Evaluation of Alternative Presentation Control Techniques

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ABSTRACT
Although slideshow presentation applications, such as PowerPoint™ have been popular for years, the techniques commercially available to control them rely on mouse and keyboard, which can be restrictive for the presenters. We evaluated two representative alternative designs of presentation control techniques - *Bare Hand* and *Laser Pointer*, through a Wizard-of-Oz user study. The result showed that *Bare Hand* was better than *Laser Pointer* and *Standard* (mouse/keyboard) control in terms of acceptance and preference from both presenters and audience. We also proposed design directions based on user feedback.

Author Keywords
Presentation, control techniques, user study

ACM Classification Keywords
H5.2. [Information interfaces and presentation]: User Interfaces - Evaluation/methodology, User-centered design

INTRODUCTION
Nowadays people are relying more and more on computers and slideshow presentation software to convey ideas to public. While the scenario of giving presentations is completely different from single-user desktop applications, currently available presentation applications, are still relying on control mechanisms using keyboard and mouse, which highly restricted the interaction between the presenter and the audience.

Many people attempted to develop alternative technologies that could assist people to give presentations. But as far as our knowledge, little research has focused on the systematic evaluation of alternative interaction techniques specific to electronic presentations. In this paper, we explored two representative alternative designs of techniques to control electronic presentations: *Bare Hand*, where the presenter controls the presentation by touching the projection screen using hand; and *Laser Pointer*, where the presenter controls the presentation by pointing to the projection screen with a laser pointer and clicking a button on it. Instead of technological issues related to a specific working prototype, we are interested in people's overall acceptance and preference of the techniques concepts, and the design issues related to them. Therefore, we conducted a Wizard of Oz user study. We hope our study result will guide the real design and implementation of future technologies, preventing usability problems from the beginning stage.

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RELATED WORK
Several people have explored technologies to support intuitive interaction techniques for electronic presentations. Baudel and Beaudouin-Lafon [1] used data gloves to capture hand gestures to control presentation. Nelson et al. [5] describe a paper interface for presentations using index cards, which was empirically evaluated in [3]. Cheng and Pulo [2] use an infrared laser pointer to control presentation by use of hotspots and gestures.

Some researchers also explored the tools and guidelines for creating electronic presentation slides. Zongker & Salesin [7] discussed principles for creating animated presentations and proposed a script-based tool to actually create them. Johnson and Nardi [4] conducted a study to investigate the use of generic versus task-specific application software by people who create and maintain presentation slides.

Despite of the related research, as far as we know, few have systematically studied the user response and design demands of different interaction techniques for electronic presentations through controlled experiments. We believe our work adds a brick to fill in this area.

TECHNIQUES DESIGN
Inspired by the application demands and previous work, we explored two alternative techniques for controlling presentations:

Bare Hand
The basic idea of *Bare Hand* technique is to control the presentation slides by touching on "hot areas" or dragging "active objects" on the screen using hand directly. (Figure 1) This technique could be implemented by using a touch-sensitive large display such as the SmartBoard system (www.smarttech.com), or by computer vision techniques.

Our design of *Bare Hand* technique supports the following functionalities:

Next/Prev Slide: Two pairs of arrows are placed on the screen's bottom corners (Figure 1). By touching on the arrows, the presenter goes to the next/previous slide.

Progress through Bullets/Sections: By touching on the place where a bullet is going to appear, the presenter displays that bullet.

Trigger pre-programmed action: The presenter can tap hot areas on the screen to trigger pre-programmed animation effects, or tap on a movie to play/stop it.

Interactive graph: Interactive graphs can be used to assist illustrating complex ideas. In an interactive graph, the presenter can use hand to click or drag control widgets to change parameters of the graph, and the other parts of the graph change accordingly. In this way, the presenter can interactively illustrate the relationship between different factors. Figure 1 gives an example: the presenter could drag the control point to illustrate different light routes.

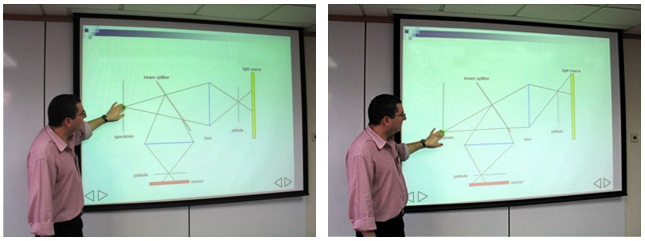

Figure 1. Using *Bare Hand* to control presentation

Laser Pointer

Several researchers [2, 7] have explored using laser pointers for interaction with large displays. The laser point can be easily tracked using simple computer vision techniques. For sake of simplicity and familiarity for the user, our design is based on laser pointers augmented with an additional button used to trigger actions, which provides the same input dimension as *BareHand* or mouse. For the purpose of comparability in the user study, we supported exactly the same features for *Laser Pointer* as for *Bare Hand*. For example, in Figure 2, the presenter controls an interactive graph using a laser pointer by dragging a control point on the horizontal axis.

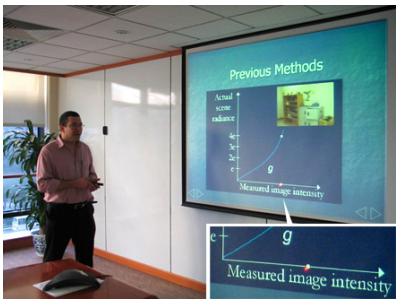

Figure 2. Using *Laser Pointer* to control presentation

USER STUDY

Goals

We sought to quantitatively evaluate the acceptance of the three control techniques: *Bare Hand*, *Laser Pointer*, and *Standard* (Mouse/Keyboard) from the audiences. At the same time, qualitative ratings and feedbacks were collected from both presenters and audiences.

Apparatus

We employed Wizard-of-Oz method in our user study. For the *Bare Hand* and *Laser Pointer* techniques, an experimenter acted as the "wizard", who watched the presenter's actions and controlled the presentation. For *Standard* technique (mouse/keyboard control), the presenter used a laptop placed on a table in front of the projection screen. The wizard was hidden from the audience, but visible to the presenters. Therefore the Wizard of Oz technique was only for the audience, who was the main interest of our quantitative evaluation. The presentations were video-recorded for further analysis.

Participants

6 presenters, 5 men and 1 woman, were invited from the research staff in our institute. They all had at least medium experience in giving presentations using standard PowerPoint™. 30 audiences, 23 men and 7 women, were recruited from the interns in our institute.

Procedure & Design

We asked each presenter to prepare a 5-min presentation (around 10 slides) with PowerPoint™ for a quick introduction on his/her recent research. Together with the presenters, we tailored the presentation slides for similar length and style, and added some interactive features.

We employed a within-subject (in terms of audience) design for collecting quantitative ratings on presentations from the audiences (illustrated in Table 1). Each audience rated all the 6 presenters' presentations, which were presented using the 3 control techniques respectively, with 2 presentations per technique. Each presentation was rated by the audiences according to 4 criteria, each on a 7-point Likert scale, with 1 being the worst, and 7 the best:

Overall: General feeling of the presentation performance

Clearness: The extent to which the presentation contents were clearly conveyed and understood.

Efficiency: The extent to which the presentation was smoothly streamed without interruption or time spent on irrelevant issues.

Attractiveness: The extent to which the audience felt attracted by the presentation.

	Group 1		Group 2		Group 3	
Order	Tech	Presenter	Tech	Presenter	Tech	Presenter
1	L	1	H	3	S	5
2	H	2	S	1	L	4
3	S	3	L	2	H	6
4	S	4	L	5	H	1
5	H	5	S	6	L	3
6	L	6	H	4	S	2

Table 1. Arrangements of presenters and techniques for each audience group (Letters stand for techniques: Standard(S), Laser Pointer(L), Bare Hand(H))

In order to counterbalance the effect of different presenters and presentation contents, the 30 audience were divided into 3 groups. For each presenter, he/she presented the same presentation to the 3 audience groups using 3 different control techniques, *Bare Hand*, *Laser Pointer* and *Standard*

(Mouse/Keyboard), respectively. To counterbalance the possible order effect of the different techniques, within each group, the 3 techniques were ordered as ABCCBA across the 6 presentations. In addition, the first halves of the orders from the 3 groups formed an order-3 Latin square. Taking all into account, the final arrangement was as Table 1.

In additional to the numerical ratings, after the study both the presenters and the audiences were asked to fill a questionnaire, which included: ranking the techniques by preference; likes/dislikes about each technique; and additional comments /suggestions.

Results

Quantitative Rating

The average rating scores of the presentations from the audience are illustrated in Table 2 and Figure 3. For all the 4 criteria, *Bare Hand* received the highest scores, followed by *Laser Pointer*, and S*tandard* technique lowest. This difference was statistically significant for *Overall* ($F_{2,58}$ = 3.655, p = .032) and *Attractiveness* ($F_{2,58}$ = 7.983, p = .001), but not statistically significant for *Clearness* ($F_{2,58}$ = .976, p = .383) and *Efficiency* ($F_{2,58}$ = 1.563, p = .218). Pair wise comparisons showed that the score of *Laser Pointer* was not significantly different from that of *Standard* for any of the 4 criteria (p>0.5), while *Bare Hand* had significantly higher scores than *Standard* in terms of *Overall* (p=0.010) and *Attractiveness* (p<0.001), as well as significantly higher scores than *Laser Pointer* in terms of Attractiveness (p=0.003) Given that the real range of the rating scores from the questionnaires was relatively small (mostly between 4~7), these differences are considerable. This result illustrated that *Bare Hand* had an advantage over the other two techniques in terms of audience acceptance, especially on overall performance and attractiveness.

Technique / Criterion	Standard	Laser Pointer	Bare Hand
Overall	5.117 (SD=.155)	5.133 (SD=.187)	5.533 (SD=.115)
Clearness	5.150 (SD=.186)	5.183 (SD=.201)	5.450 (SD=.138)
Efficiency	5.217 (SD=.177)	5.317 (SD=.206)	5.550 (SD=.136)
Attractiveness	4.867 (SD=.205)	5.000 (SD=.206)	5.617 (SD=.133)

Table 2. Quantitative rating by techniques and criteria

Qualitative Evaluation

As to the 30 audience members, 21 (70%) liked *Bare Hand* best, 8 (27%) liked *Laser Pointer* best, and 1 (3%) liked *Standard* best. On the other hand, 24 participants (80%) liked *Standard* least, 4 (13%) liked *Laser Pointer* least, and 2 (7%) liked *Bare Hand* least.

Similarly, for the 6 presenters, 5 (83%) liked *Bare Hand* best, 1 (17%) liked *Laser Pointer* best. 4 presenters (66%) liked *Standard* least, 1 (17%) liked *Laser Pointer* least, and 1 (17%) liked *Bare Hand* least.

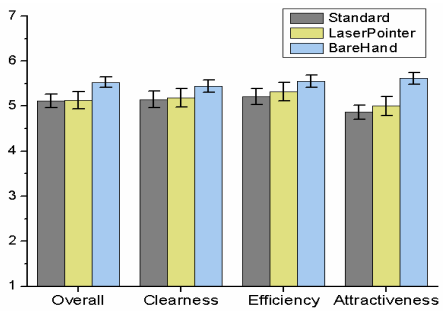

Figure 3. Quantitative rating by techniques and criteria

Again we showed that *Bare Hand* was the most appealing technique among the 3, followed by *Laser Pointer*.

Comments & Observations

Below summarizes the subjective comments/suggestions from both presenters and audiences about each technique, as well as observations from video review.

Bare Hand:

Advantages:

• 5 of the 6 presenters had the habit or preference of standing besides the screen and using hand to emphasize things on the screen. Thus the *Bare Hand* technique was natural and easy to use for them.

• The presenters could make more use of eye contact and body language than was possible with the other two techniques.

• The audiences felt that *Bare Hand* enabled very attractive presentations. Not only was the technique itself appealing to them, but the presenters tended to be more active, and used a more personalized, humanized, story-telling style.

• Pointing with hand was found easiest to follow by the audience compared with laser point and mouse cursor.

Concerns:

• When the presenters touched the screen for operations, they might block the slide content from the audience.

• Presenters might feel constrained to the space near the projection screen when they did wish to walk around.

• As there was no firm feedback for the hand, like the force feedback provided by the button in *Laser Pointer* and *Standard*, presenters may be concerned whether their actions have been received, or they would mis-trigger an action when pointing to the screen spontaneously.

• Since "Next Slide" was the most commonly used command, presenters preferred having a quick way to achieve that rather than looking for the arrow to touch.

• Finally, as constrained by the length of human arms, *Bare Hand* can be used in most common scenarios (meeting rooms, classes), but is not directly applicable for huge or high projection screens without certain special design.

Laser Pointer:

Advantages:

• The presenter could move freely as wished, such as far from both the projection screen and the computer.

• The presenter could make all the operations by small finger and wrist motion, thus accelerate the interaction.

• The presenter had more space for using body language and eye contact to convey ideas, while this advantage was compromised by the fact that the presenters tended to face the projection screen when using a laser pointer.

Concerns:

• The presenter's hand tremor was amplified by the laser beam, making it very hard to point precisely and stably, especially when dragging objects.

• The audiences reported that the laser point was hard to follow because it was too small, moving too fast, and its trajectory was unpredictable.

Standard (Mouse/Keyboard):

Advantages:

• Although very few participants liked the *Standard* technique, it is reliable, familiar, and fit most scenarios.

Concerns:

• The presenter was constrained to the computer. The presenter either had to stay with the computer, making it near impossible to use body language and eye contact, or had to walk back and forth between the computer and the projection screen, resulting in many interruptions.

• Without using hand or laser point to emphasize contents, the presentations were found less easy to understand. The mouse cursor was hard to follow for audience as well as for presenters themselves.

Current user study showed promises for the alternative presentation control techniques, especially *Bare Hand*. But each of the techniques has its own strong and weak points, suitable scenarios, and needs further iterative design.

DESIGN DIRECTIONS

Inspired by the participants' feedback, we discuss some possible design directions for the control techniques.

Quick "Next Slide" operation. As for both *Bare Hand* and *Laser Pointer* techniques, a quick "Next Slide" operation is needed, such as a special button click or a special gesture.

Error prevention and recovery. To prevent mis-triggering actions when the presenters point hands spontaneously to the screen, we could apply highlighting or other visual hints to the hot areas when the hand is hovering over them. On the other hand, a globally available "undo" operation, could be achieved by use of special gestures to make up for any unwillingly triggered actions.

Combine *Laser Pointer* with *Bare Hand*. To exploit the advantages of both techniques and adapt to various scenarios, *Laser Pointer* could be combined with *Bare Hand*. The presenter could use a laser pointer as an auxiliary control device when he/she needed to walk away from the projection screen, or when the intended control component on the screen are out of the reach of bare hand.

Interactive presentation authoring tool. It is essential to have a tool to easily author presentations that incorporate the interactive features supported by the techniques. Possible authoring UI provides commonly-used interactive controls. Warnings and layout suggestions help user to optimize his/her slide design, considering factors like reachability of controls, minimizing occlusion of contents by the presenter, minimizing the presenter's need to walk back and forth, etc. Presentation templates and interactive graph construction tools could also reduce users' efforts to build an interactive presentation.

CONCLUSION

Our work has evaluated two alternative presentation control techniques: *Bare Hand* and *Laser Pointer*, which enable more interactive and fluid electronic presentations. We conducted a fully-controlled Wizard-of-Oz user experiment to compare the audience's acceptance of different control techniques. We also collected valuable comments and observations from both the audience and presenters, which led to design directions for the techniques.

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