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VIRTUAL REALITY – CURRENT MULTIMEDIA – THE WORLD OF VIRTUAL REALITY FOR CHILDREN

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1. Introduction

About fifty years have passed since computers were first developed. If asked to name the most outstanding characteristic of this machine, it is the speed at which computers have developed which seems the most prominent. Recently, computer capacity has doubled each year. A simple calculation shows that over a period of ten years a thousand-fold increase in capacity will be produced, a figure almost beyond comprehension. Fig. 1 indicates the decrease in price of LSI memory per bit. Cost reduction in LSI memory by about several hundred times has occurred in one decade.

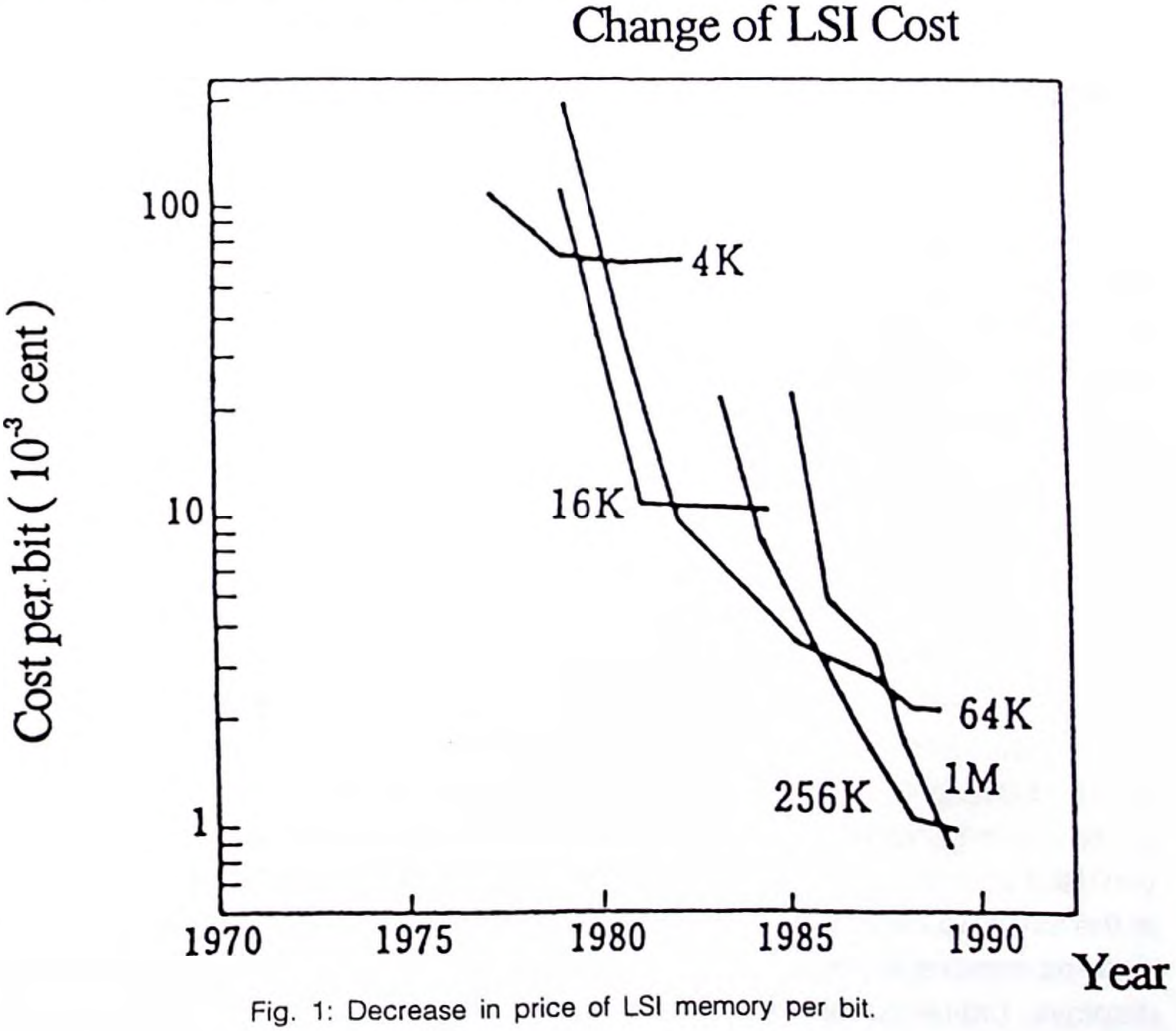

Fig. 1: Decrease in price of LSI memory per bit.

2. Progress of Computer Technology; From Kilo to Giga

The early eighties are considered to be the dawn of the personal computer age in Japan. At that time, the memory capacity of a computer was several kilobytes, and the data transmission speed was several kilo bps (bit/s); we can say the computers were in the "kilo era". In 1990, workstations made their appearance in laboratories and offices. The memory capacity of workstations is several megabytes, and network technology such as its ethernet whose transmission speed reaches several Mbps has become popular. Thus, computer capacity has become "mega" in scale and improved by more than one thousand times compared to its "kilo" capacity computers of the 1990s. Thus, as of 1998, we have entered the "mega era".

It is claimed that the "giga" unit will appear in the early 21st century; thus, the "giga era" is close at hand. This astounding quantitative expansion in capacity is bound to result in qualitative changes as well. The information that can be processed by one kilobyte almost equals one page of a Japanese writing pad (400 Japanese characters). One Japanese character equals 2 bytes so that 400 characters are equal to 800 bytes, which is 0.8 Kbytes. On the other hand, handling a photograph requires almost one megabyte. One-byte pixels are arranged as 1000 x 1000 meshes, which is 1 Mbyte. Furthermore, even higher gigabyte capacity will be required for processing moving images.

In the transition from the "kilo era" to the "giga era", we should note that the type of information processed by computers has changed remarkably. In the "kilo era", computers were capable of processing only text and numbers because of insufficient capacity. Backed by highly advanced technology, this recent expansion of multimedia diversifies data processing potential, ranging from moving images to letters in an interactive format.

3. Virtual Reality Technology and Simulated Experience

Among multimedia technologies, virtual reality technology is at the leading edge (Fig. 2), although this technology is relatively new and was introduced only in 1989. People are now able to perform various activities in a "virtual" space created by a computer, enabling them to broaden the world through direct experience. Glasses similar to ski goggles, which the woman is wearing the figure, are known as HMD (Head Mounted Display), and are used so that a person can observe a computer-generated 3D world. A pair of black gloves, called "data gloves", is a device used for grasping, throwing and handling virtual objects which appear in the virtual 3D world. In addition to these, various interesting interface devices such as immersive projection displays, force displays, 3D sound displays, tactile displays, bidirectional treadmills and a 3D mouse have now been developed.

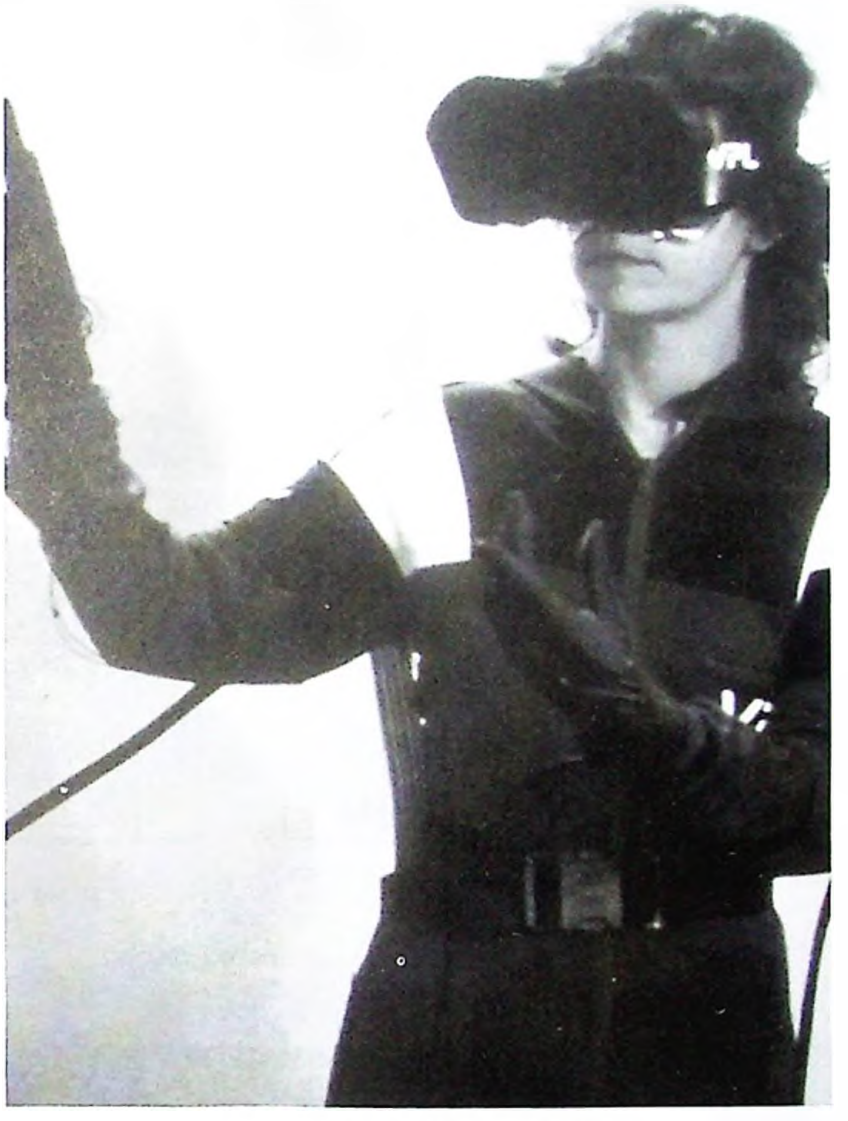

Fig. 2: Virtual reality technology.

Fig. 3 shows an example of an immersive projection display. This system is known as "CABIN" (Computer-Augmented Booth for Image Navigation) and is installed at the University of Tokyo as one of the world's largest virtual reality systems, enabling us to experience various simulated world. Fig. 4 shows an example of a simulated world; the world of Einstein's theory of relativity. Various phenomena predicted by this theory such as space distortion, or color shift by this Doppler effect of light, can be simulated by a computer. By using this virtual environment, even children can experience the world of scientific theory, which can be difficult even for science students to understand.

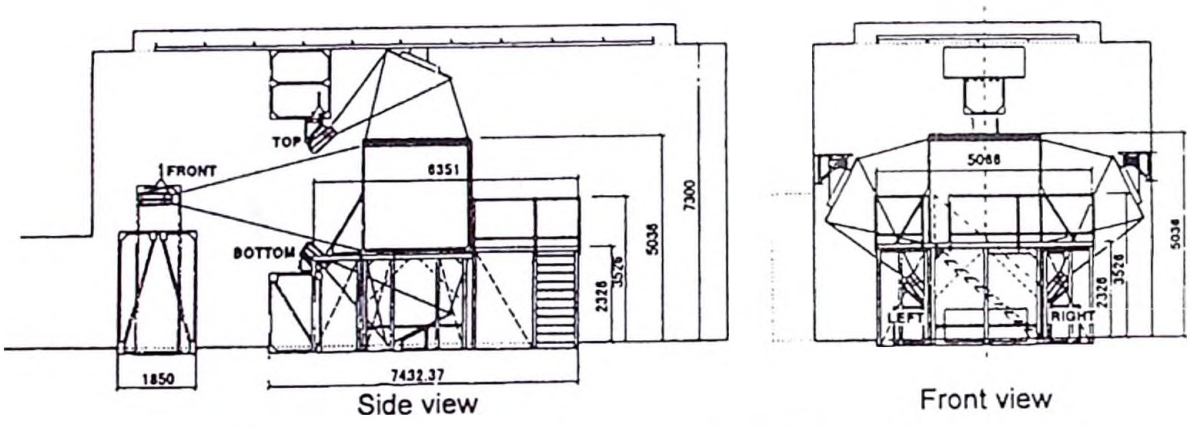

Fig. 3: An example of immersive projection display.

Fig. 4: An example of simulated world.

I do not believe that virtual reality technology will immediately mode a complete change in fundamental science education. However, there is no doubt that the technology provides an additional, attractive potential tool for teaching our children. In the past, only written logical knowledge could be transmitted systematically and efficiently by characters or script. Today we are fortunate to be able to introduce a new world to children by providing them with "experiences." Reality becomes meaningful when children incorporate their experiences into their frame of reference, by the process of watching and touching. The invention of microscopes and telescopes quickly led to the enhancement of scientific knowledge. Likewise, virtual reality technology will have a great influence on intellectual activity Fig. 5 shows the microscopic world of carbon atoms and oxygen molecules. Supercomputers can simulate such small-scale phenomena. Through this kind of experience, we, including children, should be able to understand scientific theory in greater depth.

Fig. 5: Microscopic world of carbon atoms and oxygen molecules.

4. New Image of Computers; Body Motion

One feature of virtual reality technology is that computers used in this technology have a rather different shape from conventional computers. Present-day computers are not necessarily only associated with a CRT display and a

keyboard, a stereotype presented in the past. The image of computers has changed drastically; virtual reality technology demonstrates this change.

Nowadays there are computers which can be interactively operated, using body motion with this assistance of a "motion capture" device. This system is one of the successors to the data glove, in that body motion can be directly transferred into computers by using this device; thus we have a channel which does not use symbolic information such as alphabets or numbers. This channel will result in a completely different concept of human-computer "interaction". Conversational metaphor will be inadequate to describe this type of interaction.

Using the "haptic display" shown in Fig. 6, one can touch a simulated image and fell its weight and movement[2]. Haptics is an interactive sense closely related to body motion. Touch sensation occurs only when body motion occurs. Current mobile computers or wearable computers are closely related to the mobility of human beings (Fig. 7). Many have raised the issue that computers deprive the individual of mobility. However, this preconception is rather old-fashioned, based on a imperfect image of computers. As for this future educational use it is obvious that children's contact with computers will no longer be limited to static classroom computers, but will also facilitate children's "real" experiences outside the classroom, proving to be an extremely powerful medium for providing then with various new experiences.

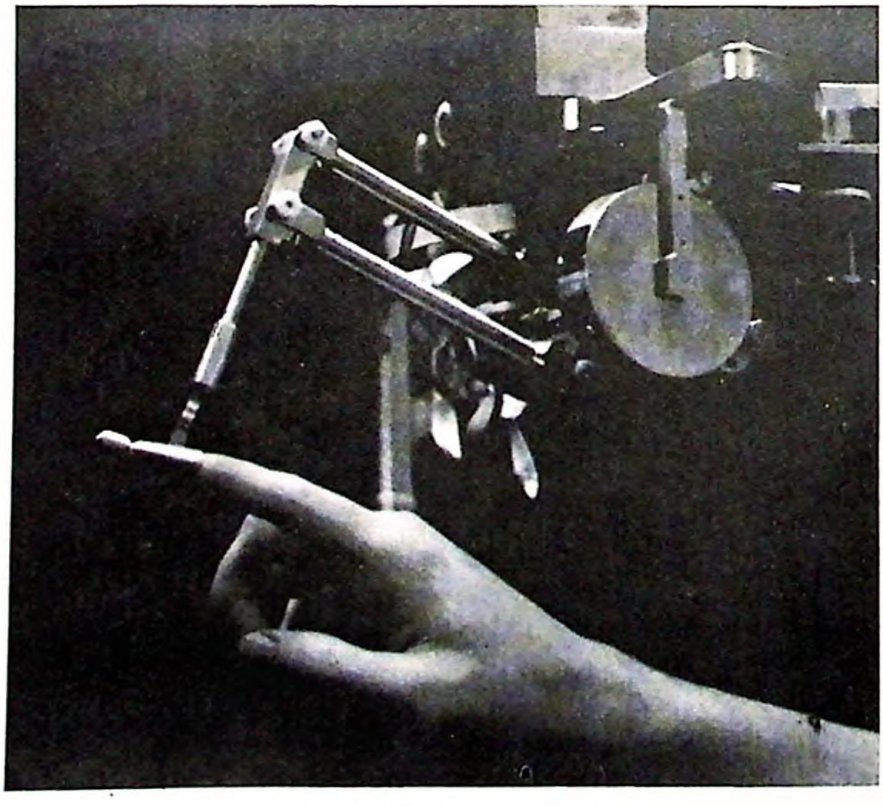

Fig. 6: Haptic display.

Fig. 7: Current mobile computers.

5. Summary

Some people go as far as to say that the invention of virtual technology is comparable to Columbus' discovery of the American continent. Nowadays, computers are regarded as essential tools for children to explore their new world. It will be interesting to observe and guide the growth of these children who have entered into such a world filled with many possibilities.

REFERENCES

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