Big Fat Wand: A Pointing Device for Open Space Edutainment

Toru Takahashi[1], Miki Namatame[2], Fusako Kusunoki[3], and Takao Terano[1]

[1] Tokyo Institute of Technology, Nagatuda, Midori-ku, Yokohama, Japan
{toru,terano}@trn.dis.titech.ac.jp
[2] Tsukuba Institute of Technology, Tsukuba, Ibaragi, Japan
miki@a.tsukuba-tech.ac.jp
[3] Tama Art Univeristy, Hachioji, Tokyo, Japan
kusunoki@tamabi.ac.jp

Abstract. This paper presents principles, functions, and experiments of a new edutainment tool: Big Fat Wand (BFW). BFW is developed from a conventional laser show device, however, it is modified to a small enough one to be used at an open apace. BFW is connected to a laptop PC, which provides character, symbol images, and/or animations. From experimental results, we conclude that BFW is a good gear for a facilitator to educate and educate hearing-impaired students.

Keywords: Laser Show Device, Edutainment in an Open Space, Education for Hearing-Impaired Students, Interactive Sessions.

1 Introduction

Although there are various methodologies for education of hearing-impaired or deaf people, it is still difficult to give lectures to them at out-of-classroom environments, for example, the explanations of artistic materials at a museum. Because the students cannot focus on both of the materials or hand languages at a same time, a teacher meet the troubles to manage students' interests about the objects and their explanation.

To cope with the issues, we are developing a new intelligent pointing device: Big Fat Wand (BFW). BFW is a handy smaller version of a conventional laser show device. A programmable laser-light show device will allow the user to specify the pattern displayed via any characters and/or symbolic patters on the targeted object [10], [11]. BFW stands for the very big magic wand. The device aims at presenting the learners both the focus points and the contents information about the target object (Figure 1). This paper describes basic principles, functions of the device, and experimental results of BFW.

The rest of the paper is organized as follows: in the next section, we discuss the motivation of the research. Then, we explain the basic principles and the architecture of BFW. Next, we describe the preliminary experiments on a lecture with and without BFW at a large room for sketch exercises of traditional plaster figures of Tsukuba University. Finally some concluding remarks will follow.

A. Nijholt, D. Reidsma, and H. Hondorp (Eds.): INTETAIN 2009, LNICST 9, pp. 240–245, 2009.

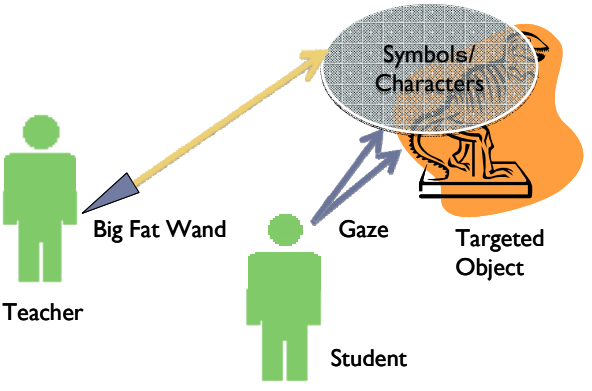

Fig. 1. BFW Directly Presents the Focus Points and Explanation

2 Background and Motivation

In the literature of the study of hearing-impaired peoples, there are several researches on their understandings on the explanations of a targeted object.

Gentry, M. M., et al. [5] present that additions of image information to language or character information remarkably help their understandings of the explanations of the targeted object. Jensema, C.J., et al and Jelinek Lewis, M.S., et al. [2], [3], [4] have reported that when native hearing-impaired people enjoy a TV drama with captions, they are divided to the two groups: the ones tend to focus on the mouth moves and the others tend to focus on the characters and that too many characters are hard to be recognized. Wilson, M., et al., [6] have discussed the roles of the working memories to the processes of encoding and decoding of hand language and character information. Also, we have analyzed that hearing-impaired people have the wider focus areas about their environments [8].

There are other various studies on the development of support systems for hand language educations and communication skills [7], [8], [9]. However, they do not cope with the out-of-classroom lectures.

These researches suggest that the following design guidelines of a new pointing device: i) It is desirable to dynamically show the explanation among the targeted object, but it is not so severe to show the information at the same place; ii) The smaller numbers of simpler information, the better; and iii) Both character and symbol information are necessary for good explanation.

To follow the guideline, we have not found good devices for the lectures. A conventional laser pointer has too poor information. Conventional PC projectors are too dark and too heavy at out-of-classroom environments. Because of financial and technical reasons, we have no chance to develop the pointing devices from scratch. Therefore, we have decided to develop a new one from conventional laser show devices.

3 Big Fat Wand: Handy Laser Show Device

Big Fat Wand system has the following components: i) A laptop PC with line drawing image generation, image display and editing software, ii) A one-board micro-computer to convert the digital information of the drawings to the analog ones to control the device, and iii) Laser show device with laser light generator, small dynamic mirror devices to control displays of the drawings, and power supplies. Very unique points of BFW are summarized as follows: i) A one-board 16 bit micro computer manages DA conversion of explanation and controlling the images, ii) The cylinder part is carefully designed to avoid heat damages of the laser devices, iii) the components of the devices are packaged in separated two parts to easily use the system, and iv) special purpose authoring tools are developed for naïve users to prepare the lectures.

Figure 2 shows each component and Figure 3 depicts the photos of an integrated BFW. A user or teacher uses the cylinder like device to show the desired information. The box behind the cylinder contains devices such as one-board micro-computer, power supply,

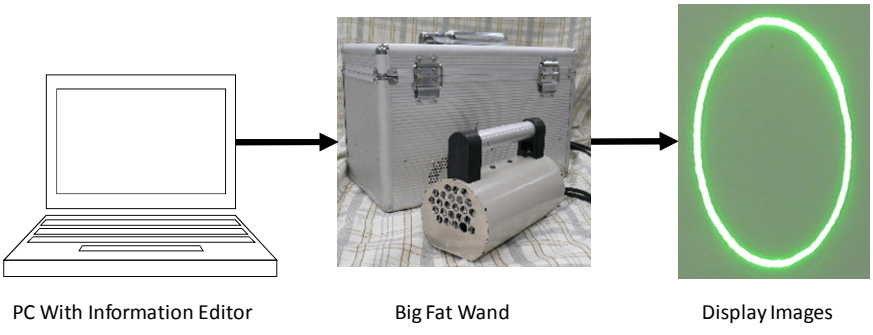

Fig. 2. Architecture of BFW

Fig. 3. Outlook of the Integrated Device

laser light generator, and so on. The information is prepared beforehand and/or at the learning site using special purpose authoring tools equipped on a laptop PC.

The current version of the tools are able i) to process static bitmap images (both characters and symbols), which are converted to line drawings, ii) to generate simple animations combined with the bitmap images, and also processes line drawings written with the postscript language. This means that the user is able to both design and generate the necessary information with bitmaps beforehand and draw pictures and character in a real time environment.

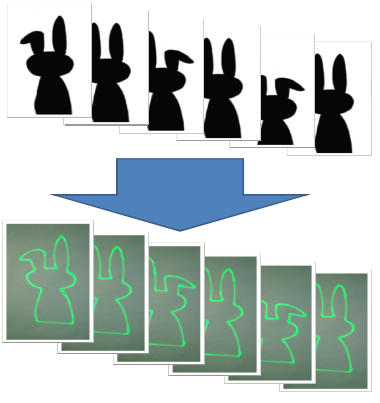

Fig. 4. Making Drawings from Bit-map Images

Figure 4 shows the processes to generate laser animations from bit-map images. Users of BFW are easy to make such drawing images and moving animations.

4 Experiments

Following preliminary experiments reported in [12], we have carried out intensive experiments of BFW for out-of-classroom lectures to evaluate the basic functionality of BFW on November 4, 2008 at Tsukuba University Art Department.

We have had two instructors: the one is a professor of Art Department, Tsukuba University and the other is the second author of this paper, who is a specialist to teach hearing-impaired students. They gave a 30 minute lecture to twelve subjects, who are the third grade under-graduate hearing-impaired students of Tsukuba Institute of Technology. Their specialty is art and design. The objective of the lecture is to explain the characteristics of big traditional plaster figures, which ware made from original ones in real size scales, in the room for drawing exercise (Figure 5). The subjects were the first time to visit the room. We have made two explanation materials of the Figure 5, beforehand. They are developed under the advices of the professor on the art domain. The explanation materials consist of both traditional paper forms and laser drawing forms. Figure 5 also shows a sample of the laser display information.

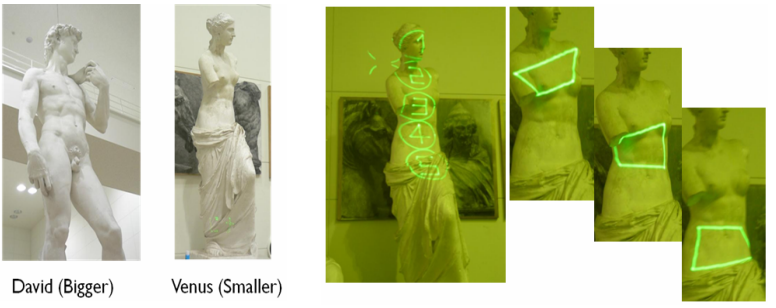

Fig. 5. Targeted Sculptures and Sample Laser Explanations

Fig. 6. Photos of Learners at the Sketch Room

Subjects are divided into sub-groups based on the experimental design methodology [1]. We have designed all the subjects have both paper and laser explanation twice for the different plaster figures. After each lecture, subjects are required to answer simple questionnaire. Also, they were required to describe free answers. After the al the explanations, they were required to make rough sketches, which aim at to evaluate their understandings on the target sculptures (Figure 6).

From the experimental results, the observations of experiments, and free descriptions of the questionnaire, we have drawn the following statements:

- BFW device is usable for instructors, who are not familiar with any other interaction devices.
- Operations of BFW are sometimes disturbed by the lecture environments, for example, obstacles of the room prevent smooth displays and movements of information.
- Although the number of the subjects is very small, there are comparative evaluation with BFW and traditional explanation.
- The figures are the bigger, the effects of the laser explanation will become the superior.
- We expect that the number of students becomes larger, the effectiveness of BFW will increase.

5 Concluding Remarks

This paper has proposed a new laser pointing device Big Fat Wand for education aid to hearing-impaired students. The objective of the device is to effectively give lectures at the out-of-classroom environment. The paper has also reported some experimental results to evaluate the effectiveness of BFW.

Our conclusion is simple: although BFW is at beginning stage of the development, the idea is effective to develop a new methodology for education of hearing-impaired students. The usage is not limited to the current purpose. Future work is to improve BFW to Small Smart Wand.

References

1. Jacko, J.A., Sears, A. (eds.): The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications. Lawrence Erlbaum Assoc Inc., Mahwah (2002)
2. Jensema, C.J., Danturthi, S., Burch, R.: Time Spent Viewing Captions on Television Programs. American Annals of the Deaf 145(5), 464–468 (2000)
3. Jensema, C.J., Sharkawy, S.E., Danturthi, R.W., Burch, R., Hsu, D.: Eye Movement Patterns of Captioned Television Viewers. American Annals of the Deaf. 145, 275–285 (2000)
4. Jelinek Lewis, M.S., Jackson, D.W.: Television Literacy: Comprehension of Program Content Using Closed Captions for the Deaf. Journal of Deaf Studies and Deaf Education 6(1), 42–53 (2001)
5. Gentry, M.M., Chinn, K.M., Moulton, R.D.: Effectiveness of Multimedia Reading Materials When Used with Children Who are Deaf. American Annals of the Deaf 149, 394–402 (2004)
6. Wilson, M., Emmorey, K.: Working Memory of Sign Language: A Window into the Architecture of the Working Memory System. Journal of Deaf Studies and Deaf Education 2, 121–130 (1997)
7. Michaud, L.N., McCoy, K.F., Christopher, A.: An Intelligent Tutoring System for Deaf Learners of Written English. In: Fourth Annual ACM Conference on Assistive Technologies, pp. 92–100 (2000)
8. Namatame, M., Harada, Y., Kusunoki, F., Inagaki, S., Terano, T.: To Use PYA Tool or Not for Learning Japanese. In: Proceedings of the ACM SIGCHI International Conference on Advances in Computer Entertainment Technology (ACE 2006), pp. S17–a79 (2006)
9. Su, S.A., Furuta, R.K.: VRML-Based Representations of ASL Fingerspelling on the World-Wide Web. In: Third Annual ACM Conference on Assistive Technologies, pp. 43–45 (1998)
10. http://www.laserfx.com/
11. Qijie, G., Yanyan, L.: Development of an Intelligent Laser Show System - A Novel Application of Mixed Reality Technology. In: 2005 ASEAN Virtual Instrumentation Applications Contest (2005)
12. Takahashi, T., Namatame, M., Kusunoki, F., Ono, I., Terano, T.: A Laser Show Device Works in An Open Space for Hearing-Impaired Students. In: Proc. Asia Modeling Symposium (AMS 2008), vol. F-12, pp. 385–389 (2008)