A Presentation Support System by Expanding Embodiment with a Mobile Touchscreen Device

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Abstract— **Most of the people make presentations by using tools such as pointers. However, the use of information devices such as laser pointers and mice can restrict the presenter's embodied motions and actions. In this paper, we propose a presentation support system that can expand embodiment by using a portable touch screen device. First, we develop a prototype of the system by using an iPhone, and then, we perform experimental evaluation. Next, we performe the evaluation of the modes of PPTouch, and the effectiveness of the system in various situations is clarified. Then we perform comparison with conventional pointers, and evaluation by participants. Both experiments also show the effectives of PPTouch.**

Keywords- presentation support; expansion of embodiment

I. INTRODUCTION

In presentations, tools such as pointers are used together with embodied motions and actions of body language and gestures [1]. However, the use of information devices such as laser pointers and mice can restrict the presenter's embodied motions and actions. For example, when using a pointer, a presenter can explain the slides with various motions and actions depending on the content. Nevertheless, when the presenter uses a laser pointer or mouse, the participants may have difficulty seeing the presenter's movements, and this makes the presentation harder to understand.

Several researchers have studied this problem and attempting to provide possible solutions by using information devices. For instance, Murata et al. developed a presentation tool that superimposes a shadow, as in an OHP presentation [2]. Shimizu et al. developed a system that enables multiple pointing using mobile devices [3]. Some applications are available on App Store for iPhone [4, 5] or iPhone software [6]. However, these researches are based on functional support.

On the other hand, we have developed a presentation support system that can share embodied rhythms between the presenter and the participants and demonstrated the effectiveness of our system. Our speech-driven embodied entrainment presentation support system can generate a listeners' nodding reaction via visual and auditory information and create a sense of unity between presenters and participants [7]. We have also introduced the presenter's embodied motions and actions into the system via a pen display and enabled the rhythmic communication of information [8]. In this study, we introduce the concept of PPTouch. With PPTouch, presenters can use mobile devices with embodied motions and actions as if they are a part of their body by expanding embodiment. We also develop a prototype and perform evaluation experiments.

II. CONCEPT

Figure 1 shows the concept of PPTouch. The presenter moves the finger-shaped cursor on the screen by operating a mobile touchscreen device, and the presenter can feel as if the embodiment is expanded.

The mobile device has a touch screen and is WiFi-enabled. Its use allows the presenter to gesture from various positions in various situations. Moreover, because the touchscreen has an intuitive interface, it can be used as if it is a part of the presenter's body.

In addition, the embodied visual effects such as the finger-shaped cursor enhance the efficiency of communication.

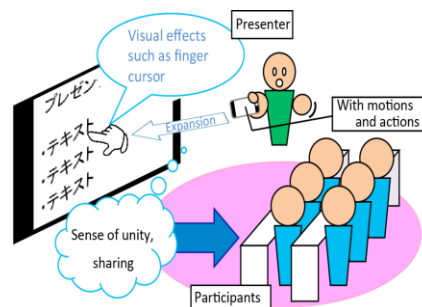
Fig. 1 Concept of PPTouch.

III. PPTOUCH

A. System Configuration

Figure 2 shows the system configuration of PPTouch. For the mobile touchscreen device, we used an Apple iPhone (with iOS 4.2.1) and developed the software using XCode 3.2.6. When a presenter touches the iPhone screen, the software detects the input. When cursor operations are input, messages are sent to the PC (HP, EliteBook 8730w) using UDP. When page-control or effect-control commands are input, messages are sent using TCP. The PC handles the received messages and controls the presentation software (Microsoft, PowerPoint 2010). A finger-shaped cursor is projected on the main screen and controlled using the iPhone.

B. Modes for Expanding Embodiment

On the iPhone, we display a copy of the projected slide in the upper section of the touchscreen. The lower section contains the buttons that control the visual effects. We have developed three operation modes (see Figure 3):

Mode A: Finger cursor

A finger-shaped cursor is displayed on the iPhone screen and synchronized with the cursor on the main screen. By moving the iPhone cursor, presenters can point to the same point of the main screen.
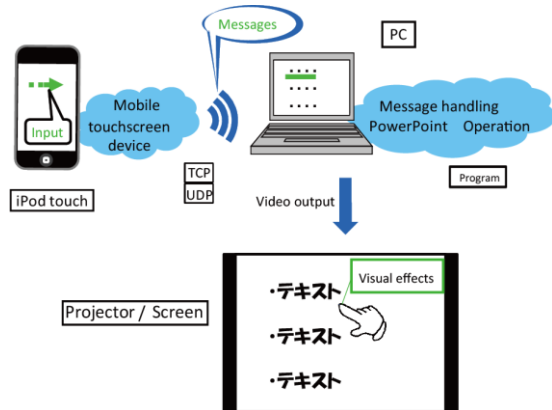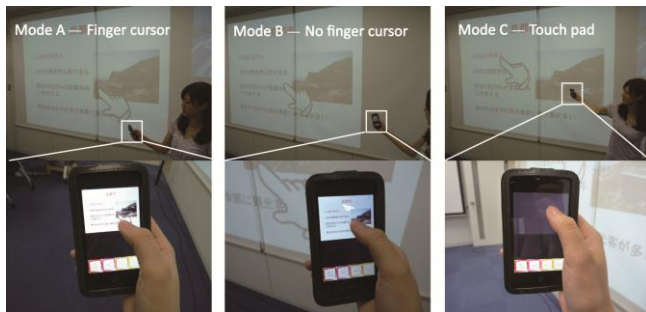

Fig. 2 System configuration.

Fig. 3 Three modes for expanding embodiment.

Mode B: No finger cursor

Presenters can touch a point on the iPhone slide, and the cursor on the main screen will move to that point. Presenters feel as if they are directly touching the main screen. No finger-shaped cursor is displayed.

Mode C: Touchpad

As for a PC touchpad, the finger cursor on the screen moves according to the distance to which it is dragged. There is no slide or finger cursor on the mobile device.

IV. COMPARISON BETWEEN MODES

A. Method

To compare the three modes, we assumed the four presentation scenarios shown in Table 1 and conducted an experimental evaluation.

First, we explained PPTouch and the experimental scenario and asked the subjects to become familiar with the PPTouch system. We then selected a scenario, randomly. We evaluated the modes via a paired comparison ($_3P_2 = 6$) by asking the subjects to give a presentation using the three modes in random order. For the presentation, we prepared three slides that the subjects could easily explain without any previous knowledge. The slides included red keywords, as shown in Figure 4 and the subjects were asked to emphasize these during the presentation. We followed this procedure for four scenarios.

After that, the subjects were instructed to perform seven-point bipolar rating scale from 1 (not at all) to 7 (extremely), over all evaluation, and free comments of each mode as an overall evaluation. The experiment was performed by 15 pairs of 30 Japanese students. Figure 5 shows the example scene of the experiment.

Table 1. Scenarios.

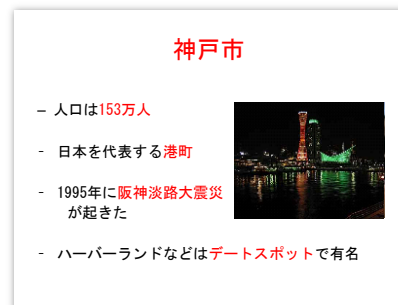| Scenario	Details
Large screen	Presenter can not touch the screen.
Medium screen	Presentation in a room with a medium screen. Presenter can use a pointer.
Speech	Presenter looks at the audience.
Meeting	Presenter and participant sit side by side.

Fig. 4 Example slide.

B. Results

Table 2 shows the results of paired comparison. Here, the Bradley-Terry model [9] was fitted to the result for a quantitative analysis, and preference π was estimated. Figure 6 shows the result. As a result, in a large screen scenery the "mode A - finger cursor" and "Mode B - no finger cursor" were rated about twice than " Mode C - touchpad". In a medium screen scenario, mode B was rated more than twice as high as mode C. In speech, mode A was rated extremely high. In meetings, there was no large difference.

Fig. 7 shows the result of overall evaluations. Mode B was rated highest. Mode A followed to it, however, mode C was not selected so much.

Figure 8 shows the results of seven-points bipolar rating. The result of average, SD, and the Friedman test are also shown in this figure. For "I felt as if I was touching the screen" and "I looked at the device frequently", there was a significant difference at a significance level of 1%; mode A and mode B were rated higher than mode C. There was also significant difference in "I looked at the main screen".

Table 3 shows the result of users' comments. Mode A and mode B were commented favorably, however, some of the subject pointed out that "I had to check the finger position", etc.
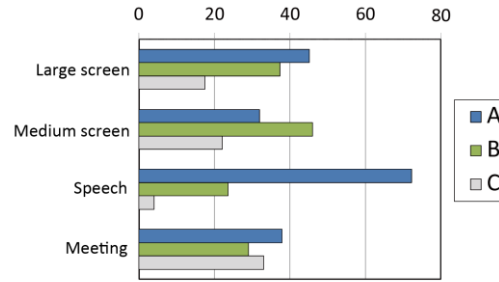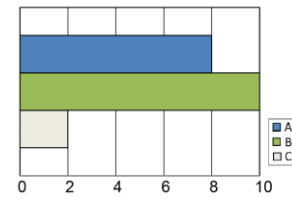

Fig. 6 Preference π.

Fig. 7 Overall evaluations.
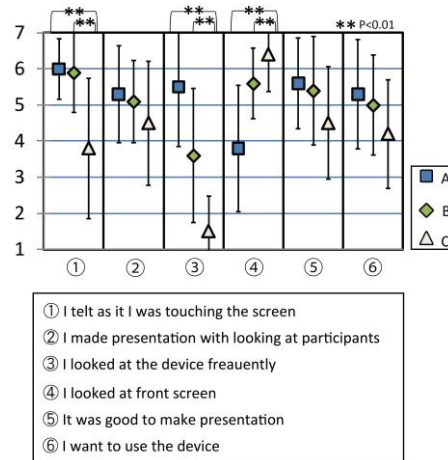

① I telt as it I was touching the screen
② I made presentation with looking at participants
③ I looked at the device freauently
④ I looked at front screen
⑤ It was good to make presentation
⑥ I want to use the device

Fig. 8 Results of seven-point bipolar rating.
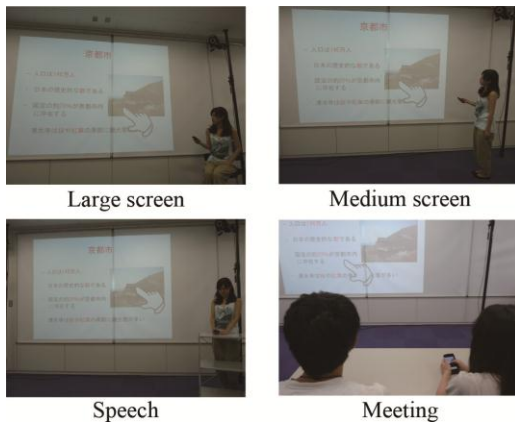
Fig. 5 Four experimental sceneries.

Table 2. Results of paired comparison.

Large screen	A	B	C	total
A		15	23	38
B	15		19	34
C	7	11		18

Medium screen	A	B	C	total
A		12	18	30
B	18		20	38
C	12	10		22

Speech	A	B	C	total
A		22	29	51
B	8		25	33
C	1	5		6

Meeting	A	B	C	total
A		16	17	33
B	14		13	27
C	13	17		30

Table 3. Users' comments.

Positive comments

A	The cursor made it easy to know where was pointing.
B	I could operate intuitively. I could use it unconsciously.
C	I could perform familiar operations in a standing position.

Negative comments

A	I had to look for the cursor first.
B	I had to check the finger position.
C	I had to check the pointer's position constantly.

C. Discussion

Mode B (no finger cursor) received the highest evaluations except in the speech scenario. Thus, mode B was confirmed to be useful in various situations. Mode A (finger cursor) was also rated highly, especially in the speech scenario. Thus, a presenter can use this device even when facing the audience. Modes A and B were rated highly overall and in the category *I felt as if I was touching the screen*. Thus, our device is useful for presentation support. On the other hand, mode C received some positive evaluations; this was because some subjects favored a familiar operation on a mobile device. These results show the effectiveness of PPTouch.

V. COMPARISON WITH CONVENTIONAL POINTERS

A. Method

Next, we compared the use of a pointer, a laser pointer, and PPTouch in three scenarios: large screen, medium screen, and meeting (see Figure 9). In the experiment, we asked each pair of subjects to choose the appropriate mode and become familiar with PPTouch. Then, we asked one person in each pair to identify himself/herself as the presenter and the other as the participant.

We selected one scenario randomly. We evaluated the modes via a paired comparison ($_3P_2 = 6$) by asking the subjects to give a presentation using the three modes in random order. Then, the subjects were instructed to perform seven-point bipolar rating scale from 1 (not at all) to 7 (extremely), and free comments of each mode. The experiment was performed by 15 pairs of 30 Japanese students.

B. Results

Table 4 shows the results of paired comparison. (Pointer is described as S, Laser pointer is L, and PPTouch is P hereafter). Here, the Bradley-Terry model was fitted to the result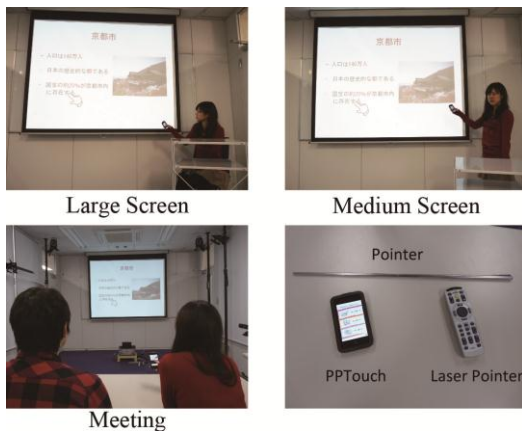 for a quantitative analysis, and preference π was estimated. Figure 10 shows the result. As a result, laser pointer was rated high in meeting. PPTouch was rated high in all scenery. Figure 11 shows the results of seven-point bipolar rating. The result of average, SD, and the Friedman test is also shown in this figure. Friedman's test revealed significant differences of 1% between the pointer and PPTouch for all items. There was a 1% significant difference for "I was good to make the presentation", "My pointing was clear", and "I want to use the device" between the pointer and laser pointer. There was a 5% significant difference for "I could move or gesture freely". On the other hand, there was no significant difference between the results for the laser pointer and PPTouch.

We then classified the results on the basis of the response to "I want to use the device". Figure 12 shows the results. Seventeen subjects preferred PPTouch, and thirteen preferred other devices. As shown in Figure 12, seventeen rated PPTouch highly. Friedman's test revealed significant differences of 1% or 5% between the pointers for all the responses. There was a 1% significant difference for "I want to use the device". There was a 5% significant difference for "It was good to give the presentation", "I looked at the participants", and "I felt as if I was touching the screen". On the other hand, the remaining thirteen participants reported no significant difference between the results for the laser pointer and PPTouch. Thus, PPTouch was rated as highly as the laser pointer.

Figure 13 shows the results by participants. There are significant differences between pointer and other devices at 1% or 5% of significant level. However, there was no significant difference between laser pointer and PPTouch.

Table 5 shows the result of users' comments. PPTouch commented favorably for both presenter and participants. However, some of the subject pointed out that "Some of the words may be hidden by the finger cursor", etc.

Fig. 9 Three devices and three sceneries.

Table 4. Results of paired comparison.

Large screen	S	L	P	total
S		3	0	3
L	27		7	34
P	30	23		53

Medium screen	S	L	P	total
S		12	10	22
L	18		11	29
P	20	19		39

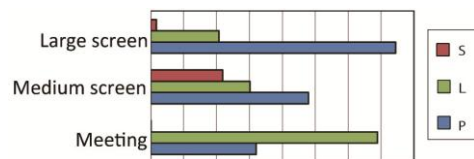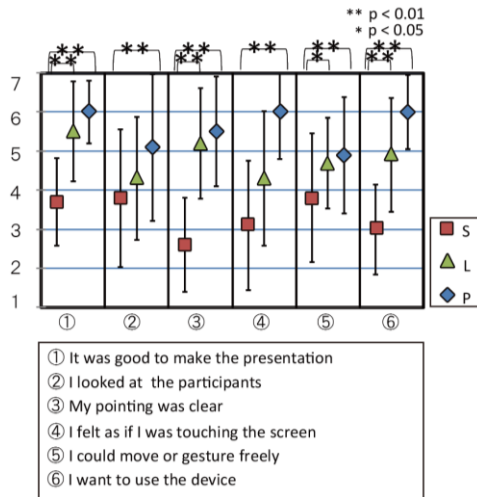| Meeting	S	L	P	total
S		0	0	0
L	30		20	50
P	30	10		40

Fig. 10 Preference π.

Fig. 11 Results of seven-point bipolar rating (presenters).
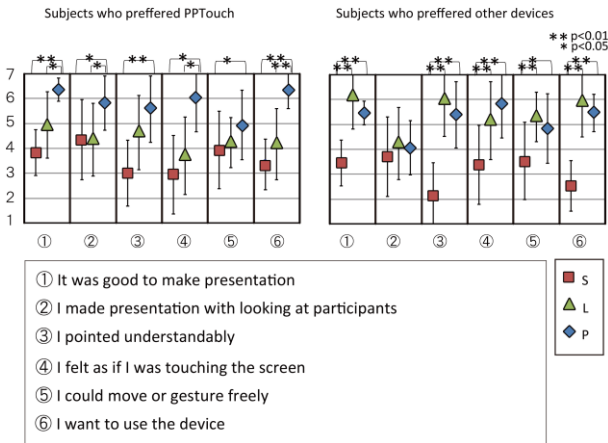

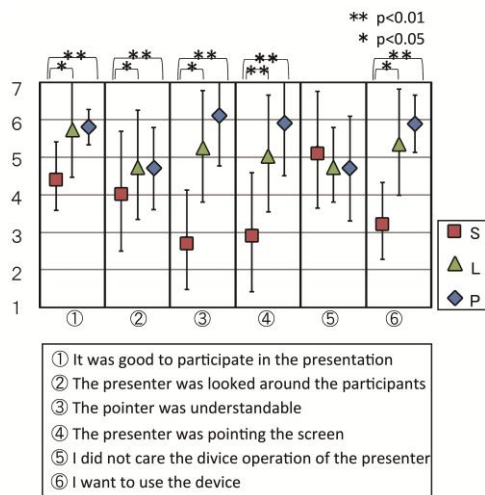Fig. 12 Results of seven-point bipolar rating (presenters) subdivided by preference.

Fig. 13 Results of seven-point bipolar rating (participants).

Table 5. Users' comments.

Presenter

Positive comments	· PPTouch was versatile sufficiently. · The pointed area was easy to understand. · I could make the main presentation without looking at the front screen.
Negative comments	· I had to look at the device till I got used to it. · Some words may be hidden by the finger cursor. · The font size on the screen was small.

Participants

Positive comments	· Important points were emphasixed adequately. · The pointing was clear.
Negative comments	· Some of the words may be hidden by the finger cursor. · The presenter looked at the device during the presentation.

C. Discussion

The pointer was rated highly in the medium-screen scenario, but its use is limited by its length. The laser pointer was rated highly in the meeting scenario because it was useful when the presenter pointed to the screen from the front. PPTouch was rated highly in all scenarios. Thus, we conclude that PPTouch is sufficiently versatile for various presentation scenarios.

VI. EVALUATION BY PARTICIPANTS

A. Method

According to Lilian's study, Highlighting, Outlining, the Pointing and Emphasizing are important in presentation [1]. As an evaluation experiment by participants the situation with a big screen where PPTouch can be used easily was prepared (see Figure 14 of left). The experiment was conducted by 3 persons (one presenter and two auditors were in a pair).

First, we prepared the slide for each subject (Figure 15), and asked them practice the presentation by using PPTouch. In the practice, we told the method of pointing according to the contents of the slide, how to move the cursor at the presentation, and how to change the size of a cursor. After that, they performed the presentation of the slide using a laser pointer or PPTouch. Then, the participant filled in the seven-points bipolar rating and free questionnaire of the device. These are determined as one set. Then, we changed the device and asked them to fill out the form again. Then, they changed a presenter as a next set. And they performed the three set in total.

An order of the used slides or a device was in random. The experiment was performed by 10 pairs of 30 Japanese students.

Fig. 14 Big screen scenario for evaluation by the participants.

Fig. 15 Example of the slides.

B. Results

Figure 16 shows the results. Friedman's test revealed significant differences of 1% or 5% between the pointers for the items ③－⑦. There was a 1% significant difference for "The figure was highlighted" and "Explanation of the graph was understandable" and "The pointing was clear" and "I want to use the device". There was a 5% significant difference for "The text on the slide was clearly emphasized".
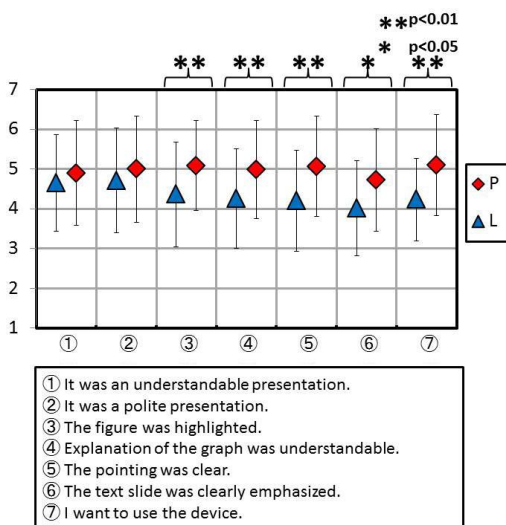

Fig. 16 Results of seven-point bipolar rating (participants).

C. Discussion

Because the cursor position of PPTouch was stable, the participants rated PPTouch higher than laser pointer. As for Emphasizing, it was not rated so high than the other modes. It may be caused by the occlusion by the finger cursor.

VII. CONCLUSION

In this study, we proposed a PPTouch presentation support system that can expand embodiment. We developed a prototype using an iPhone and implemented three operation modes. Then, we performed an experimental evaluation, the results of which showed that PPTouch is useful for presentation support in various scenarios. We then compared PPTouch with conventional pointers and found that PPTouch is sufficiently versatile. Also, we performed evaluation experiment by the participants, and made clear its advantage.

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