

## Correlation between the gaze-point movement and usability for the purpose of Web page selection containing usability problems

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## Background

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Designing attractive Web sites is an essential issue in business, since Web sites directly reflect the images and sales of companies.<sup>[1]</sup>



### Examples of Usability Problems<sup>[2]</sup>

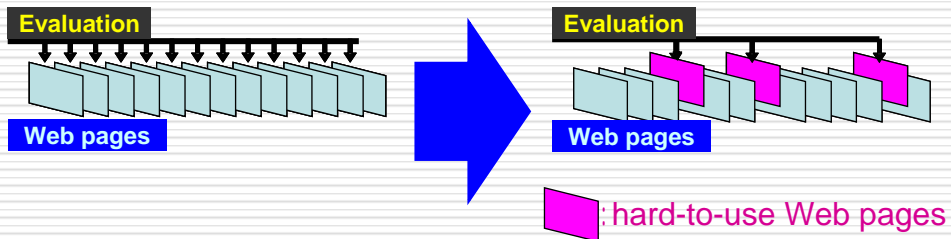
- Long Scrolling Pages
- Dead links
- Inconsistency

[1] Kelly Goto, Emily Cotler: "Web ReDesign," Peason Education, 2002.

[2] Jakob Nielsen, "Designing Web Usability", New Riders Pub, 1999

## Research goal and approach

- A quantitative usability evaluation method



- Using operation data
  - Gaze-point
  - Browsing time
  - Mouse movement

## The Experiment

- Is the usability of Web pages correlated with operation data?

### Impressions of usability

- ✓ hard to use
- ✓ relatively hard to use
- ✓ relatively easy to use
- ✓ easy to use
- ✓ don't know

### Web usability problems

- ✓ layout is bad
- ✓ character size is small
- ✓ too many characters
- ✓ ...

### User's operation data

- ✓ distance of gaze-point movement (Pixels)
- ✓ speed of gaze-point movement (Pixels/sec)
- ✓ browsing time (sec)
- ✓ distance of mouse movement (Pixels)
- ✓ speed of mouse movement (Pixels/sec)

## Outline of the experiment

### Subjects

- 15 users familiar with Internet
- They have never visited the site used for the experiment



### Tasks

find two information from a school's web site

- Task 1: the required classes
- Task 2: the phone and fax numbers of the secretary

## Experimental setting

### Eye tracking equipment



Operation data

- Gaze-point
- Browsing time
- Mouse movement

### Playback Interface

## Procedure

### Procedure 1

While subjects are doing the tasks, operation data is recorded.

### Procedure 2

Subjects evaluate the Web pages.

- The visited Web pages are displayed.
- The subjects are asked to write on a questionnaire.

## Questionnaire (excerpt)

### 1, Impression of Usability

What do you think of usability of this web page?

Please choose the best one which would express your impression.

- |                           |   |                      |
|---------------------------|---|----------------------|
| 1. hard to use            | } | low usability pages  |
| 2. relatively hard to use |   |                      |
| 3. relatively easy to use | } | high usability pages |
| 4. easy to use            |   |                      |
| 5. don't know             |   |                      |

2, Please check following sentences which describe the reason why this page is hard to use.

#### Page Title

( ) Naming of the page title is bad.

## Analysis

1. Analysis on the relation between quantitative operation data and usability
  - difference between the two classes of cases

high usability

low usability

## t-test of user's operation data

Operation data	Average values of High usability	Average values of low usability	t-test
Distance of gaze-point movement (pixels)	5243	5337	0.4573
Speed of gaze-point movement (pixels/second)	421	359	0.0004
Browsing time (seconds)	13.1	15.6	0.1491
Distance of mouse movement (pixels)	1946	2107	0.2972
Speed of mouse movement (pixels/second)	186	166	0.1704

✓ the usability is apparent from the speed of the gaze-point

# Analysis

## 1. Analysis on the relation between quantitative operation data and usability

- difference between the two classes of cases

high usability

low usability

- Correlation between operational data and usability

# Correlation between operational data and usability

Operation data	Kendall's rank correlation coefficients
Distance of gaze-point movement	-0.025 (negative)
Speed of gaze-point movement	0.205 (positive)
Browsing time	-0.120 (negative)
Distance of mouse movement	-0.015 (negative)
Speed of mouse movement	0.098 (positive)

- ✓ faster movement of the gaze-point means higher usability
- ✓ slower movement of the gaze-point means lower usability

## Discussion 1

- Distance of gaze-point movement,  
Distance of mouse movement, Browsing time  
:no correlation  
Although these values are larger on average for the cases with low usability, the differences are not statistically significant.
- Speed of mouse movement  
:no correlation  
Some subjects put the mouse pointer to their gaze-point, while other subjects put the mouse pointer outside of the Web page window.
- Speed of gaze-point movement  
:correlative  
When searching Web pages for some information, each subject keeps the gaze-point moving.

## Analysis

1. Analysis on the relation between quantitative operation data and usability
  - difference between the two classes of cases
    - high usability
    - low usability
  - Correlation between operational data and usability
2. Correlation between the speed of gaze-point movement and each Web usability problem

## t-test of the move speed of the gazing point

The Web usability problems [2]	Speed of gaze-point movement		the means of two groups with variances (Significant probability P)
	the cases <b>with a problem</b> in Web usability	the cases <b>without a problem</b> in Web usability	
The layout of the current page is different from that of the previous page.	509	370	<b>0.0003</b>
The layout is bad.	354	402	<b>0.0136</b>
The width of web page height is large.	420	386	0.1584
The anchor text does not describe the content of the linked page.	347	403	<b>0.0033</b>
The linked text is hard to read.	352	398	<b>0.0450</b>
There are a lot of characters.	415	385	0.1129
The character is small.	419	387	0.2333
The character is hard to see.	366	398	0.0978

## Discussion 2

- ❑ “The layout of the current page is different from that of the previous page.”  
 Subjects look over the web page when the layout is different from previous page.  
 —→ **the gaze-point moves fast.**
- ❑ “The layout is bad.”  
 Subjects are confused and look at the web page carefully.  
 —→ **the gaze-point moves slowly.**
- ❑ “The anchor text does not describe the content of the linked page.” “The linked text is hard to read.”  
 Subjects look at the anchor text carefully.  
 —→ **the gaze-point moves slowly.**

## Future Work

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- More elaborate experiments
  - This will clarify the relation between the various types of quantitative data and the various issues regarding Web usability problems.
  
- Analysis of web pages
  - At this time, the experiment focused on web sites. So, we need to analyze each web page to find out further usability problems.

## Conclusion

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- Web pages with a high speed of gaze-point movement tend to have high usability.
- The average speed of the gaze-point significantly changes if the Web page has one of the four problems.