

A study of Design Application in Tangible User Interface

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Abstract

In the research of HCI (Human-Computer Interaction), we always use the GUI (graphical user interface) of graphics input devices until we invent TUI (tangible user interface) which is used to control the computer by hand-touching or other subjects. In this study, we investigate and classify several TUI for the most part in business with the theory and concept of Tangible Bits by Hiroshi Ishii & Brygg Ullmer in order to research the development of TUI.

I. Introduction

We will live in the age of ubiquitous computer. Despite PC is very popular currently, the technologies of existing interface are not sufficient to meet the needs of the users. Ubiquitous computing will provide us more convenient conditions. However, ubiquitous computing is still at the primary stage. Ubiquitous computing is an integration of human factors, computer science, engineering, and social sciences. It names in the third wave of computing. First wave was mainframes; one computer is used by many people. And then in the second wave we enter to personal computing era, person and machine interact through a desktop. The next wave will be Ubiquitous Computing, which is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user. [1] Due to its invisibility it also referred as the disappearing computer. Audiences

of computer will also benefit from the computer must be of universal computer literacy of staff to the ordinary people. No longer limited to desktop computers, it will be embedded into our working and living space, (eg. into a handheld or wearable device) and even our daily lives with a variety of apparatus used in combination. The human and machines interface is constantly developing with our technology.

II. User interface

User interface (UI) is the medium of informational exchange from the system to user interaction, and it also forms the internal information and acceptable form for individuals.

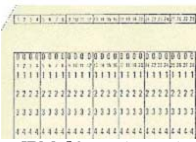




Between users and hardware, Software is designed by professors as a medium to allow users to operate hardware efficiently and complete some remarkable works. The definition of User interface include human-computer interaction and graphical user interface, which means that humans and

machines can participate in the exchange of information in the field of user interface. Systems and users are generally limited by the problem-oriented natural language interaction. [2]

History of user interface

The history of user interfaces can be divided into the following phases according to the dominant type of user interface:

[table 1] History of User Interface

Batch interface, 1945-1968	
 <p>IBM 29 card punch (circa 1950's)</p>	<p>(Batch) is a simplified scripting language. The very simple example is written line by line in the command line will be used in a variety of orders. Batch operating system features are: multi-channel and into the batch.</p>
Command-line user interface, 1969 to present	
	<p>Command line interface is a user interface to a computer's operating system or an application in which the user responds to a visual prompt by typing in a command on a specified line, receives a response back from the system, and then enters another command.</p>
Graphical user interface, 1981 to present	
 <p>Macintosh System 4.2, 1987</p>	<p>Today, most users prefer the graphical user interface (GUI) offered by Windows, Mac OS, BeOS, and others.</p>
Tangible user interfaces	
 <p>Reactable</p>	<p>Tangible user interfaces: Tangible user interface is a user interface in which a person interacts with digital information through the physical environment. The initial name was Graspable User Interface, which no longer is used.</p>
 <p>Microsoft 2007</p>	<p>Touch User Interface: Touch user interface is tangible interface's continue. In my opinion, it elements of GUI and TUI.</p>

GUI and TUI

GUI is now most commonly used in interfaces, the mode of human-computer interaction to use the form of communication using icon,

Although the use of GUI is widespread, it has some inconveniences. For instance, pc only



Fig 1.TUI

support single person to operate the mouse and keyboard and hands should not leave when we are moving files, so that it limits the use of computer. TUI give us a new direction, human-computer interaction into a dynamic interface. Hiroshi Ishii, a professor in the MIT Media Laboratory who heads the Tangible Media Group, particular vision for tangible UIs, called Tangible Bits, is to give physical form to digital information, making bits directly manipulable and perceptible.[4] TUI as a new form into our field of vision. Touch user interface is a branch of the tangible interface. Talking of the concept of TUI, it cannot be separated from Brygg Ullmer and Hiroshi Ishii, and their research about tangible bits is foundation of the TUI design.[3]

III. Definition the TUI

Tangible Bits

The concept of tangible bits is put forward by Hiroshi Ishii and Brygg Ullmer who moved in artistic circles MIT Media Laboratory of Tangible Media Group.[4]

- Giving physical forms to digital information and computation, making bits - directly manipulate with two hands.
- Continuity between physical and digital representation in design
- Supporting multi-user collaboration and "tangible thinking" .

"Tangible Bits" is an attempt to bridge the gap between cyberspace and the physical environment by making digital information (bits) tangible. The key concepts are:

- 1) Interactive Surfaces: Transformation of each surface within architectural space into an active interface between the physical and virtual

worlds.

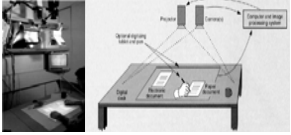
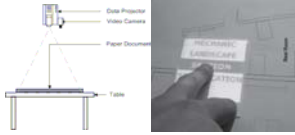

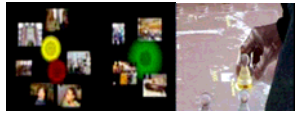

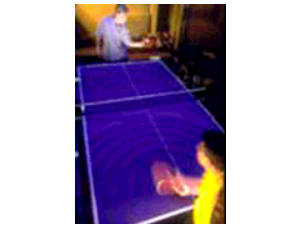
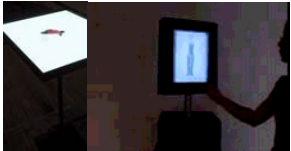
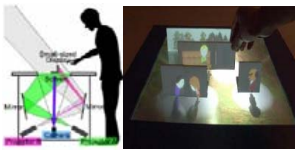
- 2) Coupling of Bits and Atoms: Seamless coupling of everyday graspable objects with the digital information that pertains to them.
- 3) Ambient Media: Use of ambient media such as sound, light, airflow, and water movement for background interfaces with cyberspace at the periphery of human perception.

Classification of tangible user interface

According to the former concept, the types of TUI are following:

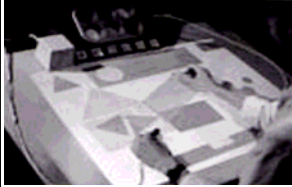
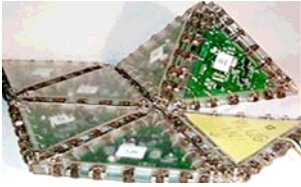




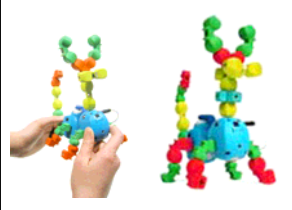

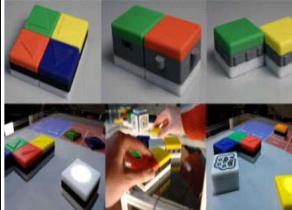



- Interactive Surfaces (walls, desktops, ceilings, doors, windows)

[table 2]

	
Digital Desk [Wellner, EuroParc, 1991]	Paper-based Review
	
Photo browsing interactions	Beat-Bearing
	
A paper based TUI	PingPongPlus [Wisneski, 1998]
	
Spinning Dancers and Tilting Table [Lee, 2004]	Tablescape 2006

- Coupling of Bits and Atoms (cards, books, models)

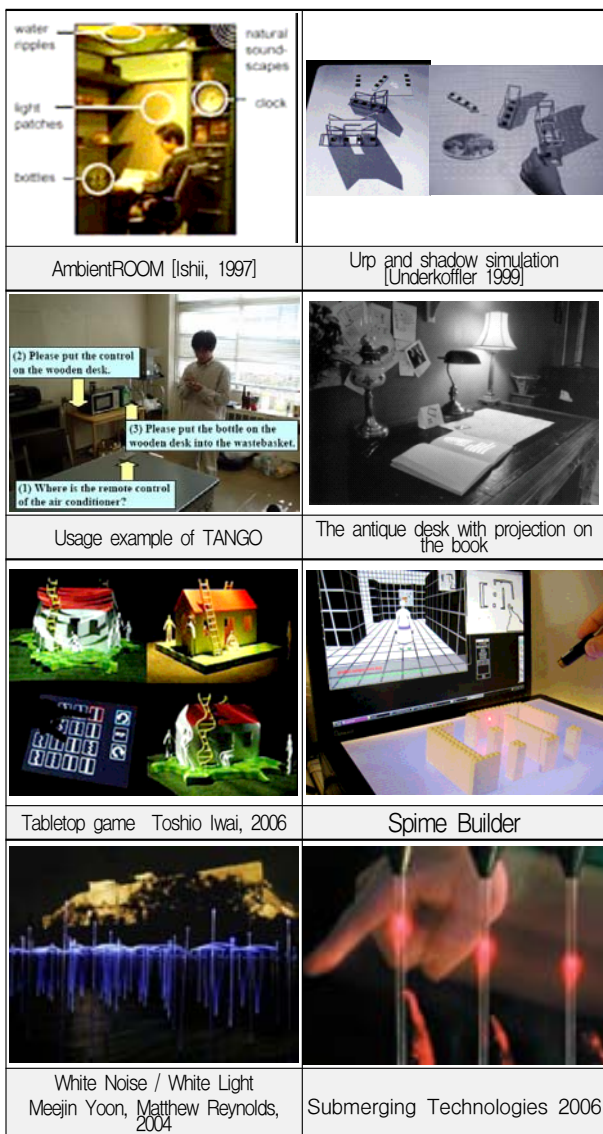
[table 3]

	
GraspableBricks[Fitzmaurice,1995]	Triangles [Gorbet, 1998]
	
Music Bottles [Mazalek, 2001]	Beat-Bearing
	
Logo slot-machine	Kismet (Breaseal, 2000)
	
Topobo [Raffle, 2004]	Learning Cube
	
TUImod Tangible molde	IO Brush [Ryokai, 2004]
	
Tabletop game	mediaBlocks and media sequencer



- Ambient Media: (sound, light, airflow, and water)

[table 4]



However, there are several contact way between users and computer in Tangible Interface, such as Object Tangibles, Device tangibles, surface

tangibles, space tangibles, Touch user interface, [1]

Product of now

- Tangible game

This is Derivatives of TUI concept. It combines with traditional game machine and new technology, in which players feel in the game. For instance, Will put his friends around game machine, he does not play games alone like conventional game machine.

[table 5]



Touch user interface

Touch user interface is one kind of TUI, it is becoming increasingly popular. The introduce of product is following :

[table 6]



Fashionable Apple's iphone and Microsoft's surface showed that users are crazy about new user interface. More user-friendly touch screen support us to operate the system intuitive. The appearance of surface foretells that new interface will quickly enter our life. People can use their hand and many physical props to move interface at will. In the All Things Digital Conference, Steve

Ballmer, CEO in MS appreciated visual media. Web pages and the features of microsoft surface and Tangible Media are designed for better experience.

Products for the human touch of the research has been progress, more direct contact with the system for the convenience and efficiency because of human beings never-ending demand, owing to the need of human ,the technology is increasingly progressing.

[table 7]

	
<p>"Lucidtouch" Microsoft Research</p>	<p>Sphere design by moixa (uk)</p>

The Benefit of TUI

- ▷ TUI requires little time to learn how to use the interface.
- ▷ TUI can offer a variety of interactions.
- ▷ TUI supports more than one user.
- ▷ TUI supports repeatedly modified and reversible operation.
- ▷ TUI can offer direct touch with system.

In human-computer interaction, the interface only allows one user to communicate with a computer. But, TUI can accept that more user operate a computer at the same time. It is possible to let more persons use computer simultaneously. We can learn and discuss questions together, so that totally changes our approach of using computer. Every icon in computer have special meaning, we must learn it to control computer. However, TUI products new experience, friendly physical interface, we can master computer pretty soon. No longer using keyboard input command, users will have amazing experience.

IV. Conclusion

Currently, the system started to use multimedia technology to develop a new generation of user interface.

-The future of user interface: more realistic interactive virtual reality: for example, is a rude action than can be used as Control-Alt-Delete keys mean. We would like to complete the action is just a gesture than can be achieved.

-Brain-computer interface: it is in human or animal brain (or brain cell culture) and external devices to establish the direct connection access, is still the experimental stage, scientists in general paralysis of the actual brain patients placed on a computer chip has been successful use of brain waves to control the computer, draw a simple design and computer games, but the success of future research could allow the human brain can use as a user interface.

As the development of computer technology in 21st century, human-machine interface has a great progress. Now widely used technologies are GUI and TUI in which operating computer are more perceptive and humanoid. Owing to the development of diversified TUI, individuals offered a variety of idea about TUI. So far there are numerous prototypes that are already products, such as surface and iphone. This article is about investigating present situation. TUI is a new concept for most people. TUI is researched by professors along multiple directions.

Since human started to use tools, human using tools have gone through a process from simple using tools to complex tools. People intelligence is increasingly grown, and productive efficiency is increasingly improved too. People constantly create a variety of tools to facilitate people's lives. Interface design completed an evolution just like human created tools in the labor. People are the creators and users of tools. In the human-machine interaction, interface design will

progress with the present researches.

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