IASDR07
INTERNATIONAL ASSOCIATION OF SOCIETIES OF DESIGN RESEARCH THE HONG KONG POLYTECHNIC UNIVERSITY 12TH TO 15TH NOVEMBER 2007

A LEGIBLE DESIGN USING EMBODIMENT ICON WHICH COINCIDES DISPLAYS AND OPERATIONS

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ABSTRACT:

In today's personal computing, we use the displays for the information presentation and use the mice and the keyboards for the information control. The style has no substance feeling of the operation from the interaction design point of view. In an attempt to bring the direct manipulation, there are a lot of research and products of the tabletop device which are able to close the gap between display and touch. However, there is the problem of being technically immature. It is thought that one of the causes is that there is less body characteristic of the icon copied to the plane surface. Therefore, we tackled how to embody it and the interaction design of the icon. This study looks at how to bind a function, cancel and execute the function, it proposes the interaction including the mental model, and proposes the design to put the block of 5cm cube as the icon on the transparency table.

Keywords: Direct Manipulation, Legible Interface, Collaboration Reality

1. INTRODUCTION

After the computer is utilized in office work, the improvement of efficiency and paperless office was expected. However, it is not actualized realistically. Appearance of the personal computer has contributed to the improvement of the quality regarding design work, but conversely it brought the substantial extension of job time as the side effect. GUI and direct manipulation environment of the personal computer made the threshold of the computer low for many people, but it has not contributed to drastic ease of use.

1. 1. OUR GOAL

In office work, it should be necessary to share fields where persons commit to something simultaneously. It is so-called collaboration reality. The conference system and the personal computer environment have no collaboration in reality. In that sense, they have deviated from the essence of collaboration work. In the beginning to solve this problem, direct manipulation environment of a tabletop device is made on an experimental basis and the Legible Interface which enlightens the re-recognizing memory of the brain on the meeting is researched.

1. 2. RELATED RESEARCHES

DigitalDesk (Wellner 1993) is an attempt to make a physical desktop which been made virtual on the personal computer screen as a desktop metaphor. In his experiment, a projector and a camera were fitted above a desk, projecting images of documents onto the desk that were interactive using image recognition technology. This research was pioneering in the quest to unite the inside of the computer with the physical world. While this technology has been adopted and succeeded EnhancedDesk (Yamazaki 1999), Augmented Surfaces (Rekimoto & Saitoh 1999), and the iTable (Johanson, Fox & Winograd 2002), they seem a long way to make an epoch in interaction design, which has reality of operation. There are many researches which have utilized the force feedback and sense of touch technology like Tangible Media（Ishii & Ullmer 1997）for regaining the reality. However, there is a doubt where these also have universality in them.

2. INTERACTION BY LOW TECH

At the time of information designing of the electronic device, no restriction of layout has produced chaos. The freedom of layout allows designers to hold a fantasy that they can do anything like painting on the white canvas under their personality and art characteristic, Then, the user interface is designed so that is impossible to distinguish whether control object being or mere indication, has been overflowing. This is nightmare for users. For the person who does not have expert knowledge, the high technology looks like magic. The magic makes the thought process of the human stop. The attempt to connect to understanding of the mechanism from the magic is not easy. In other words, the low technology that is understood immediately becomes important for the interaction design.

2. 1. RUBE GOLDBERG MACHINE

Rube Goldberg Machine is an expression technique that cartoonist Rube Goldberg in the United States conceived, and the devices in the cartoon that he illustrated. The simple thing that can be easily done is expressed in an absurdly connected mechanism. Certainly, it is not necessary to fly a kite and to scorch pants with an iron to sharpen a pencil (Fig.1). Goldberg put the sharp criticism spirit on it and confronted the ridiculous mechanization and rationalization at the twentieth century.

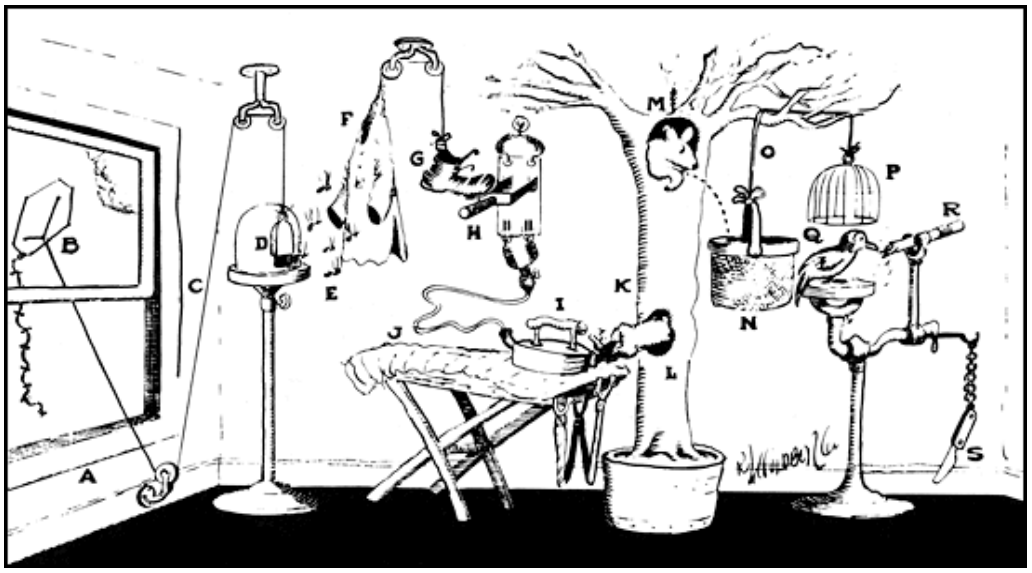

Figure 1: Rube Goldberg Machine, Simplified Pencil Sharpener.

2. 2. VIDEO GAMES

There are video games named The Incredible Machine of Sierra Entertainment, Crazy Machines of Pepper Games, and Chain Reaction of Monster Studios (Fig.2). It is evidence that people are pleased with the interest of the chain of a physical movement like Rube Goldberg Machine. In these, the chain reproduced on the personal computer screen is presented as a challenge. If the problem is solved by setting up the prepared parts, it is cleared. The puzzling aspect is strong.

Figure 2: The Incredible Machine, Chain Reaction and Crazy Machines

2. 3. PYTHAGORAS DEVICE

Even though Rube Goldberg Machine is enjoyable, it is just a pipe dream. That won't actually happen. On the other hand, Pythagoras Device (Fig.3) was presented in a television program in Japan. This is a kind of Media Art that actually produces Rube Goldberg Machine, and the children can feel pleasure and study intuitively the laws of physics like gravity, acceleration, balance, and friction, etc.

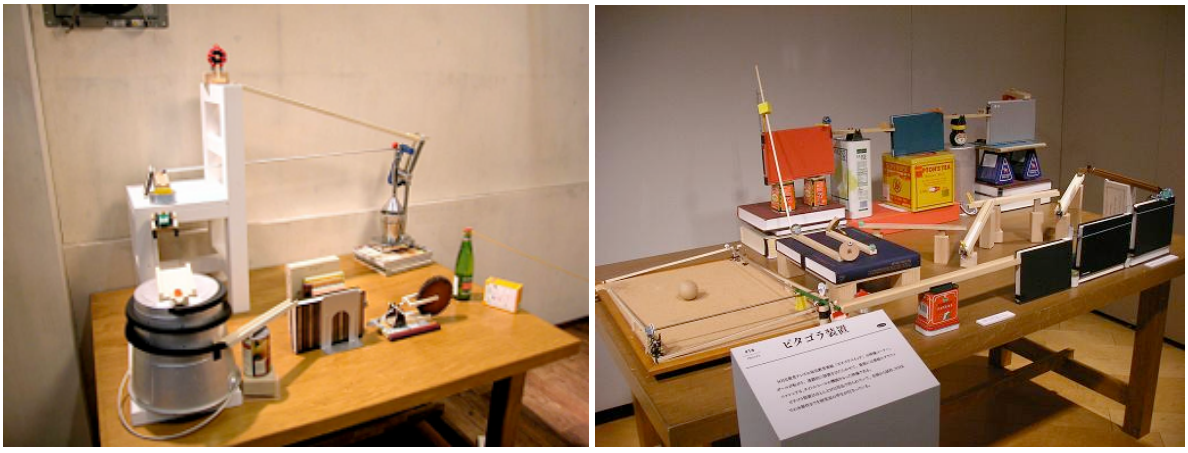

Figure 3: Pythagoras Devices

These devices pass a lot of trial and error for taking film. It means that the freedom of the imagination is enlightened when the paradigm is broken down for the actual inconvenience, not when the tip of escaping from the actuality is shown (Satoh 2007). In addition, like the Rube Goldberg Machine, which does not move to actuality assume that simply fantasy. The Pythagoras Device is not fantasy. Its worth is how much can designate actualization impossible image as actuality.

2. 4. INTELLECTUAL EDUCATION TOY

You can say that as the Pythagoras Device is calculating carefully, it has made process of each one as for something seems to be ruled by incident. It looks a great balance. However, no reproducibility is disqualified as a technology. In such sense, the Intellectual Education Toy, which is represented in Ernest Toys and Scalino becomes a reference, (Fig.4). The combination of lanes and cubes make a speed and direction of marbles. Physical theory such as gravity and friction is hidden in the toy, the charm where also the adult is absorbed not only as the child is.

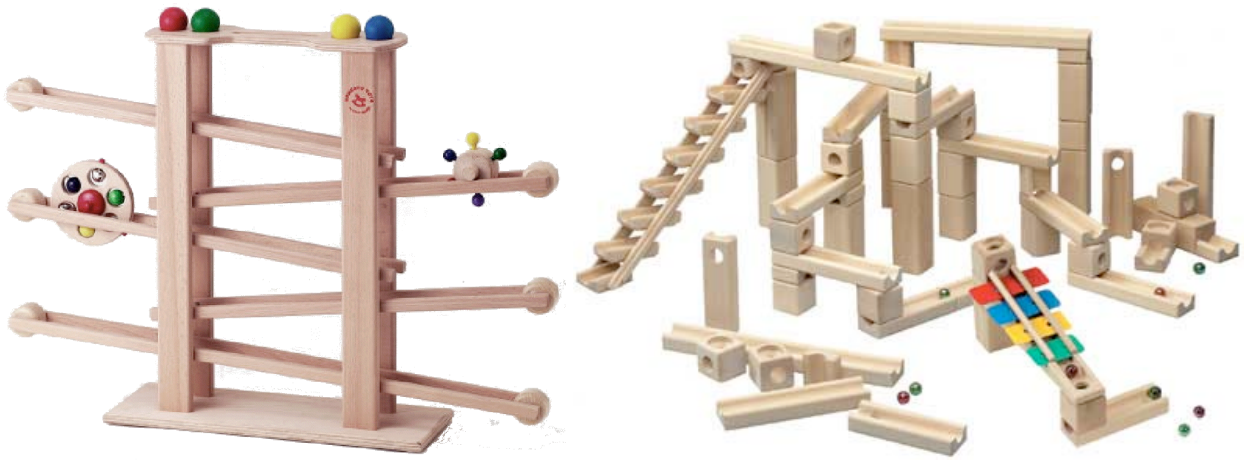

Figure 4: Ernest Toys and Scalino

2. 5. LOW TECH WAY

As for Rube Goldberg Machine, freedom of the imagination does not happen in actuality. But the nonsense of complicated mechanism becomes pleasantness and interesting. It has evolved into a lovable device, different to his intentions and criticisms to the machine civilization. It came to the different dimension. As for the Pythagoras Device, it exceeds and it fascinates the people due to the fact that it really moves over the actual inconvenience. In other words, today's society, there is feeling of nostalgia for the machine. Electronics and

computer software begins to recall a fear of black magic. The mechanism, which is able to understand the principle immediately, and the fantastic chains, which are made of individual simple mechanism are required from also interaction design.

3. LEGIBLE INTERFACE

Currently, personal computer is something that supports the intellectual work of the individual, but it is powerless for collaborative work. It is better to use a tabletop device for cooperation of a small group. In addition, when individuals move to the individual work from collaborative work, even if it is tabletop, they can move smoothly. For that, it is necessary to have large-sized interactive tabletop and finger recognition system which can be used by more than one person.

3. 1. TABLETOP METAPHOR

In the personal computer, metaphor is introduced because of ease of use. Desktop Metaphor has presumed a display as a desk. Because the Legible interface dose not uses such a metaphor ideally, that can be designed, the tabletop itself is used. It is the standard table form which supposes to use the surroundings, from the formal meeting which sits down in the office chair, to the standing style, intending the fact that it can be utilized widely in casual meetings; the standard table basic specification becomes width 900mm and the height 700mm which are the same at the office. Because it has combination of the information presentation area and capturing document area, it is not only rectangular in shape, but also complicated shapes are designed, (Fujii, Nam & Choh 2007). In order to enable large numbers of collaborations, we designed various shapes for expanding and combining the tabletop (Fig.5), in addition to designating restriction of layout, obstructing a freedom of working style it has been actualized as a problem.

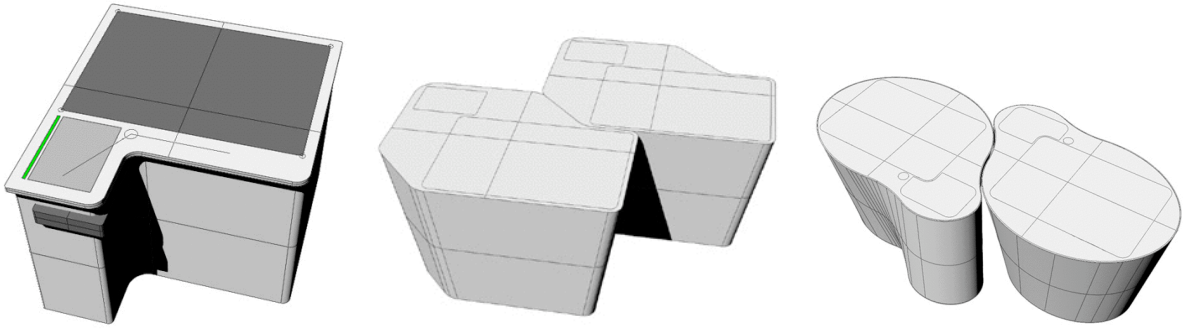

Figure 5: Legible Tabletop Designs

3. 2. MULTI-POINT SENSING AND FINGER RECOGNITION

There are many problems in the mouse device, which with the personal computer is used as the pointing method. First, there is no way to indicate the plural points simultaneously. Next, physical location of the indicator and finger location differ and the operation is not intuitive especially for beginners. In order to overcome these problems, the sensor, which detects the position of the finger, becomes necessary. There is some research and products, utilizing the reflection of ultrasonic wave, image recognition with camera picture and a method of using the electric conductive film and so on. However, they are unsuitable because of adjustment necessity, being subject to surrounding lights, and not being easy to sense a large area. To solve those problems, it is likely a good method to utilize the laser radar technology (LIDAR), which is strong for the any environment and is able to be utilized on a large-sized screen (Fujii & Choh 2006). (Fig.6).

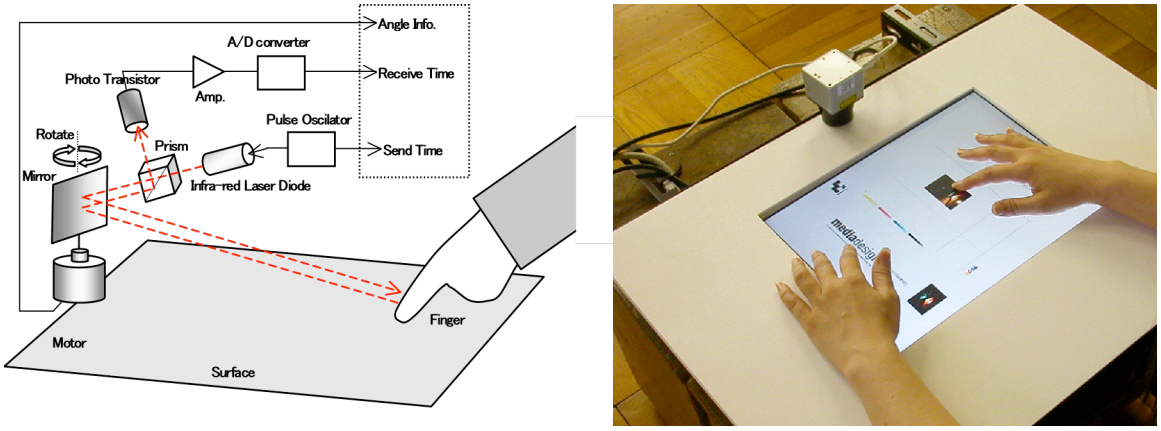

Figure 6: LIDAR Sensing Method and The Prototype

4. LOW-TECH AND LEGIBLE INTERFACE

It is important for Legible Interface that it is clear what one is doing to those who work in cooperation. There are many foundation of Legible Interface, a gesture and a shape of tools, visualization of production process, visualization of human recall memory. Especially, by combining the low technology gadget, you can easily understand the theory that it is the guiding principle for Legible Interface.

4. 1. TABLE-LESS DESIGN

Basically, it is possible to put any object on the desk and to arrange it freely However, the keyboard and display usually occupy a large area and have to be fixed on the office desk, Thus, function is easily localized to

be in the part of the desk. The same problem occurs even with Legible Interface. We tried imagining the infinite sized table as the thought experiment for this (Fig.7). It is virtually same as table-less. It probably means that any function does not localized. However, it is impossible to make the tabletop, but the transparent table is close to that function. Besides the fact that with trial manufacture the acrylic board was used, (Fig.8), also the table which stretches the plastic net is used for this experiment, (Fig.9). It designates the translucent plate as the information display device on that.

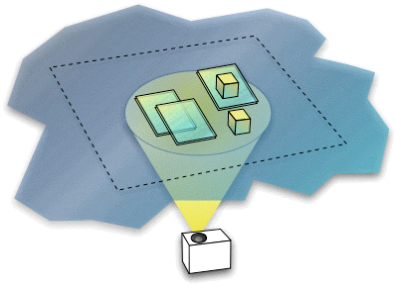

Figure7: Infinite Sized Table

Figure8: Prototype with Acrylic Top

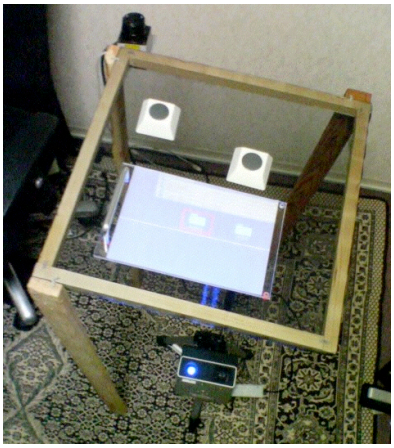

Figure9: Prototype with Net Top

4. 2. EMBODYMENT ICON STRUCTURE

An icon is an image, a picture and a sign in the screen of the personal computer. It is the representation of some processing, which is expressed with the picture. Selecting an icon by using a mouse is easier than typing a letter command from the keyboard. However, the circumstance where the picture is found not to be intuitive, and the design has difficulty. In addition, there is a problem that embodiment characteristic and metaphor as a tool is weak. To enforce embodiment characteristic, a three-dimensional icon was made on an experimental basis. At the beginning those in the 40mm cubical acrylic block surface that pasted the small screen were used, but afterwards it replaced with the Television Stone (Ulexite), because of the fiberglass effect which transmit an image from one side to the other. It looks like an unusual optical phenomenon can be seen. Those that have been used for this experiment are artificial ones. The surface of this artificial Television Stone has made the screen the obscured glass by finishing. Thus Low Technology mechanism (Fig.10) is an advantage as the shadow of the projection does not occur at all positions, so the picture appears clearly even with when you place on the translucent plate where the picture is projected, (Fig.11).

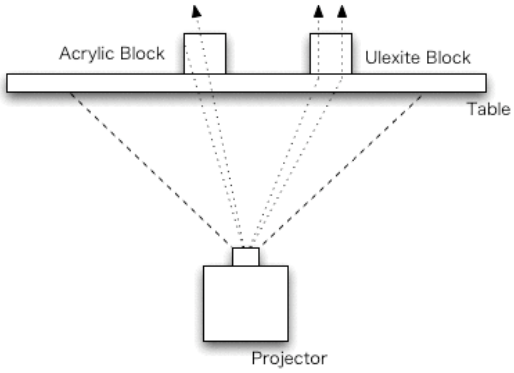

Figure10: Embodiment Icon Theory

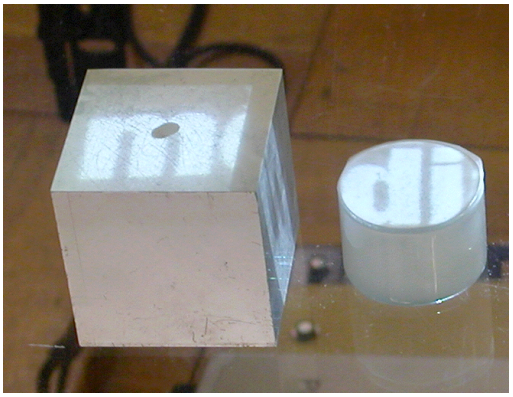

Figure11: Acrylic (left) and Ulexite (right)

4. 3. EMBODIMENT ICON INTERACTION

The cost of electrical copy is too low, but the cost of physical object duplication, in contrast, is too high. The embodiment icon has same problem. If it has single function and is bound permanently, it is necessary to prepare a lot of them. So the embodiment icon should be blank at the beginning, then any function ideally can be bound to it and release it. For this experiment, three interactions were defined: bind, execute and release. For binding a function, put the embodiment icon on the surface and lift it. For executing, rotate the embodiment icon. For releasing the function which once bound, just shake 2 and 3 times (Fig.12). The prototype has contact switch, tactile switch, touch sensor and tilt switch for detecting its movement (Fig.13). The position and rotation of embodiment icon can be detected with the laser radar sensor, which was mentioned before. In addition, due to the fact that the embodiment icon is stacked vertically, compound function can be actualized. This can be called primitive programming, (Fig.14)

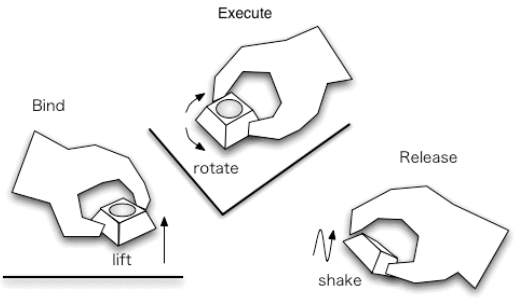

Figure12: Interaction of Embodiment Icon

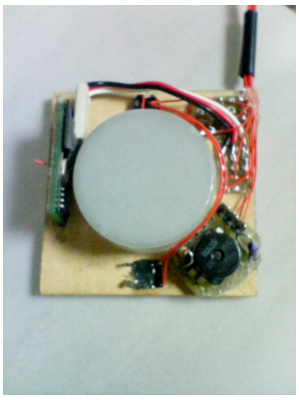

Figure13: Inside the Icon

Figure14: Programming with Icon

5. CONCLUSIONS AND FUTURES

In this research, the embodiment icon and the transparent tabletop were considered. In future research, we would like to restrain the embodiment icon, for example, utilizing the force feedback, improving the shape of the embodiment icon, and have more specific functions like magnifier, pencil or eraser. In addition, we would like to keep looking for the universality of the embodiment icon.

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