Letting Every Pupil Learn Japanese Hand Alphabets with VISUAL Interfaces

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ABSTRACT

This paper discusses the effects of a visual interface for the Japanese hand language system. The system *Practice! Yubimoji AIUEO* (*PYA*) we are developing aims at letting ordinary pupils learn basic character expressions (AIUEO) of the Japanese hand characters (Yubimoji). Because very few pupils in Japan are currently able to communicate with handicapped people and there are only complex, expensive, and difficult software systems and/or textbooks available to learn the language system, it is critical to deliver easy-to-use software systems on a PC at elementary schools. This paper describes what are the principles of PYA, how PYA works, and why PYA is effective from pedagogical and computer human interaction points of view.

Author Keywords

Visual Interface, Learning Hand Characters, Classroom Experiments.

ACM Classification Keywords

Web-based interaction, Computer-supported cooperative work, User-centered design.

INTRODUCTION

Japanese sign language and Japanese hand alphabets or KANAs are not common for ordinary Japanese people. The language and alphabet system is a local one, and different from English one. Thus, to promote the language system, we are conducting a project to develop a PC-based education system for every pupil at elementary school ages as very beginners to learn Japanese hand alphabets.

Although the rapid development of computer technologies, until recently, the research on studying computer supports for hand languages or hand characters has not been a popular

topic. Most of the current support systems focus on highly motivated users, therefore, they have a lot of sophisticated functions. For example, studies reported in [1] or [2] emphasize on the network communication functionality to use hand language systems. Mimehand or Mimehand II system in [3] utilize language representation movement of animated agents, which also requires very complex implementation. In S-Tel [4], they have implemented avator type characters to transmit the representation of the hand language. Virtual RadLab [5] also provides school children with a large scale virtual environment for learning.

Therefore, from pedagogical and computer-human interaction points of view, few studies have been conducted. To envision an easy-to-use and interfaces for ordinary beginer pupils, we are developing the learning system: *Practice! Yubimoji AIUEO* (PYA). PYA aims at letting ordinary pupils learn basic character expressions (AIUEO) of the Japanese hand characters (Yubimoji). The main focus of the paper is to discuss the effectiveness of the visual interface.

ISSUES OF CONVENTIONAL HAND LANGUAGE LEARNING SUPPORT SYSTEMS AND PRINCIPLES OF PYA

As described in the previous section, most of today's hand language learning support systems targets on highly motivated people. This means that their digital contents are usually manipulated via keyboards and/or menus from the equipped dictionary keyed by specified words or verbs. Some systems display continuous animation images to display the contents. They often emphasize the importance of both the amount of contents and query processing functions.

Such functions are adequate for motivated and advanced users, however, the beginners are very hard to understand the language system. Contrary to such conventional learning support systems, we would like to motivate, introduce, and promote ordinary people, especially elementary school pupils, to learn the Japanese hand language system. As the first stage, we only focus on the Japanese Kana characters. In the

practical educational environments for the handicapped people, they really require the integration of ordinary Kana characters, finger shapes of the hand characters, corresponding mouth forms, and sounds. Especially, the forms of the hand characters must be understood by the standpoints of both speakers and listeners. We often forget the forms are in the opposite relations from the both sides. The same requirements also hold to PYA.

Based on the discussion, the principles of PYA are summarized as follows:

(1) Visual representation of the characters from both sides of speakers and listeners;

(2) Simultaneous displays of the corresponding Kana characters, finger shapes, mouth forms, and sounds;

(3) Integration of finger shapes, sounding faces, and the corresponding animations;

(4) Animated graphics of the finger movement; and

(5) Explanation of the origin of the finger shapes of the characters.

PYA is designed to be used in both a classroom lecture and home work, thus, implemented as a client-server system on the web shown in Figure 1.
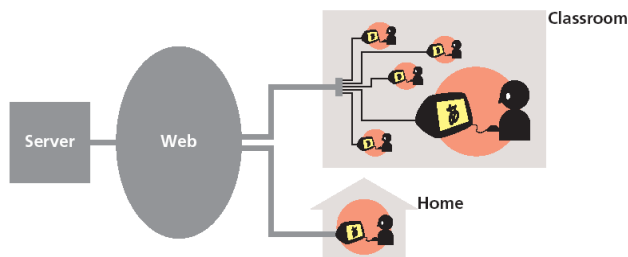

Figure 1. System Configuration of PYA

HOW PYA WORKS

Implementing the five principles in the previous section, PYA works as shown in Figure 2. The integrated visual interface supports the learning of the very beginners..

The first display in Figure 2 is the main entry of PYA, which shows all the Kana characters and three kind shift icons. Each Kana character is an entry to show the corresponding hand characters.

The second display is shown when a user points the mouse to the place 'A', then PYA automatically shows the third display.

The girl appeared in the third display pronounces the sound of 'A'. At the same time, she shows the corresponding finger shape with appropriate movements. The center finger form represents the character from a listener, and the bigger finger form corresponds to the one from a speaker. These simultaneous finger forms enables a user to easily understand

the correct form of 'A'. These displays are designed based on the principles of (1) through (4).

If there are hints about the origin of the finger shape, the puppy waggles its tail. Then, the fourth display will appear to explain how the form is determined. The help information is the answer to the principle (5) in the previous section.
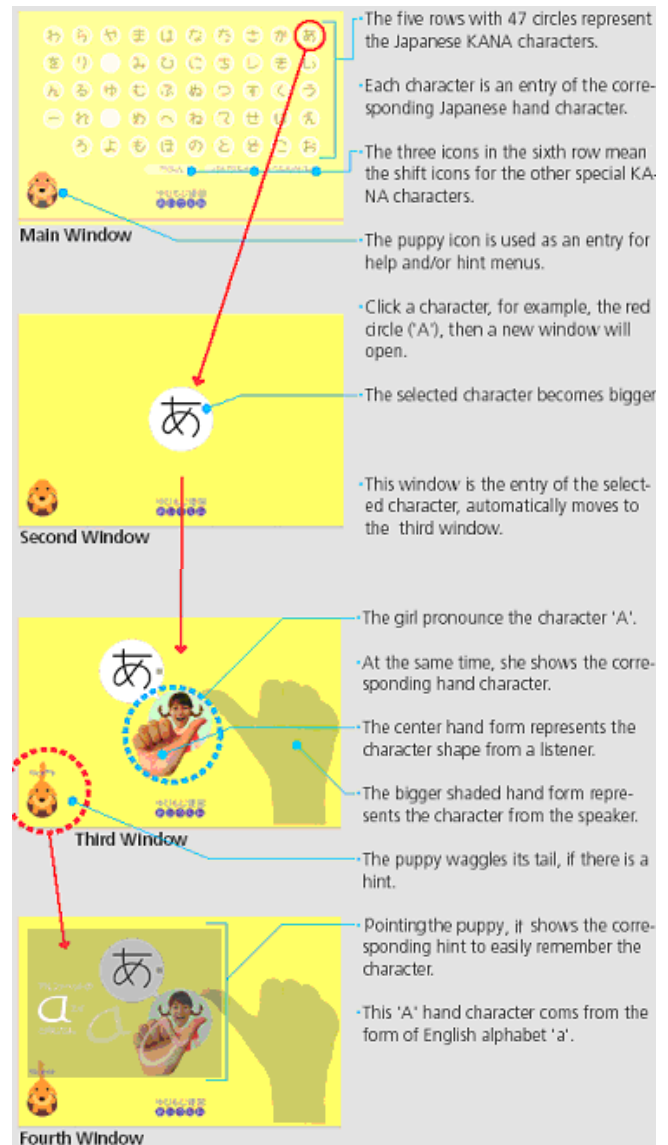

Figure 2. How PYA Works

EXPERIMENTS

Using PYA, we have conducted three hours classroom experiments, which was held at Sumiyoshi Elementary School in Kobe as a special lecture on the "integrated courses" in December, 2003. The experiments consist of an oral lecture and a practice with PYA. The oral lecture was given by the first author, who is an expert of lectures to deaf students at Tsukuba College of Technology. The second author, who is the designer of PYA, supported the computer exercise.

Experimental Set Up

Usually, in Japan, it is not allowed to carry out such experiments in an elementary school. Therefore, from experimental setting, the design plan was not sufficient. They required us to give the same contents and ways of the lecture to all the subject.

The 41 pupils with 11 or 12 years old are selected as the subjects of the experiments. They are all ordinary school pupils and the five of them have educational experience in the outside of Japan.

They are divided into the two groups Group 1 of 21 pupils and Group 2 of the other 20 pupils. We give Group 1 pupils PYA practice first, then an oral lecture. Group 2 pupils are given an oral lecture first, then PYA practice. We give them the same problems with different orders.

The oral lecture, which took 50 minutes, contains the explanation of the importance of the hand language system and the exercise to remember how to spell the subjects' own name and simple exercises of some popular words. The PYA practice, which also took 50 minutes, consists of the free use of the system and simple exercises of some popular words. After each session, simple questionnaires on the interestingness, understandability, and usability have been conducted.

(a) Snapshot of an Oral Lecture by the First Author

(b) Snapshot of PYA Exercise

Figure 3. Snapshots of the Experiments

Figure 3 displays some snapshots of the experiments. In the upper picture, the first author has given an oral lecture, which

emphasizes the importance both mouth forms and finger forms. In the lower picture, a pupil have freely explores the visual interface of PYA.

After the practice and the lecture, we have conducted individual performance testing to uncover how they understand the language system.

Method of the Performance Tests

The individual performance tests contain the practice of displaying hand characters of (1) the subjects' name, whose difficulty is subject change according to the name, (2) simple words: "I-E"(house), which they were taught at the first stage. This consists of the first five characters of the Kana table; (3) "HA-RU"(spring), which they were taught, (4) "NA-TU" (summer), which they were also taught, and the forms are somewhat confusing; (5) "MI-RU-KU" (milk), which they are also taught, however, the forms are very confusing because of the directions are difficult to represent; and (6) "A-SI-TA-A-O-U" (meet tomorrow), of which they must compose using their knowledge. It took 2 to 5 minutes for each pupil to have the tests.

The results have been evaluated the correctness of the forms of the characters (0-15 points), the directions of the forms (0-5 points), and the smoothness of the movements (0-5 points).

Results and Discussion

From the performance tests, we have had 40 samples (21 from Group 1 and 19 from Group 2). The summary of the sum of the evaluation items (0-25 points) is shown in Table 1.

The total average score is 7.00and its standard deviation is 4.43. thus, the scores cover wide range of the performance tests, and the tests are not easy ones for the subjects. The subjects are divided into two or three categories according to the groups, understandability, difficulty, and interestingness:

Category	Sub-cat	Average	Category	Sub-cat	Average
Group 1		6.33	Difficulty	High	6.50
Group 2		7.74	(1-st	Middle	7.24
PYA	Middle+	6.33	Course)	Low	7.33
understand	High	7.74	Interests	Middle+	7.77
PYA	Middle+	8.18	(1-st crse)	High	6.63
interests	High	6.55	Difficulty	High	6.14
Lecture	Middle+	6.92	(2-nd	Middle	8.25
understand	High	7.04	Course)	Low	6.20
Lecture	Middle+	7.40	Interests	Middle+	8.36
Interests	High	6.87	(2-nd crse)	High	6.48

Table 1. Average Scores of the Performance Tests

- Category 1: Group1 or Group 2
- Category 2: PYA Understandability: Middle+ or High
- Category 3: PYA Interests :   Middle+ or High
- Category 4: Lecture Understandability: Middle+ or High
- Category 5: Lecture Interests: Middle+ or High
- Category 6: 1-st Course Difficulty: High, Mid, or Low

- Category 7: 1-st Course Interests: Middle+ or High
- Category 8: 2-nd Course Difficulty: High, Mid, or Low
- Category 9: 2-nd Course Interests: Middle+ or High

From Table 1, we observe the following findings:

1) Recent use of PYA reflects the better performance of the learning. This means that the PYA use is better for the pupil.

2) The higher understandability on both the lecture and PYA shows the better performance, however, the higher interests do not affect the performance. This means that the understandability of the course is essential for the learning.

3) Both the higher and lower difficulties of the course show the poorer performance. This means that there would be a some proper level of the course.

4) The higher interests show the lower performance. This means that over attractiveness would show worse effects of the learning.

From the experiments and preliminary statistical analyses, we have suggested that PYA is a good tool for the learning, however, more comprehensive analysis is necessary to reveal the characteristics of our learning courses.

From the questionnaire data, most of the subjects have much interests in hand alphabets and desires to communicate the handicapped people, thus, the experiments were successful from the pedagogical points.

For learning new stuff, they emphasize the importance of the concepts of situatedness [6] and/or cultural-historical approach [7]. Learning does not mean individual knowledge acquisition, but, collaborative knowledgeable activities, thus, situations of collaborative activities are most important.

Although, the current implementation of PYA only supports individual learning, however, from the experiments, we have often observed that pupils are enjoying emerging collaborative practices. This would lead our projects towards total learning environments with mutual communications and collaborative environments [5], [8], [9], [10].

CONCLUDING REMARKS
In this paper, we have reported a PC-based Japanese hand alphabet learning system PYA and have discussed the effects of its visual interfaces. The current implementation of PYA is available from the web site [11].

The mosit important future work to be explored from the reserarch is that we should develop a collaborative framework for the learning.

Further research also includes enhancing the functionality of PYA to be able to utilize 3-D visual interfaces. To uncover the characteristics of behaviors of pupils, furthermore, we will conduct experiments to observe detailed motions of the subjects using, for example, motion capture devices.

REFERENCES
1. Magnussen, M. : Videotelephony in Intervention with People with Speech and Language Disabilities. *12th Annual Conference, Technology and Persons with Disabilities*, MAGNU2_T.TXT (1997) 8.

2. Sperling, G. : Future Prospects in Language and Communications for the Congenitally. In *Deaf Children: Developmental Perspectives*, Academic Press (1978) 103-114.

3. Mimehand web-page (2001): http://www.hitachi-eu. com/egov/case_studies/mimehand1.htm (in English), http://www.hitachi.co.jp/Prod/comp/app/shuwa/ (in Japanese).

4. Kuroda, T., Sato, K., and Chihara, K. Development of S-Tel: Avatar-Type Hand Language Transmitting System (in Japanese). *Journal of Virtual Reality Society in Japan*, Vol. 3, No.2 (1998) 41-46.

5. Virtual RadLab Web-Page (2003): http://www.virat.nottingham.ac.uk

6. Lave, J., and Wenger, E. *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, 1991.

7. Cole, M., and Engestrom, Y. A Cultural-Historical Approach to Distributed Cognition. In Salomon, G. (ed.): *Distributed Cognitions: Psychological and Educational Considerations*. Cambridge University Press, (1993), 1-46.

8. Hammond, N., and Allinson, L. Travels around a Learning Support Environment: Rambling, Orientating or Touring? *Proc. CHI 1988,* (1988) 269-273.

9. Hudson, J. M., and Bruckman, A. Effects of CMC on Student Participation Patterns in a Foreign Language Learning Environment. *Proc. CHI 2001,* (2001) 263-264.

10. Sherman, L., et al. StoryKit: Tools for Children to Build Room-sized Interactive Experiences. *Proc. CHI 2001,* (2001) 197-198.

11. Harada, Y.: PYA Web-Page. (2004) http://ss4.idd.tamabi.ac.jp/~haraday/yubimoji/