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Gender Differences in the Navigation of Electronic Worlds

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INTRODUCTION

Recent developments in visualization techniques coupled with the widespread use of complex graphical interfaces, frequently designed to meet the needs of a perceived homogenous set of ideal users, have served to highlight the gap between what an interface demands of its user and the user's actual capabilities (Hindmarch & McDonald, 2006). Consequently, if we are to be able to develop more usable interfaces, then a consideration of individual differences in interaction becomes increasingly important. The most fundamental individual difference of all is that of gender, yet surprisingly it is often the most overlooked. In this article, it is argued that if we are to develop more usable interfaces then individual differences such as gender are not factors that may be considered in the design process, but factors that must be considered. The issue of navigation in virtual and information spaces will be used as a vehicle for this discussion.

THE IMPORTANCE OF NAVIGATION

Navigation is a complex process, which involves determining and following a path through an environment to reach some goal or target. In the physical or virtual world, this might be to arrive at a particular place; in information worlds, this goal may be to find a particular Web page or unit of information. In recent years, navigation has become a key issue within human computer interaction (HCI) research. It has also been the focus of much research in the field of individual differences, meaning that it is one of the few areas in which there is a good corpus of work on gender-based differences in interaction. In

addition to providing a forum for this discussion of gender differences on a key interaction task, navigation also provides an example of how performance differences in interaction may be an artifact of the metrics used to study a particular behaviour. The next section of this article presents the results of research studies that have investigated gender differences in navigation. The implications of this work are discussed and areas of future research are highlighted.

IMPACT OF GENDER ON NAVIGATION

A number of studies of way-finding in the physical world have demonstrated gender-based differences in terms of navigational efficiency (usually assessed by task completion times), and navigational strategy (for example, Lawton, Charleston and Zieles, 1996). The results of such studies usually end up being reported in the popular press as evidence that males are generally superior at this type of activity than females. This may serve to strengthen the stereotypical view that some careers that might draw upon this skill would be unsuitable or in some way inappropriate for women, and in so doing increasing the possibility that some women may feel discouraged to engage in these areas. These studies have also impacted on the study of navigation in virtual worlds as it is assumed that there is a direct parallel between the development of navigation knowledge in real and virtual worlds (Kim & Hirtle, 1995).

The findings of studies of gender differences in virtual worlds do seem to support the general trend that has emerged from studies of physical spaces. The general pattern of results suggest that females

tend to rely much more heavily on landmark knowledge than males, who can use landmark knowledge but are more adapt at using other environmental cues. For example, Devlin and Bernstein (1995) found that males made fewer errors and were better able to use visual-spatial cues than females in a computer simulation of a real environment. Schmitz (1997) found that girls relied upon salient landmarks within a maze to guide their navigation to a greater extent than boys. Similarly, Sandstrom, Kaufman, and Huettel (1998) and Dabbs, Chang, Strong, and Milun (1998) also found that females tend to rely predominantly on landmark information whereas males use both landmark and geometric information equally well. Previous research has also shown that females are more likely than males to refer to landmarks when asked to give directions (Miller & Santoni, 1986), and are more accurate at recalling landmarks than men (Galea & Kimura 1993). Cutmore, Hine, Maberly, Langford, and Hawgood (2000) suggest that while both males and females make good use of landmarks as navigational cues, males tended to do so with greater efficiency. They studied navigation through a virtual maze and found that male subjects were able to find their way out of the maze with fewer moves than female subjects. Cutmore et al. (2000) found that subjects' navigation of the maze improved over a series of trials suggesting that subjects were forming a mental representation of the environment, however male subjects reached a more optimum level of performance in the maze before female subjects.

The reliance upon landmarks demonstrated by female participants in these studies is of particular interest since landmark knowledge is thought to represent the primary stage of spatial knowledge acquisition in a new environment. According to Siegal and White (1975), the development of spatial knowledge of a new environment progresses through three levels of representation. Initially landmarks are recognized and are used to guide subsequent navigation. Landmark knowledge is followed by the development of route knowledge, which is characterized by the ability to navigate from one point in the environment to another, using existing knowledge of landmarks to guide decisions concerning when to take right or left turns. The final level of representation is survey knowledge. Survey knowledge allows us to give directions to others, traverse unfamiliar routes, and know the general direction of places. As such, survey knowledge is based upon a global frame of reference. This level of representation is often referred to as a cognitive map. Hence the implications of studies that have found gender differences suggest that females take longer to acquire spatial knowledge than males. However, they do not tell us about the quality of the representation once it is fully formed. It may be that while it takes longer for women to acquire this knowledge their resulting representation is much richer, as yet this has not been examined in the research literature. Moreover, it is unclear as to the extent that the environments used in these studies will have affected performance. The complex and often unrealistic environments used may only serve to heighten differences in performance.

It has been suggested that the parallel between spatial knowledge acquisition in real and virtual worlds may also extend to hypertext systems. While the results of some early studies suggest that this parallel might actual hold (Kim & Hirtle, 1995), the issue of gender differences in this domain has not been considered in much detail. McDonald and Spencer (2000) conducted a small preliminary investigation into gender-related differences in Web navigation. The study focused on the three areas in which gender differences have been previously found, user confidence, navigational efficiency, and navigational strategy. The study employed a variety of behavioural and self-report measures including rating scales for user confidence measures, and unobtrusive monitoring of the users' movements and verbal protocols. Participants were required to complete a number of search tasks and a direction giving task. Participants were asked to direct a co-experimenter to a specified area within the Web site. McDonald and Spencer found that while there were no differences in efficiency on the search task, female subjects indicated they were less confident about their ability to complete the tasks than males. In terms of verbal data, female subjects made more references to landmarks in the direction giving task than male subjects. They also tended to engage in more analysis of where a particular link might take them. In addition, female subjects were less confident about their ability to complete search tasks than male subjects.

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