Design of Shadows on the OHP Metaphor-based Presentation Interface which Visualizes a Presenter's Actions

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Abstract. We describe the design of shadows of an overhead projector (OHP) metaphor-based presentation interface that visualizes a presenter's action. Our interface work with graphics tablet devices. It superimposes a pen-shaped shadow based on position, altitude and azimuth of a pen. A presenter can easily point the slide with the shadow. Moreover, an audience can observe the presenter's actions by the shadow. We performed two presentations using a prototype system and gather feedback from them. We decided on the design of the shadows on the basis of the feedback.

Keywords: presentation, graphics tablet devices, digital ink, shadow

1 Introduction

Some presentation systems provide an ink annotation feature. A presenter can draw supplemental information or fix presentation slides on the spot using it. The presenter usually uses it with graphics tablet devices (GTDs), such as tablet PCs and pen displays.

However, earlier studies do not provide the following two features that we believe the presentation systems with GTDs should provide.

The presenter can easily point the screen. The presenter often points the presentation slides with his/her pointer or laser pointer. In presentation using GTDs, doing this is difficult because the presenter already have a pen device. This problem makes the presenter draw some attentional marks that includes deictic references to the slide elements [1]. Deictic references should be provided with pointing rather than attentional marks because digital inks are persistent while the deictic references are impermanent. Hence presentations using GTDs should be designed for that the presenter can easily point the screen.

The audience can easily observe the presenter's action. The presenter's actions are an important way to convey his/her intention. Moreover, some of the presenter's actions help the audience to easily follow the presentation. For example, the audience can notice when the slide changes and when and where the annotations are drawn by watching the presenter try doing them. However, in the presentation using GTDs, the audience cannot observe these actions because the presenter operates on the input area of GTDs while the audience watches a large shared screen. Hence, presentations using GTDs should be designed to allow the audience can observe the presenter's actions.

Our goal is to achieve the aforementioned two features in presentations using GTDs. These two features help and improve communication. Thus, the presentation using GTDs should provide the two features.

Our contribution is to present the design of shadows that is suitable for pointing in the presentation using GTDs. Note that its design is based on feedback from actual presentations. The result of our study contributes to all the presentation systems using GTDs.

This paper consists of the following parts. First, there is a description of our approach. Next, we present a description of experiments with our prototype system that gathers feedback that is the basis for a description of the requirements of the design of shadows. There follows a description of the improvement that is based on the requirement. Finally, it describes related work and conclusion.

2 Approach

We took our cue for achieving the two features from overhead projectors (OHPs). In a presentation using the OHP, the presenter can easily point to the transparency by casting pen's shadow as well as drawing ink annotations. Moreover, the audience can observe these presenter's actions on the screen since these actions are also projected by the OHP.

On the basis of these observations, we designed an OHP metaphor based presentation interface and implemented it as Shadowgraph+. Shadowgraph+ visualizes the pen's current position and orientation as the pen-shaped shadow (Fig. 1). The presenter can point to the screen with the pen-shaped shadow and simultaneously draw annotations. Therefore, the audience can easily observe the presenter's action.

We developed Shadowgraph+ based on feedback gathered from the experiments on actual presentations. First, we developed experimental implementations and used them in presentations. We gathered feedback from the audience of the presentations and developed Shadowgraph+ based on them.

Fig. 1. Presentation using Shadowgraph+

3 Presentations using the experimental implementations

We examined the experimental implementations in two presentations; one was at an academic conference and the other was as a university lecture. The implementations were add-ins of presentation software. We implemented two add-ins: one was for Microsoft PowerPoint and the other was for Kotodama [2] that is pen-based presentation tool. The add-ins superimposes a transformed ellipse as the pen-shaped shadow over the presentation slide. The procedure of the transformation is illustrated in **Fig. 2**. The add-ins transformed an ellipse using the pen's position, altitude φ and azimuth θ, all of which are the output of the GTD. The azimuth and the altitude of the pen's orientation are illustrated in **Fig. 3**. We used φ and θ for simulation of a real shadow. The shadow's color is (R, G, B, A) = (0, 0, 0, 0.5). We used a GTD based on electro-magnetic sensing. The tablet can detect that the pen is held over the tablet even while it is not touching the tablet. This feature was needed to simulate casting the pen-shaped shadow.

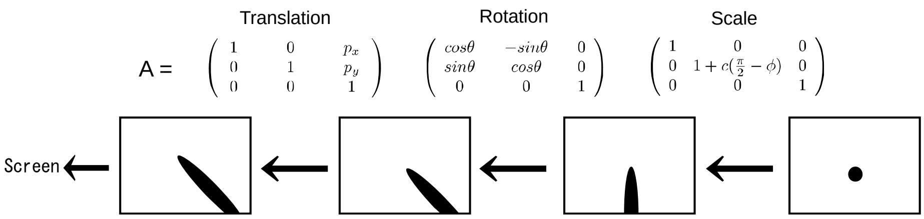

Fig. 2. Drawing procedure of the pen-shaped shadow

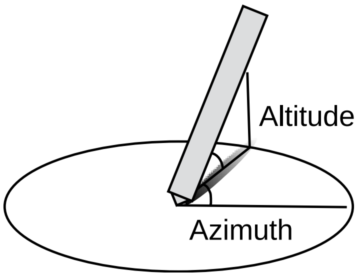

Fig. 3. Azimuth and altitude

3.1 Feedback from the Conference

We used our experimental implementation (PowerPoint add-in implementation) to make a presentation in a conference related on interactive systems and software. There were approximately 150 people in the audience. In the conference, almost all participants used a common chat system to hold discussions and to give the presenter feedback. We analyzed the logs of the chat system.

The number of comments was 148 in total. There were 91 comments mentioning our system or the presentation using it. The following were comments mentioned by various members of the audience.

(A) Movement of the shadow is strange or distracts attention (10 comments).
(B) Suggestion of compensation of wobbling (4 comments).
(C) Suggestion of a feature that fixes the azimuth and the altitude (3 comments).
(D) Shadow is pesky (2 comments).
(E) Feel sick (2 comments).

The most interesting comments were related to the movement of the shadow. Comments (A) directly pointed out that the movement of the shadow is bad. Comments (B and C) implied it because they are suggestions of stabilizing the movement of the pen-shaped shadow.

The second point of interest in the comments implied that the shadow clamed too much attention. Comments (D) pointed this out directly. Comment (E) implied that the shadow claimed too much, and so the audience felt nauseous.

3.2 Feedback from University Lecture

One of the authors used the implementation for Kotodama in a lecture on teaching methodology of information sciences in the university. There were fourteen students. We introduced our system before the lecture and instructed the students to attend in usual.

After the lecture, we obtained feedback by questionnaire. The number of students who had positive comments and negative comments are shown in **Table 1**.

Table 1. Numbers of students who made positive comments or negative comments

		Number of Students who made	
		Positive comments	No positive comments
Number of Student who made	Negative comments	7	2
	No negative comments	4	1

The following were comments gathered from the questionnaire.
(G) It is clear to see where the presenter is pointing (6 students).
(H) It was clear to understand the point the presenter was talking about (3 students).
(I) The shadow claims attention (5 students).
(J) Appearance and disappearance of shadows claim attention (1 student).
(K) Flickering shadows distract attention (2 students).
(L) Eye is irritated (1 student)
(M) Wiggled shadow distracts attention (1 student).

Eleven students in total made positive comments while nine students made a negative comment. Seven commented both of positively and negatively. One student made only a neutral comment. The comment only suggests another shape of the shadow, which was to use a detailed silhouette as a pen-shaped shadow.

The positive comments (G) indicate that the audience can well observe where the presenter is pointing. Comments (G and H) indicate that the shadow helps that the audience to better comprehend the course of the story. Because this comprehension is important for the presentation, this yields positive effects on the presentation. The negative comments (I and J) indicate that the shadow claimed too much attention. We found reasons from comments (J, K and M). These comments are related to the design of the shadow. We could ease these negative effects by improving the design of the shadow.

3.3 Design Guidelines based on Feedback

From the feedback of the experiments, we found that the shadows support the presentation but too attract the audience’s attention too strongly. More specifically, the unnatural orientation changes made the audience sick and distracted their attention. This result suggests that the shadow needs a subdued. Moreover, the negative comments gave us the following design guidelines:

Guideline 1 To reduce the visual strain, transparency should be higher unless the color is difficult to see.

Guideline 2 To reduce unnatural orientation changes of the shadow, they should be stabilized.

4 Implementation of Shadowgraph+

Following the design guidelines, we implemented Shadowgraph+. The previous design and the improved design of the shadow are shown in **Fig. 4**.

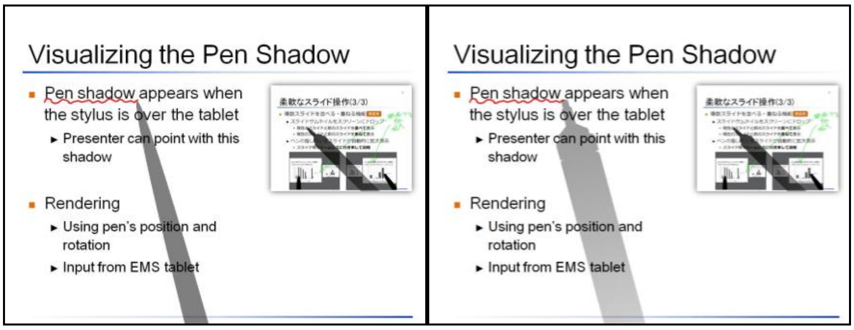

Fig. 4. Previous design (left) and improved design (right)

We changed the appearance of the shadow from a transformed ellipse into a gradational silhouette (**Fig.5**). The color of the nib color is (R, G, B, A) = (0, 0, 0, 0.4) and the tail color is (R, G, B, A) = (0, 0, 0, 0). Following Guideline1, the gradation makes the place where the presenter is pointing obvious, but the shadows comparatively little attention.

Fig. 5. Gradational silhouette of pen-shaped shadow

Following Guideline 2, our Shadowgraph+ ignores the altitude and strongly filters the azimuth using a following low-pass filter:

$$filtered\_x_n = \frac{(\alpha - 1)x_{n-1} + x_n}{\alpha}$$

where x_n is the n-th azimuth value, and α is a parameter that represents the strength of the filter. We empirically determined the parameter as α = 50.

5 Presentation using Shadowgraph+

After refining the design of the shadows, one of the authors made a presentation. The audience of approximately 100 people included software developers, project managers, and researchers. We collected comments from the audience informally, and there are no negative comments about visual strain. This indicates our new redesign reduces the visual strain for the audience.

6 Discussion

From the aforementioned experiments, we got design guidelines and improved the design of shadows. While we have mainly discussed designing shadows and the result is not enough to validate our approach. But some feedback reinforce that our approach worked as we intended. From the feedback (G), we conclude that the audience could observe where the presenter is pointing. This implies that the audience can observe the presenter's action.

7 Related Work

There are related works that support pointing by superimposed human bodies and tools, or that support computer-human interaction by superimposed shadows of human bodies and tools.

7.1 Support Pointing by Superimposed Human Bodies and Tools

The following research supports pointing by superimposing human bodies and tools on the computer workspace. Videodraw [3] and Clearboard [4] are distributed shared drawing system and superimpose the cooperator's body and his/her tools on the shared canvas. They support pointing and communication using it by the superimposing. C-Slate [5] supports the same feature on digital applications.

Videowhiteboard [6] and LIDS [7] superimpose shadows of the cooperators' body. While superimposing shadows have less textural information, it can convey the pointing and current situation of the cooperator in a calm.

Distributed Tabletops [8] and Video Arms [9] superimpose human arms extracted by detecting skin color. These systems also support pointing between cooperators in distant places. The detection can be implemented as software, and so the composition of systems can be smaller.

Meanwhile, our research supports the pointing in particular for presentations. Furthermore, it works with current presentation environments.

7.2 Support Computer-Human Interaction by Superimposed Shadows of Human Bodies and Tools

Wesugi et al. present an interaction between the tool's shadow and object in virtual space [10]. They describe that human perceive the tool's shadow that the human have as a part of the human's body, and they also describe the rationale for interaction by the tool's shadow.

Shomaker et al. present Shadow Reaching [11], interaction using the shadow of the human body. The shadow becomes bigger when the human is close to the shadow's light source. By making use of the natural nature of the shadow, Shadow Reaching achieves faster pointing of a distant object on a large screen.

Meanwhile, our research is mainly designed as pointing for the benefit of the audience rather than for interaction with computers.

8 Conclusion

We presented the design process of the shadow and implementation of the OHP-metaphor-based presentation interface with the improved shadow. We found that the translucency of the pen-shaped shadow should be higher and the unnatural orientation changes should be stabilized.

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