the reels. In combination with the left-to-right direction of the tape compartment, this cues the user that pressing the right part of the toggle will fast forward the tape while the left part will reverse it.

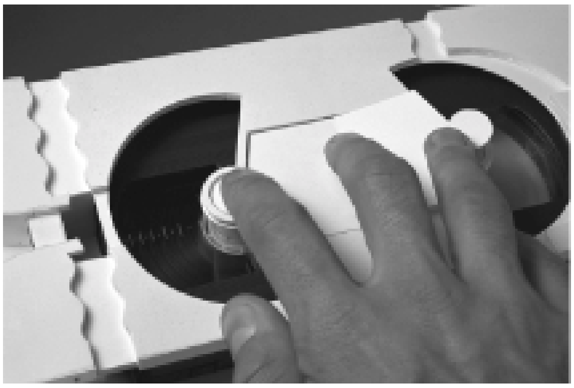
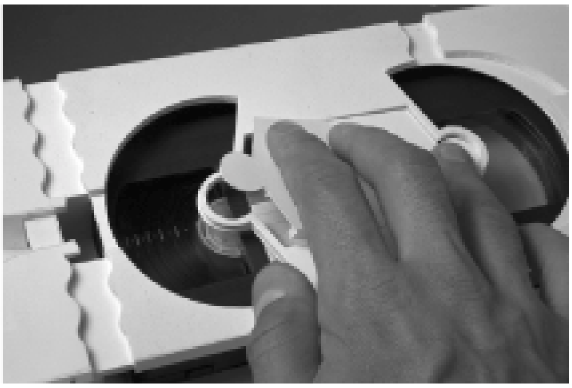
 

Figure 7 (left): Reverse. Figure 8 (right): Fast-forward.

RESEARCH: 3D COMPUTER SYSTEMS

The status quo

3D computer systems are becoming increasingly popular in various fields, including computer aided design and the medical sciences. The current generation of these 3D computer systems teases the user by showing virtual objects with photographic realism behind a monitor screen where he cannot reach them. The systems also frustrate him by forcing him to use input devices such as mice and trackballs. These ignore the skills for interacting with physical 3D objects, which he has acquired in everyday life. The display space, which holds the virtual objects behind the monitor screen, and the manipulation space, where the user operates his input devices, are separated. Again, you can view this as a case of indirect access. Surely it would lead to more intuitive interaction if the user could handle the virtual objects directly?

Our approach

In our desktop VR system named Cubby we use head-coupled perspective to make the display and manipulation spaces coincide (Djajadiningrat et al., 1997, 191). The user manipulates objects where they appear by means of an instrument which behaves as a pair of tweezers (Figure 9). The hybrid instrument, with a physical barrel and a virtual tip, emphasizes that it bridges the physical and the virtual world, thus allowing the user access to a parallel world (Figure 10).

We like to think that Cubby’s design reflects respect for the user. Unlike helmet-based virtual reality systems, Cubby respects the social interactions between people. As there is no helmet which blocks the face, facial expression remains available as a communication channel. Similarly, Cubby’s input devices do not encumber the user. Unlike glove-based systems, the instrument is very quick to put down and pick up. The frame on which the head-tracking sensor is mounted is very light and again can be easily put on or off. There is no umbilical cord by which technology ties down the user.

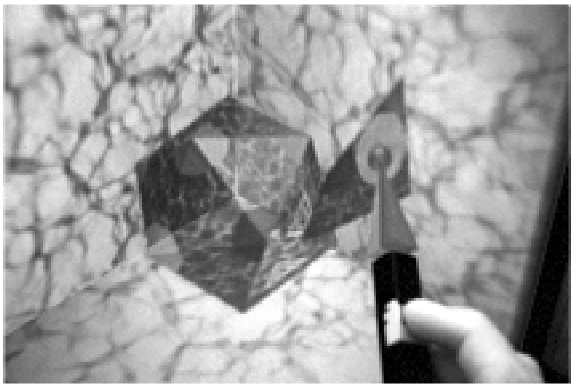



Figure 9 (left): Manipulating virtual objects in Cubby. Figure 10 (right): The hybrid instrument.

EDUCATION: PHOTOCOPIER CONCEPTS

This is an exam question in which we try to convey elements of our research to our teaching. Students had approximately 30 minutes to answer this question.

"One of the most common 'mistakes' when operating a photocopier is choosing the wrong paper format. Form Theory I emphasizes the importance of physical interaction (actions instead of buttons) and exposing physical components instead of hiding them. Redesign, on the basis of this design approach, the way in which the user selects the paper format. Address only this aspect of the device. Technical feasibility is of no importance."

We give two examples, which we consider in keeping with our research approach. Figure 10 shows a proposal with transparent paper cassettes, which rotate around a pillar. To select a paper format, the user picks one of the cassettes, swings it round to line up with the paper entrance and pushes it in. In this design no knowledge of paper sizes is required as the user can directly compare the size of his original to the formats in the cassettes. When a cassette runs out of paper this is clearly visible.

Figure 11 shows a proposal which dispenses with the hinging cover. By means of two sliding covers the original is framed and the nearest paper size up is chosen. The action of sliding the covers and its result are clearly perceivable and therefore different from paper size detection through sensors. Chances of forgetting the original are reduced as it remains visible at all times.

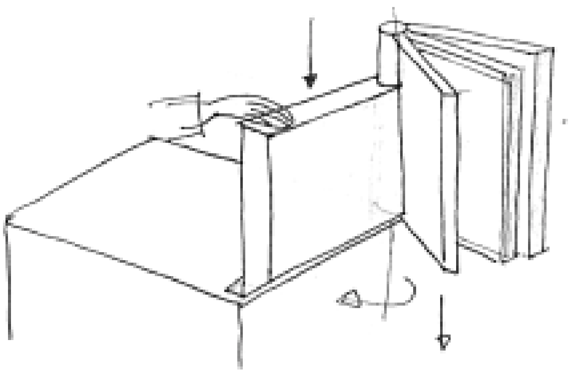
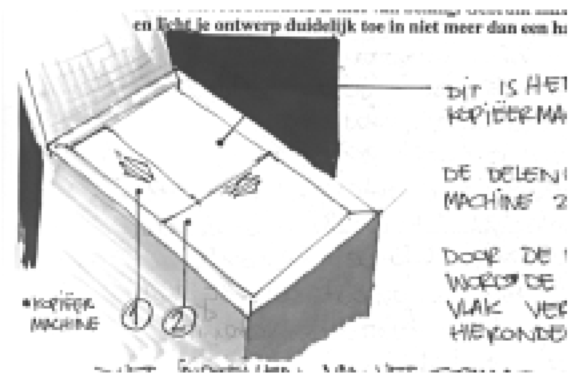



Figure 11 (left) Rotating paper cassettes. Figure 12 (right): Sliding covers.

Though none of the concepts which emerged can be considered complete, many of them are interesting as they show how exposing physical components instead of representing them on a display, can clarify how controls relate to functions.

About feeling: A context for waking up

Waking up can be a vulnerable emotional experience that may colour the rest of your day. When you consider different contexts of waking up, e.g. waking up to catch an early flight, to do a weekend activity or after a night-out you can imagine experiencing these situations with different emotions. Knowing, doing but especially feeling is different in each of these situations. Yet the accompanying product, the alarm clock, does not support these differences, because it cannot adapt itself to the emotional experience of the user. Why can it not detect that you feel tired and do not want to wake up with an active sound but with a more relaxing sound? To be emotionally intelligent, the alarm clock would need to recognise, express and develop emotions, and react in an intelligent way to these emotions.

RESEARCH: PROBES

Before designing such an alarm clock you need to know the different emotional aspects of waking up. You need to capture the experiences of the users. Researching the emotional aspects in human-product interaction is relatively new and therefore may benefit from a new methodology, because conventional methods such as questionnaires and interviews capture the user experience only in a verbal way. When researching experiences, the research has to be done in the context you are investigating. You cannot invite the participants into a lab situation or invite yourself as a researcher into the user's bedroom. But 'probes' (Gaver et al., 1999, 21) are well-suited to this kind of research. A probe is brought into the right context where it can gather information. The idea behind the method is to invite users to a more playful and creative way of giving both information and inspiration to designer-researchers. It can also be more respectful to the participants in a way that this method might be more stimulating and interesting than conventional methods.
Just as design should consider all of man's skills, so should research. Therefore the ingredients of our probe focus on knowing, doing and feeling amongst the users and give the researcher multi-sensorial information and inspiration. The feedback will be richer, more personal and more stimulating.

The probe

Our probe is a package (Figure 13) containing different tasks, coloured pens, question cards, a diary, an audio recorder and a disposable camera.

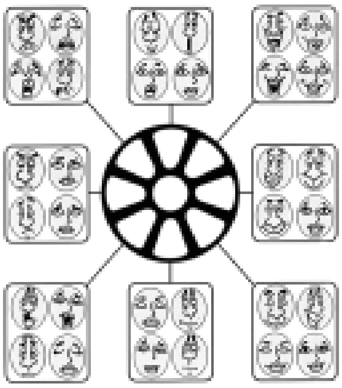


Figure 13 (left): The probe. Figure 14 (right): The facial expressions.

Diary

The central task in the probe is a small diary in which the participants are asked to monitor their day. The questions relate to what time they got up, what their plans are for the rest of the day and how their day has been, and they would mark with different coloured pens how they feel about it (Figure 14). This method for measuring emotions through images of facial expressions is currently under development (Desmet, 1999).

Family tree

The participant is asked to imagine that his current and ideal alarm clock can have parents and inherit their characters. Who would they be? For this purpose he is provided with portraits (Figure 15) which he can stick on a family tree postcard. The first findings show Stalin ("my alarm clock is a dictator"), and a tv-news anchorman ("it's a bit boring but reliable") as the most often chosen parents of current alarm clocks. The golden retriever ("as a loyal companion") and the rooster are popular parents for both current and ideal alarm clocks. The sun ("a natural gradual way of waking up") is by far the most popular parent.

Figure 15: Portraits used in family tree.

Sound and images

The probe also contains a disposable photographic camera and an audio recorder. The participants are asked to explore and capture their experience of waking up by making pictures and recording sounds: sounds and images of themselves, their alarm clock, their bedroom, something pleasant, something irritating, something relaxing or beautiful. They are also asked to record sounds and images with which they want to wake up in different situations.

Emotional advertising

People attribute emotions to products (Reeves and Nass, 1996). To investigate how the participant experiences products, a different task was set up. He is asked to choose an ideal product and a least ideal product out of four different products. This question is asked for seven different product categories: alarm clocks, bedrooms, televisions (Figure 16), computers, telephones, diaries and pets. After making his choice, he is asked to promote his ideal product with advertisement slogans such as those in Figure 17. The slogans do not concern functional aspects but emotional character traits, both positive and negative. Of his least ideal product out of the four products he is asked to express what he really thinks about it, using the same set of slogans.

Figure 16 (left): A set of products. Figure 17 (right): The advertisement slogans.

In these different tasks the participant is involved in capturing his experience of waking up in a multi-sensorial way through doing, knowing and feeling. All the captured words, images and sounds provide information about the user's experience of waking up, and inspiration for new designs.

EDUCATION: ALARM CLOCK CONCEPTS

To integrate research and education we gave our second year students the assignment to design a context for waking up. One of the problems is how an alarm clock could detect the emotional state of the user. Current research concentrates on detecting emotions through physiological measures e.g. heart rate, skin conductivity, blood pressure (Picard, 1997). An alternative approach is to design the product in such a way that it affords actions which are rich in emotional content. The user can then perceive the possibility of acting in an emotionally expressive way, act how he feels and the alarm clock can detect the emotional state through the user's actions. This way the detection of emotions is done in a less intrusive manner.

Examples

The design by De Groot and Van de Velden (Figure 18) consists of two parts, a home base and an alarm ball. Turning the two halves of the alarm ball sets the alarm time. The right half is for the minutes, the left half for the hours. Depending on how he feels, the user can then place or throw the alarm ball away from the home base. The distance between the two is a measurement for the urgency of waking up. The further the ball is away from the home base, the more urgent the type of sound and the volume will be the next morning. To silence the alarm the user has to get out of bed, get the ball and replace it in the home base. By doing this he seals off the loudspeaker and muffles the sound.
The design by Hellman and Ypma (Figure 19) has multiple pins. Each pin represents a few minutes. If the user wants a great deal of sleep, she can make this known to the alarm clock by pressing as many pins as possible at the same time. The display then shows that she will wake up at, say, 10 o'clock instead of half past 8. So she has pushed too many pins and has to pull out some pins to subtract time to reach half past 8. These actions will give the alarm clock an idea of how much sleep the user actually wants. It also knows how precisely she set and chose the alarm time and adapts its behaviour according to all the information.

Figure 18 (left): The alarm ball. Figure 19 (right): The pin alarm.

Conclusion

Respect for all of man’s cognitive, perceptual-motor and emotional skills enriches industrial design. The aesthetics of interaction concept offers a powerful mindset in human-product interaction. Future research will cover rich action-based interaction in emotionally aware products.

Endnotes

[1] The video deck concept was entered by J.P. Djajadiningrat for a design competition organized by the Sekisui Design Corporation (Japan) in October 1997.

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