

research alerts



Visual Search and Mouse Pointing in Labeled versus Unlabeled Two-Dimensional Visual Hierarchies

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This paper demonstrates that a clearly labeled visual hierarchy will significantly reduce visual search time and motivate a more systematic search strategy. It also refines an understanding of Fitts's Law.

To improve the speed and quality of visual

communication, screen layout design guidelines recommend that screen layouts be organized with a clear visual structure that allows the user to visually navigate the layout systematically and somewhat predictably. Although this might seem an obvious recommendation,

many screen layouts in computer interfaces and Web sites do not impose a clear and useful structure and thus make visual tasks unnecessarily difficult. Few experimental studies have verified or measured the effect of incorporating a clear visual hierarchy.

The experiment presented in this paper verifies and measures the effect. In the experiment, participants were presented with screen layouts similar to those shown in Figure 1. Note that the layout on the left does not incorporate group labels to help guide the viewer in his or her search and the layout on the right does incorporate such labels.

To emphasize fundamental mechanisms and strategies involved in visual search rather than semantic issues, the visual layouts used in the actual experiment were simpler than those shown in Figure 1. All of the items in the layout were more concise, and participants were told the exact target item and target group label for every layout they were shown.

Participants found and clicked on the precued target item. In some blocks of trials, the groups had labels that helped guide the participant to the target. In other blocks of trials, there were no labels. The number of groups,

each of which always contained five items, also varied from block to block.

The observed visual search times demonstrate that a labeled visual hierarchy can be searched significantly faster than an unlabeled visual hierarchy. Details in the search time data, such as a more pronounced number-of-groups effect for unlabeled layouts, also suggest that people adopt fundamentally different search strategies for labeled versus unlabeled visual hierarchies.

Visual search of a computer screen is often followed immediately with the user clicking on the target item with the mouse. In order to develop more accurate models of visual search and manual selection, detailed and precise measurements of both subtasks are required. To that end, this paper also introduces a new experimental paradigm for separating visual search time from mouse pointing time for experiments that incorporate these two subtasks. The paradigm incorporates a point-completion deadline. Once the participant begins to move the mouse from the cued position, he/she has a limited amount of time to click on the target before the trial is interrupted. Search time can thus be measured from

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Figure 1. A real-world analogy to the experimental task used in the visual search experiment. The layout on the left does not incorporate a labeled visual hierarchy to help the user find a story about the Mets baseball team. The layout on the right does incorporate a visual hierarchy to help with such a task (adapted from NYTimes.com, 5/30/01).

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when the layout appears to when the participant starts moving the mouse to the target.

The mouse-pointing times reported in this paper contribute to the ongoing refinement of Fitts's Law as a means of predicting mouse pointing times by providing evidence that (1) target width is best measured along the line of approach and (2) typical pointing experiments may underestimate the parameters of Fitts's Law, and (3) Shannon's formulation of Fitts's Law does not fit data better than Welford's version.

Looking to the future, this research will

contribute to the construction of a tool that designers could use to evaluate the efficiency of visual layouts. The tool will take as input (1) a screen shot of a visual layout and (2) a description of the useful visual targets in the layout. The tool will predict the visual search time required to find each target and perhaps the visual scan pattern that a person would follow to find each target. This experiment contributes to the theoretical underpinnings of such a tool by carefully measuring the difference in search times for two types of layouts—labeled and unlabeled visual hierarchies. 