Extracting Information from Graphics

Sami Gülgöz (sgulgoz@ku.edu.tr)
Department of Psychology, Koç University, Istinye 80860
Istanbul TURKEY

Ömer A. Yedekçioğlu (oyedekcioglu@ku.edu.tr)
Department of Business Administration, Koç University, Istinye 80860
Istanbul TURKEY

Introduction

Graphics are used in many situations where a large set of data is to be presented in an effective manner. Having a set of standards for the construction of graphics is critical for information graphics. The current work is the first step in a project motivated to establish connections between application-oriented work (e.g., Tufte, 1983) and the theoretical work (e.g., Cleveland & McGill, 1984; Pinker, 1990). Our model is an integration of Pinker's (1990) and Cleveland and McGill's (1984) theories. Our model of graphics comprehension states that comprehension of information represented in graphics is affected by the organizational tendencies and the limitations of the perceptual system, capacity constraints of the working memory, and knowledge stored in the memory system.

According to our model, there are a number of reasons why a graph reader may have difficulty. First, the graph may require the use of inferential and top-down processes. Second, the schema for a type of graph may not contain an indication for needed information. Third, just as in any other cognitive task, the capacity of processing resources may limit the amount of information that can be manipulated at once. Finally, the graph schema may mislead the information search because the search relies primarily on default patterns.

We considered eight guidelines which were derived from the models and research in psychophysics and cognitive psychology. We selected some of our guidelines from those suggested by Taylor and Anderson (1986) on the basis of compatibility with the current research and theory in cognitive psychology. These eight guidelines were used to select graphics which are difficult for extraction of information and alternative graphics containing identical information were constructed in order to compare the difficulty of comprehension.

Method

Participants

The participants of the study were 38 students in the MBA program of Koç University.

Materials

We selected graphics from the annual reports of companies whose stocks are traded in Istanbul Stock Exchange. We used the guidelines to create correct versions of them. There were 28 slides which included the questions as well as the graphs.

Procedure

The graphs were presented to the participants in groups using the Microsoft Powerpoint presentation software. Within the given amount of time, the participants needed to respond to the questions presented on the slide.

Results and Discussion

There were 28 slides which were the correct and incorrect versions of 14 graphs. Respondents answered correctly to 79.9% (ranged between 60.5%-100%) of corrected graphics and 30.6% (ranged between 0%-68.4%) of the original graphics. The proportion of correct answers to questions for each pair of graphs were compared using the test for the difference between two proportions. The differences between the two types of graphics were significant in 11 of the 14 slides. All the significant differences were in favor of the correct versions of the graphs.

We observed the predicted differences in the participants' performance in most cases. The results we obtained in this study are motivating for continued research in applying cognitive theory to graphics construction.

References

Cleveland, W. S. & McGill, R. (1984). Graphical perception: Theory, experimentation, and application to the development of graphical methods. *Journal of American Statistical Association, 79*, 531-554.

Pinker, S. (1990). A theory of graph comprehension. In R. Freedle (Ed.), *Artificial intelligence and the future of testing.* Hillsdale, NJ: Lawrence Erlbaum.

Taylor, B. G. & Anderson, L. K. (1986). Misleading graphs: Guidelines for the accountant. *Journal of Accounting, 5*, 126-135

Tufte, E. R. (1983). *The visual display of quantitative information..* Cheshire, CT: Graphics Press.