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Usability and usefulness of ergonomics Web sites: a preliminary investigation

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1 Introduction

Design for usability is of principal importance to attract and retain visitors to both commercial and non-commercial Web sites (Van Schaik and Ling 2001). For a Web site to meet the usability objective, it must support the primary tasks involved in Web site use (Lee 2000). Web pages dedicated to the discipline of ergonomics can be subdivided into a number of broad categories, namely those that allow the Web user to gather information, review products, view case studies and read journal articles on-line. Thus there is coverage of both research and application on the ergonomics Web sites relating to both the physical work site and general consumer issues. The organization of Web sites determines how effectively the Web user can gather and review information in both text and graphic form.

Wilson (2000) defines ergonomics as the theoretical and fundamental understanding of human behaviour and performance in purposeful interacting socio-technical systems, and the application of this understanding to the design of interactions in real settings. The World-Wide Web (WWW) provides a vast array of information on these issues, but the usability and usefulness of ergonomics Web sites remain relatively untested.

The International ergonomics Association (IEA) is concerned about the use of the term Ergonomics by a number of product design companies and consultancies on the Web. Many people purport to be ergonomists or to have designed an ergonomical product, but in fact have very little in the way of credentials or experience to substantiate these claims. The Web

provides an ideal opportunity for the propagation of ideas and concepts relevant to the discipline of ergonomics but, as with many other disciplines, the usefulness and usability of Web sites need to be a central focus to ensure that reliable and useful recommendations are available to the Web user.

Navigation of Web sites tends to provide designers with a major challenge and many users have commented on bad designs and poor usability (Shackel 2000). General principles used in the design of human-computer interfaces have been widely researched by Helander and Khalid (2000) and provide some useful examples of key design elements that exhibit simplicity, support, visibility, reversible action, feedback, accessibility and personalization. These principles are essential to the implementation of a viable Web site and should be used as logical guidelines for developers of ergonomics Web sites.

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2 Methodology

2.1 Informed consent and explanation of key terms

Respondents were given detailed information relating to this research prior to data collection. Anonymity of results was guaranteed via the use of a numeric coding system. To ensure that respondents were familiar with key concepts and definitions, they were provided with a list of frequently used terms and concepts on the Web. This included definitions of a sitemap, e-commerce and hyperlinks.

2.2 Respondents

Responses were collected from Web users (N=14) with differing levels of Web experience. Respondents were divided into two groups according to the following criteria: those with experience in ergonomics (N=7) and those with no experience of the discipline (N=7). Testing was carried out during preselected times and the same computer terminal was used to ensure that mean download time (MDT) did not have an influence on responses. All sites were preloaded to ensure that the pages were similarly accessible.

2.3 Design of the survey

The data on Web site usability and usefulness were collected using a 12-item questionnaire developed to focus on ergonomics Web site issues. Respondents were required to subjectively rate Web sites based on ease of navigation, Web site usefulness and how well the site catered for the Web user. They were asked to provide a subjective comparative analysis of all sites visited. Web site ratings were measured on a 5-point scale, from very poor (1) to very good (5).

2.4 Web sites evaluated and tasks completed

Three broad Web site categories were chosen for evaluation. These included commercial, non-profit and reference sites. Six independent sites were randomly chosen to ensure that a broad cross-spectrum of ergonomics Web-based issues were evaluated. Although recent research (Lee 2000) has cautioned that the preselection of sites could lead the Web user to a predetermined response, the design of the tasks set for respondents aimed to minimize any bias in responses.

Respondents were required to complete two set tasks for each Web site category. Commercial Web sites (A and B) were evaluated based on the product information and ordering of products. Non-profit Web sites (A and B) were evaluated with a focus on membership issues and the ease of use for the prospective member. Reference sites (A and B) were assessed on information delivery and access to data or resources with a view to

furthering the knowledge of the user with regard to the discipline of ergonomics (see Apendix A for detailed task requirements).

Following the completion of the general survey, respondents were asked to rank the six Web sites visited on a 6-point scale from the most user-friendly and useful site (1) to the least user-friendly and useful site (6). Respondents were afforded the opportunity to review all Web sites during this ranking procedure.

2.5 Results and discussion

A total of 14 completed surveys were collected for each Web site. Respondents subjectively rated Web sites on these issues: navigation, menus, information delivery and site usefulness. The order of testing was standardized as follows: commercial (A), commercial (B), non-profit (A), non-profit (B), reference (A) and finally reference (B). Respondents were allowed time to alter responses to minimize bias against any Web sites that may have arisen due to the testing order.

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3 Commercial ergonomics Web sites

Commercial Web sites were evaluated based on the product information supplied to the Web user and the process of ordering the items. Helander and Khalid (2000) state that the perception of an on-line store is related to product variety, product quality and price. The design of the e-commerce platform and ease of use were therefore given particular attention to establish the general preferences of the respondents.

3.1 Navigation

Shackel (2000) postulates that navigation is one of the biggest problems for Web users. The respondents were asked to rate both complex (commercial site A) and simple (commercial site B) e-commerce ergonomics Web sites. Responses to commercial site A (the complex platform) showed that 71,4% of respondents rated the site navigation in the 'average' to 'very good' categories, while 85,7% of respondents rated site navigation for commercial site B (the simple platform) in the 'good' to 'very good' categories.

Respondents generally found the menus provided by these sites satisfactory and easily navigable. Chi-square tests for independence (Fox, Levin and Harkins 1993) revealed a high association between site navigation and overall impressions of these Web sites. Responses to commercial site A showed variations in ratings from respondents due to the more complex nature of this site. Responses relevant to navigational issues therefore exhibited the full range of ratings from 1 to 5 on the 5-point scale.

3.2 User considerations

Each site's clarification of the discipline of ergonomics was assessed. Both the complex and simple platforms scored low ratings from respondents with respect to informing the user about the principles and scope of ergonomics. Commercial site A achieved 50% ratings in the 'poor' to 'very poor' category, while the majority of ratings for commercial site B were in the 'average' to 'poor' categories. This weakness must be addressed to ensure that prospective on-line customers understand the ergonomic design principles used in the manufacturing of an item that is 'ergonomically designed'.

3.3 Usefulness

Web experience of the respondents clearly had an influence on the ratings of site usefulness. Inexperienced users found the simple e-commerce platform (commercial site B) to be more useful. In the case of the complex platform, many respondents were unable to find products

and the ordering process was complicated by a lack of user-friendly menus and options. Sixty-four per cent of the users rated the complex platform in the 'average' to 'very poor' categories. Some of the difficulties highlighted by respondents were related to problems finding information on the secure transaction platform and the verification of credit card details. Chi-square tests for independence again showed a high level of association between the finding of products and ordering information and the overall impression of the site. The commercial site A thus scored a lower overall impression and usefulness rating because of difficulties respondents had with the e-commerce platform in completing the prescribed task.

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4 Non-profit ergonomics Web sites

Non-profit ergonomics Web sites were assessed with membership issues in mind. The questionnaire thus focused on the ease of use of the Web site for the new or prospective member. Information retrieval is an important activity in using the World-Wide Web (Van Schaik and Ling 2001). Respondents were therefore required to find information about non-profit sites A and B by following the relevant menus and hyperlinks. The nature of Web content required by non-profit sites is an important consideration because much of the material remains unchanged on these pages. Material related to criteria for membership or history of the society is not updated as regularly as the product catalogues used by a commercial site. Non-profit sites therefore appear to have fewer pitfalls than commercial or reference sites.

4.1 Navigation

Both Web sites evaluated within the non-profit area received favourable ratings from respondents with respect to ease of navigation. These sites rely on a simple menu structure and were viewed by the respondents as being easy to search and navigate. Fifty per cent of respondents rated non-profit site A in the 'good' category, while 21,4% rated the site in the 'very good' category. On the other hand, 35,7% of respondents rated the non-profit site B in the 'good' category, while 63,9% rated the site as 'very good'. Chi-square tests for independence showed a high association between navigational menus and overall impression of these sites. In both cases, respondents generally concurred on the ease of navigation and overall impression of these sites. Favourable navigation ratings were manifested in higher overall impression ratings.

4.2 User considerations

Non-profit sites showed a similar flaw to the commercial Web sites when the clarification of the scope of the discipline of ergonomics was considered. Non-profit site B clearly displayed this trend with a significant difference ($p=0,05$) in the Chi-square test of independence. Respondents gave this site a poor rating for definitions of ergonomics and information delivery about the discipline. However, despite this shortcoming the overall impression of the Web site was not altered (with higher ratings being observed).

4.3 Usefulness

Experience in using the World-Wide Web and of ergonomics was of less relevance in the ratings of usefulness for non-profit Web sites. The majority of respondents rated these sites as user-friendly with useful information and hyperlinks to relevant information. Of all the categories assessed, these sites scored the highest overall ratings and provided the most useful and organized information delivery. This was an expected trend due to the nature of content hosted by non-profit sites. The user required simple information and possibly had a lower expectation of a site that delivered this genre of content.

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5 Reference ergonomics Web sites

Reference sites provide the Web user with information and resources that are relevant and topical within a discipline. Therefore, the evaluation of these sites focused on information delivery and access to definitions and material with a view to furthering the knowledge of the user with regards to the discipline of ergonomics.

5.1 Navigation

Both reference sites A and B relied on a very basic menu structure and thus received favourable ratings from respondents with respect to navigation. However, these sites were shown to provide the Web user with limited information and relevant content. Reference site B showed simple menus and site navigation, but was particularly weak on content. A Chi-square test of independence showed a significant difference ($p=0.05$) when the relationship between navigation and overall impression was considered. Although this site was viewed as easy to navigate, it did not score high ratings when respondents were required to give their overall site impressions. This finding stresses the need for Webmasters to concentrate not only on site navigation, but also on the content found on a particular site. Simply having easy navigational features does not ensure that visitors return to Web sites, as most users are justifiably searching for valuable content from a reference site.

5.2 User considerations

Both reference sites A and B showed a similar flaw to the commercial and non-profit Web sites when the clarification of the discipline of ergonomics was considered. A high 92,8% of respondents rated reference site B as being 'average' to 'very poor' when information about ergonomics was delivered, while 71,4% of respondents rated reference site A as being 'average' to 'very poor' for the same reason. A common shortfall for all ergonomics sites thus appeared to be identified by the study, namely that information about the discipline should be improved substantially to ensure clarity for the Web user with and without experience in ergonomics.

5.3 Usefulness

The majority of respondents commented on the number of broken hyperlinks and poor information delivery on both of these sites. Although both reference sites claimed to be professional resources for information relevant to the discipline of ergonomics, there was very limited content about ergonomics. Chi-square tests for independence showed a high association between the ratings of information delivery and overall impression of the site concerned. As both these sites achieved poor ratings for information delivery, the overall impression of the sites showed similarly poor ratings.

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6 Ranking of ergonomics Web sites

Following completion of the general survey, respondents ranked the sites visited on a 6-point ranking scale. To determine the level of agreement between respondents, the Kendall Coefficient of Concordance (Ferguson 1982) was computed. The assessment of all respondents (N=14) showed disagreement on the rank order of the sites visited. However, further statistical analysis between groups showed no difference in the responses of Group A (N=7; respondents with ergonomics experience), but highlighted a significant difference ($p=0,05$) in Group B's responses (N=7; respondents with no ergonomics experience). The lack of ergonomics experience thus appeared to be a significant factor in the lack of agreement for the rank order, with inexperienced respondents showing larger disagreement in ratings of Web sites. However, the interpretation of the data should be conducted with caution due to the small sample size and where personal preference on the part of a limited

number of respondents may well have significantly altered these findings. Figure 1 below illustrates the mean rankings for each of the six Web sites visited.

Figure 1 Mean Web site ranking on the 6-point ranking scale

There appeared to be an agreement among respondents about the most effective Web site visited (non-profit B) and the two least effective Web sites visited (reference sites A and B). A lack of agreement was observed for the sites ranked second to fourth. Commercial site A (the complex e-commerce platform) was an example of this disagreement, being ranked between 1 and 6. It was established that respondents' level of Web experience and knowledge of ergonomics played a role in their rating of the Web sites.

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7 Conclusions and recommendations

The study served as a preliminary investigation into ergonomics Web site usability and usefulness, involving only a small sample (N=14). With this limitation taken into account, the findings nevertheless allowed for a number of general recommendations. In terms of the design of Web sites, this research may well offer the Web developer and Webmaster some basic insight into the needs of the user searching for information or products specifically related to the discipline of ergonomics. To improve site usefulness and usability, the sites should be clearly set out with good use of traditionally accepted Web elements in the form of menus and site maps. In terms of commercial ergonomics Web sites, it is essential that the product be clearly displayed and that the e-commerce platform be effective and reliable. There is a clear need to ensure that the Web user is informed of the security features used by the site (both commercial sites A and B demonstrated this weakness).

Ergonomics Web sites must ensure that new users are informed of the general scope of the discipline and have access to basic definitions and some key guidelines. This was a flaw that was clearly evident in all sites assessed and a most notable weakness of non-profit site B. The ergonomics reference sites assessed highlighted the need to ensure that content on Web sites is kept up to date and that active hyperlinks are tested by the Web developer to ensure accessibility at all times. These sites showed a particular weakness in information delivery and content. To promote the discipline of ergonomics on the World-Wide Web, the content and layout of Web sites must ensure clarity and ease of use. Although this study only focused on a limited number of Web sites, there appears to be a need for Web developers to adhere more closely to general guidelines for Web site production. Ergonomics Web sites must improve information delivery and content and, perhaps most importantly, ensure that the Web user understands the nature and value of products, reference material and the goals of the non-profit organization before leaving the Web site. Adherence to these basic principles will not only improve overall site impressions, but also increase visit frequency to the Web site concerned.

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9 Appendix A

Tasks assigned to respondents (N=14)

1 **Commercial Web sites**

a) Find a product on this site and establish what price you would have to pay for an 'ergonomically designed' item.
b) Attempt to order and pay for an object without completing the e-commerce enabled transaction.

2 **Non-profit Web sites**

a) Find out more about this non-profit organization by following the relevant menu. Focus on membership, committees and history.
b) Does this site enable you to enroll as a member on-line?

3 **Reference Web sites**

a) Try and gather more information on the discipline of ergonomics on these sites.
b) Follow any on-line journal or reference link in your search for more information about ergonomics.

downtime arising out of or relating to the user's use of the Website.

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