HCI Performance Evaluation of Horizontal and Vertical List Controls

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Abstract

Microsoft Windows 95 uses both vertical arrangements of items in lists as well as horizontal groupings of smaller vertical lists. This paper reports the results of an experiment to evaluate selection times using horizontal and vertical lists. Two GOMS models were developed to predict differences. There was no significant difference in times, but results showed interesting trends in learning behaviour.

1. Introduction and Motivation

Microsoft Windows' file management applications use horizontal arrangement of short vertical lists to display files under certain conditions, rather than the more common vertical arrangement. On their web page, Isys Information Architects Inc. [3], noted the significance of this, and claimed that "Humans can scan written material faster from top to bottom rather than left to right". An experiment was conducted to test this theory. The experiment consisted of finding a specific word in a list of 200 elements with a scrollable view of only 30 elements. The elements were arranged as a vertical list, and also as a horizontal arrangement of three ten-item vertical sublists.

2. Task Evaluation Using GOMS

Two GOMS models of the experiment were developed, one for vertical list selection and one for horizontal list selection. A GOMS model is a description of a particular task in terms of Goals. A task is achieved by Methods, which are composed of ordered Operators. Selection rules describe which methods to use to achieve each goal [2].

An informal protocol analysis was carried out to determine how people find items in such lists. Despite the apparent simplicity of the tasks, the GOMS models were quite complicated. Several assumptions needed to be made, mostly concerning the horizontal lists. Assumptions were also made about some of the action times. These times were taken, or approximated from values found in [1]. The GOMS model developed for vertical lists is shown in figure 1. A key difference between the models lay in searching of the final view. The horizontal view had three vertical lists to search, whereas the vertical view only had one.

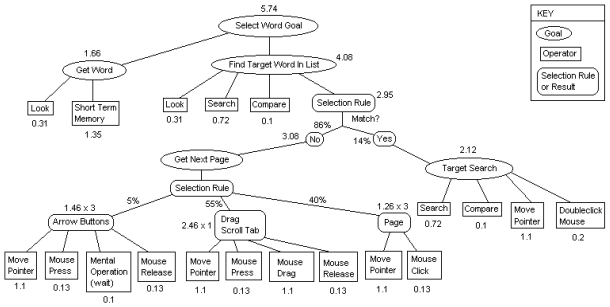

Figure 1. GOMS model of vertical list selection

The values given by these GOMS models (5.74 seconds for vertical lists and 5.85 seconds for horiztonal lists) indicated that vertical list target selection would be marginally faster than selection from horizontal lists, although the difference would not be substantial.

3. Experiment Design

The time taken to select a word from a list of 200 words in a control was measured for 20 university student volunteers. The subjects were divided into two equal size groups designated Group A and Group B. Each group performed 20 list item selections.

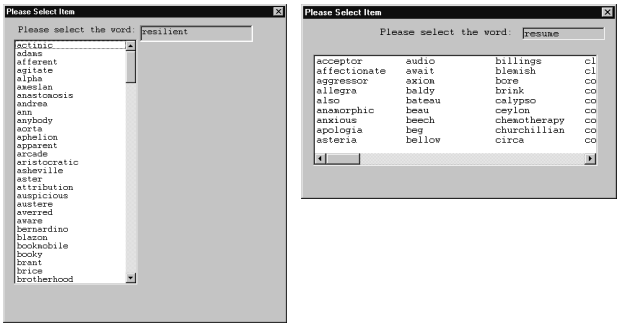

Figure 2. Horizontal and vertical list controls

Group A subjects were given 10 vertical list controls, then 10 horizontal list controls. Group B subjects were given the horizontal list controls first. By testing each subject with both control orientations, the experiment fell into the category of a "within groups" design. A "between groups" design was not considered since wide variance in

mouse dexterity from subject to subject was expected, and needed to be eliminated.

The experiment consisted of training, practice, and testing phases. The training phase applied uniform training to all subjects, by showing a short screen of instructions for 20 seconds. The practice phase allowed the subject to perform a trial test with one vertical, and one horizontal list control. The practice phase was kept short so that learning effects could be recorded and analysed.

After the practice phase, the main testing phase began. As previously described, the subject performed 20 tests with each test requiring the selection of a specified word from a scrollable list of 200 words. There was a pause of four seconds between tests to minimise subject fatigue.

To provide a uniform basis for comparison the controls in each test were sized such that only 30 words would be visible at any instant. Subjects were required to use the mouse to scroll the list until the target word was visible, then double click on it. The elapsed time between the presentation of the list and the completion of the double click was recorded. If the subject made an incorrect selection, the experiment recorded the error, and proceeded without reporting the error to the subject.

4. Results

The selection time data from the experiment showed some interesting trends. A learning effect was detected in both groups, which led to reducing times irrespective of the list orientation (see figure 3). Averaging selection time between groups showed initially the vertical times were 14% faster, but by the last question, the horizontal selection times were 2% faster. This was an unexpected result, and contrary to the prediction of the GOMS analysis.

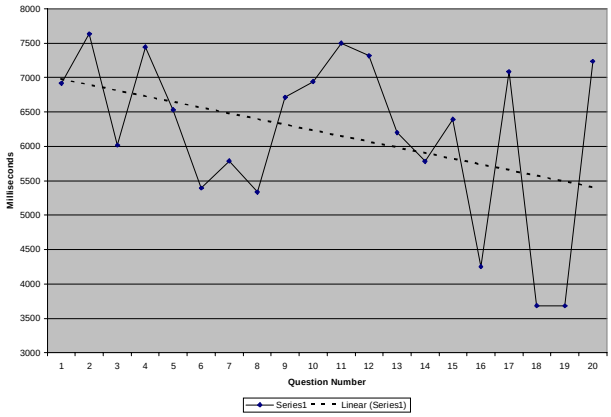

Figure 3. The learning effect

A single-factor repeated measures ANOVA of the experiment data was conducted. The results are shown in table 1. In order to discount the initial learning effect for each list orientation, the times for the first three questions were excluded from the analysis. Even having done this, the list orientation effect was not found to be significant.

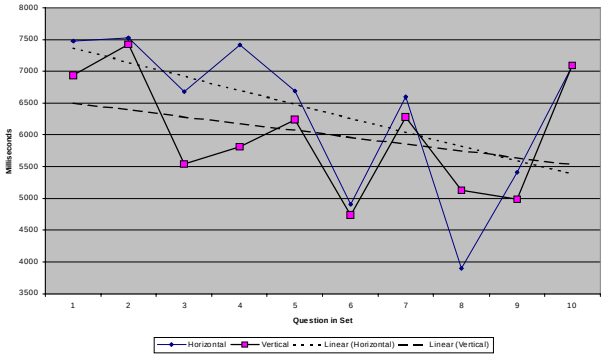

Figure 4. Vertical and horizontal list times

	Vertical	Horizontal
Mean	5743.25ms	5764.33 ms
Variance	4333030.53	4601587.79
ANOVA	F(2,238)=0.006, P > 0.94	

Table 1. Results

5. Conclusions

Empirical analysis revealed no significant difference between ease-of-use of vertical and horizontal lists, despit some indication from GOMS analysis that horizontal should take longer. However, the experiment shows surprisingly strong learning effects. Participants in both groups exhibited continually faster times during their tests, irrespective of the order of the list orientation.

Several factors may explain this. The similarities of the tasks may have led to a single mental model that could be applied efficiently to both tasks. When the arrow buttons on a horizontal list are clicked, ten new items come into view, whereas only one new item comes into view when the same action is performed on a vertical list. All of the participants were frequent computer users, so the results cannot be extrapolated to all people.

6. Acknowledgements

We would like to thank Helen Mitchard for all her help.

7. References

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[2] R.E. Eberts, *User Interface Design*, Prentice Hall, New Jersey, USA, 1994, pp. 296-326.

[3] Isys Information Architects Inc., *Interface Hall of Shame – Controls*, April 1998, http://www.iarchitect.com/controls.htm