

# A Comparative Study of Mouse-Based Interactions on Websites

웹사이트에서의 마우스 기반 인터랙션 비교 연구

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## 1. Introduction

The mouse has the most widespread usage among the variety of 2D positioning devices such as trackball, joystick, touch screen, light pen, digitizing tablet, touch pad, and eye gaze, although the mouse was reported to increase muscle activity in the shoulder, abduction of the arms, and ulnar deviation of the wrist (Harvey et al., 1997). Woods et al. (2003) compared trackball, joystick and mouse devices with the mouse assessed as most favorable considering overall satisfaction. Mouse-based interaction is the most common interaction style for contemporary computer systems including Microsoft Windows, Mac OS, and X Windows-based systems.

Mouse-based interactions have been studied extensively. However, mouse-based interaction on web sites has been little researched. The purpose of this study was to compare mouse-based interactions by activating button interfaces as a first step to finding an optimal design configuration.

## 2. Method

A simulated website consisting of a main page and sixteen additional pages was built for use with four different mouse-based interactions and web page designs were developed for the experiment.

### 2-1. Interfaces

Four interface applications were built for the experiment: a pop-up window of an e-business website, the registration web page of a portal website, an e-business website selling watches, and a simple web page with "agree" and "disagree" buttons (Figure 1).

Each web page was designed with four different versions based on four different interaction methods. The interfaces consisted of a:

- point-and-click (PC) button: regular button
- slide-over (SO) button: option is selected when a pointer moves over the button without clicking
- visible-following (VF) button: option is selected by clicking without positioning since the button always follows under the cursor. Left (right) button follows when pointer is located on the left (right) half pane.
- invisible-following (IF) button: Unseen left (right) button is selected by clicking on the left (right) half pane.

Required actions to activate buttons are summarized in Table 1. The following buttons require positioning only when cursor and button were placed on a different pane.

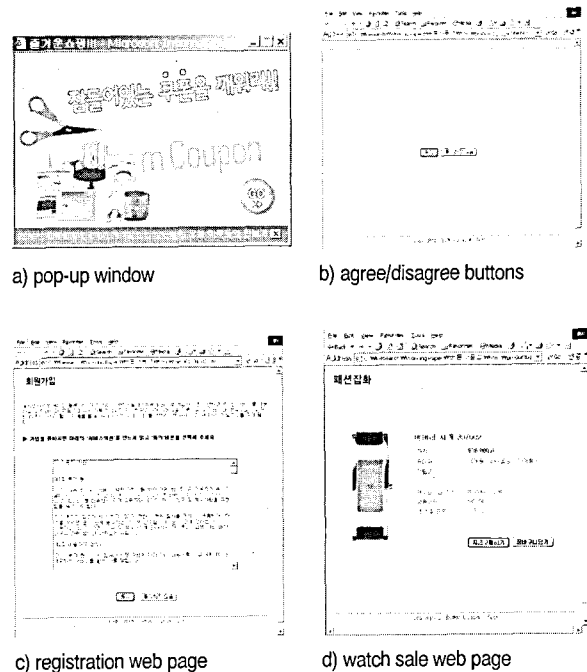


Figure 1. Interfaces of the experimental web pages

Table 1. Activation model of the experimental interfaces

Button Type	Activating Methods
Point-and-click	positioning + click
Slide-over	positioning
Visible-following	(positioning) + click
Invisible-following	(positioning) + click

### 2-2. Subjects

Eleven students (3 males and 8 females) from the graduate school of digital design at Kyung Sung University participated voluntarily in the experiment. The subjects ranged in age from 25 to 35 (mean=28.8, SD=3.09). All students reported having prior experience in the use of point-and-click buttons. Six students indicated they had no experience using slide-over and invisible-following buttons

### 2.3. Experimental Design

All combinations of interfaces and web page contents were given

to each participant in random order. Interfaces and contents refer to four different button designs and situations respectively. Performance measurements were time and error in the experiment. Other measurements were related to users' preferences and evaluated using a questionnaire after the experiment.

### 3. Results

#### 3.1 Selection Time

For the decisions, "disagreement" or "no" responses needed more time in most cases.

Interaction was detected between interface content and content answer in addition to the main effects of interface, content, and decision. Slide-over and visible-following interface were more efficient than point-and-click and invisible-following interfaces on watch-sale web page ( $P < .001$ ). The pop-up window slide-over interface was most efficient for the performance time.

#### 3.2 Error

A significant difference in number of errors was observed due to the interfaces ( $F_{3,1376}=4.549$ ,  $P < .005$ ) indicating that invisible-following button invoked more errors than did slide-over interaction ( $P < .05$ ) and slide-over button was less efficient than point-and-click interaction ( $F_{3,1376}=3.134$ ,  $P < .005$ ) for user's error.

#### 3.3 Users' Preference

Significant effects were found for simplicity ( $F_{3,40}=19.500$ ,  $P < .001$ ), easy to use ( $F_{3,40}=8.246$ ,  $P < .001$ ), familiarity ( $F_{3,40}=29.937$ ,  $P < .001$ ), predictability ( $F_{3,40}=12.382$ ,  $P < .001$ ), and overall satisfaction ( $F_{3,40}=48.417$ ,  $P < .001$ ). The point-and-click interface was simpler than was the slide-over ( $P < .001$ ) and invisible-following interfaces ( $P < .003$ ). The invisible-following button was evaluated to be most complicated while the point-and-click interface was considered simplest to use.

### 4. Conclusion

Often users are required to select an option using pointing tools on a software application and websites. In a WIMP (windows, icons, menus or mice, pointers) environment, users often must use a mouse to position a pointer on a button, image, hyperlink, or icon and then click them to activate an expected function or to navigate to linked web pages. The mouse is the most common among non-keyboard input device.

Several interfaces were manipulated during different interaction processes, with performance time, error, and other usability factors compared. For performance time slide-over interaction was most efficient since slide-over interaction does not require clicking on a mouse button, a result that corresponds to the results of Bohan et al. (1998).

The point-and-click interface performed more poorly than visible

and invisible-following interface for selection time, which is consistent with the results of Farris et al. (2001). They showed that the time to select a target can be reduced by positioning targets on the edge of the screen and introduced the term "edge target".

On the e-business web page, point-and-click interaction performed more poorly for performance time with slide-over and visual-following interfaces performing best. The use of a visual-following interface on e-business web sites is a good tactic because of the high error rate of slide-over. Invisible interaction should not be employed on e-business web sites because of poor selection time and higher error rate.

However, slide-over buttons can be a reasonable alternative for the pop-up window because error is not important and selection time can be saved by using slide-over interface on the pop-up window. Users actually made fewer errors on the pop-up window.

Invisible interaction is not efficient for either time or error. In addition, users' didn't like the invisible action. Users rely on vision to perceive the environment and visual receptors dominate our sensory receptors (Ware, 2003). Visual stimuli are also significant for efficient interaction on web sites.

Point-and-click and visible-following interfaces were reported to be simpler, easier to use, and more predictable in their response. Most common interface, point-and-click was believed most familiar and preferred.

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