

WEBSITES FOR IRISH CHILDREN: IMPLICATIONS FOR DESIGN

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ABSTRACT

Websites provide the key interface for consumer use of the Internet (Palmer, 2002). Good Websites must be usable. Shneiderman and Hochheiser (2001) maintain that in order to build universally usable systems, designers must account for user diversity. Poor and confusing Websites can turn away users, and thus potential customers (Benbunan-Fich, 2001). Spool et al. (1999) argue that the usability of a site depends on what users are trying to accomplish: indeed its usability ultimately defines how well and how easily a visitor, whether child or adult, without formal training, can interact with the site.

Druin (2002) argues that children are emerging as “an important new consumer group of technology”. Unlike adults, who typically use the Web in business settings and for goal-oriented tasks, children often use the Web for entertainment and schoolwork (Nielsen, 2002). Moreover, children and teenagers have become a growth sector for online shopping, which in 1999 made a shift from passive online advertising to actively targeting children and teenagers for digital transactions (Montgomery, 2000). Levi and Conrad (1996) state that the purpose of most Websites is to attract users and distribute information or products. Despite the growth in users and services on the Web, little is known about how children actually use Websites (Nielsen, 2002). Many Websites specifically attract children’s attention through educational or entertainment content, and even mainstream Websites are adding children’s corner sections (Nielsen, 2002). Despite the abundance of Websites for children, principles of Web design for children are not yet well defined. Children’s active, extensive and rapidly growing presence on the Internet poses both a challenge and an opportunity for researchers and Web designers (Demner, 2001). As such, designers of child-oriented Websites face unique issues, including attention span, reading level, and educational concerns. Gender is an additional consideration in Website design. Inkpen (1997) argues that it is important that we understand how each gender interacts with computer-based systems so as not to exclude particular categories in design processes. With almost ten million children worldwide using the Internet (Wimpsett, 1998), the effective design of child-centric Websites may have high benefits for designers and businesses wishing to distribute information to this audience.

The effectiveness of any Website’s design is measured through usability testing metrics. Halgren et al. (1995) describe children as a unique user population. Indeed, usability findings for children often differ from those found when testing adults. Halgren et al. (1995) argue that adult-centric design assumptions and testing methodologies must be reworked for children.

Focusing on a single commercial Website specifically designed for a young audience, this research studies the interaction patterns of 60 Irish Primary school children with the site. The study addresses gender differences in assessing the site’s objective and subjective usability. The study provides important information for designers of child-centric Websites in an Irish context: the findings have implications for businesses aiming to attract children to their Websites.

1. INTRODUCTION

When well integrated into human activities, computing is a tool that can make peoples’ lives more productive and enjoyable (Butler, 1996). Tractinsky (1997) describes the quest for usable computer technology as a major goal, and criticises the poor usability of many systems designed for human use. In essence usability refers to the effectiveness of interaction between computer users and their machines. Benbunan-Fich (2001) states that this interaction should be clear and without misunderstanding. Butler (1996) argues that whilst there is increasing pressure for computing systems to become more usable, advances will not come easily.

Usability has several relatively important components, which include effectiveness, efficiency and subjective satisfaction. Measures of effectiveness relate the goals of using the system to the accuracy and completeness with which these goals can be achieved. Measures of efficiency relate the level of effectiveness achieved to the expenditure of resources. The resources may be mental or physical effort. Measures of satisfaction describe the perceived usability of the overall system by its users and the acceptability of the system to those who use it. Measures of satisfaction may relate to specific aspects of the system or may be measures of satisfaction with the overall system (Bevan and Macleod, 1994). Palmer (2002) suggests that for Websites to be successful and for users to be satisfied, Web designers need to consider its usability. As Benbunan-Fich (2001) points out, better usability will result in more efficient interaction between the user and the Website. At best, a system with poor usability will cost its users time and effort; at worst, it will not be used at all (Goodwin, 1987). Calongne (2001) suggests that the ability to design Websites that are measurably successful, and repeat this activity across future Websites, should be the goal of every Website designer.

Optimising the user experience should be the ultimate goal of a Web usability designer (Badre, 2002). However, Calongne (2001) argues that selecting and defining effective goals is not an easy task. Yet without measurable goals evaluators cannot determine if the Website and its interfaces are usable. Henneman (1999) contends that usability exists when the design of the system matches what the intended end users needs and wants. Preece et al. (1994) assert that this would involve optimising the interactions people have with interactive products to enable them to carry out their activities at work, school, and in everyday life.

Spool et al. (1999) argue that the usability of a Website depends on what users are trying to accomplish. Are they surfing, doing research, or buying products? Henneman (1999) maintains that a system with poor usability can result in long task times, high numbers of errors, large support costs, long training times, and an overall level of end-user frustration. According to Levi and Conrad (1996) the broad goal of usable systems should be assessed using several criteria: ease of learning, retention of learning over time, speed of task completion, error rate and subjective user satisfaction. In particular, they suggest the key challenges in developing a usable Website include: a highly diverse user population, a highly diverse set of end-user computers, a wide disparity in connectivity speed and bandwidth, a deployment environment that blurs the distinction between the site content and the browser used to access this content. Benbunan-Fich (2001) contends that the more a Website helps people find the information they are looking for, the more usable it is. The usability of a Website defines how well and how easily a visitor, without formal training, can interact with the site. Clearly, better usability will result in more efficient interactions between the user and the Website and will increase the probability that the user will return and use the Website again (Benbunan-Fich, 2001). This is of immense importance to Websites that attract 'casual' rather than dedicated and committed visitors.

This growth of the World Wide Web has resulted in a large and exponentially increasing number of Websites, ranging from a single personal homepage, to large corporate sites containing thousands of pages (Cunliffe, 2000). As the number of Websites has increased, so too has the number of users. With the growing interest in systems usability, and the pervasiveness of Web-based systems, consideration of different user groups such as children has become an important issue (Markopoulos and Bekker, 2003). With the rapid growth of Web-based information systems, information has become a commodity that is both more powerful and more precious than ever. The use of the World Wide Web has reshaped the way children access, retrieve, and create information. The Web's convenience of location-independent access (such as from home or school), and richness in graphics are characteristics perceived by children as more appealing than those embedded in traditional sources, such as encyclopaedias, and books (Bilal and Watson, 1998).

2. CHILDREN AND THE WEB

Historically computer users have been adults in the workplace, while today users are of varying ages and range across many groups within society: male and females, young and old (Inkpen, 1997). Unlike adults, who typically use the Web in business settings and for goal-oriented tasks, children often use the Web for entertainment and schoolwork (Nielsen, 2002). Research has shown that the reasons why adults like certain Web-based interfaces are often totally different from the reasons why children like them (Brouwer-Janse et al., 1997). Druin (2002) puts forward the argument that children have their own likes, dislikes, curiosities, and needs that are not the same as those of adults. As obvious as this may seem, designers of new technologies for children sometimes forget that young people are not just short adults but an entirely different user population with their own culture, norms, and complexities, and with their own beliefs and behaviours (Halgren et al., 1995). Yet, it is common for developers of new child-based technologies to ask parents and teachers what they think their children or students may need, rather than gather data from children directly (Druin, 1996; Druin et al., 1999).

Children think and learn differently to adults, and the Websites they like and use are also different. However, basic Web design principles still apply, but child-oriented Web builders face unique issues when designing Websites specifically for a young audience. These include attention span, reading level, and educational concerns (Wimpsett, 1998). Sullivan and Matson (2000) argue that Websites with a visually rich graphical presentation are a vital element in capturing and holding the attention of younger users. Yet prior research suggests a minimal relationship between graphical elements and either search success or site traffic. Sullivan and Matson (2000) maintain that children, like their adult counterparts, perceive (or at least treat) Web animations as a distraction to be removed from their visual field. Nielsen's (2002) report on children's usability involved observing children interacting with 24 Websites designed for children, and 3 mainstream Websites designed for adults (Amazon, Yahoo, and Weather.com). His study found that just like adult users, confusing Websites puzzle children. For example Nielsen (2002) states that children do not like slow download time any more than adults do. Sullivan and Matson's study (2000) compared children's navigation behaviour by conducting usability tests with 16 children, using 2 general-interest topical Websites. Interestingly, its results suggest that children's Web usability needs and preferences are remarkably similar to the same needs in adults. But at the same time it also found evidence suggesting that children have special needs of their own.

3. AGE AND GENDER

Natural progressive changes in emotional development and improvement in motor skills are quicker and greater between the ages of 4 and 12 than changes between 20 and 40 years of age. The challenge in designing Websites for children is complex because depending on how we define 'children' our interfaces may or may not be supportive of their cognitive, social, or physical capabilities (Brouwer-Janse et al., 1997). Druin (2002a) argues that when designing technologies specifically for children, age is an important and vital consideration.

According to Simon (2001) significant gender differences exist in relation to adults across a variety of everyday tasks and traits. For example, adult males often perform better than adult females on spatial orientation tasks while adult females normally score better than adult males on verbal or linguistic tasks. Also adult males and females have significant differences in their reaction to visual images, which in turn affects their recall and recognition. As such, gender bias may be an important concern and a factor to consider positively when designing Websites for a particular gender. Indeed Inkpen (1997) asserts that software designers incorporate their own gender biases into the software that they develop. Often however, these

gender biases can cause the designers to miss important subtle nuances with respect to gender differences. Historically, females have been less likely to embrace new technology than males. Negative attitudes towards new technology underlie females reporting less computer experience as well as less computer competence and less favourable attitudes towards computers than males (Morahan-Martin, 1998).

In relation to children, it follows that gender is also an important consideration. Inkpen (1997) states that it is important that we understand how each gender interacts with computers so as not to exclude any children. Girls and boys think about computers differently, have different motivations for using computers, approach computers differently, have different preferences, and have even shown differences in the ability to use various interaction styles (Inkpen, 1997). Indeed such gender differences develop, evolve, and change as children become older (Berk, 1997). Markopoulos and Bekker (2003a) found that when children between 9 and 11 years old interact with computer systems, girls are more verbose than boys, and provided more arguments in support of their opinions. Furthermore, girls and boys are likely to have different evaluation criteria for assessing products, because of their preferences for different kinds of products and activities. Furthermore, Nielsen (2002) reports that in his experience after conducting usability tests with boys and girls, he found bigger differences between boys and girls than we usually find when testing adult men and women. He found that boys were significantly more annoyed by verbose pages than were girls; girls complained much more than boys when sites lacked good instructions; boys spent more time alone with computers; and girls spent more time using computers with a parent.

4. HOW CHILDREN SEARCH

Bilal and Kirby (2002) investigated the information-seeking behaviour of primary school children in using the Yahoo!igans Search engine. The participating children used the Yahoo!igans Website to find the correct answer to a fact-finding task. The study findings revealed that the children experienced difficulties in completing the task using the search engine. Another study by Schacter et al. (1998) explored the performance and searching behaviours of primary school children in using the Web on two types of tasks: fact-finding and research. Results showed that children preferred to browse rather than systematically search for answers to tasks. The study concluded that children had difficulty finding relevant information, but were more successful in finding information on open-ended than fact-finding tasks.

Bilal and Watson (1998) outline studies on primary school children's behaviour in seeking information, which reveal that although child users perceive themselves as motivated and competent in using technology, many children experience difficulties in formulating search strategies, and do not understand research processes.

5. MEASURING WEBSITE USABILITY

Little research is concerned with the systematic evaluation of the usability of Websites and Web-based systems (Benbunan-Fich, 2001). Calongne (2001) states that the design and development of an effective and usable Website involves an assessment of the audience, an identification of the common tasks that they will perform and an empirical evaluation of the Website's usability. Usability can be measured using both qualitative and quantitative methods. Examples of quantitative methods include survey methods and laboratory experiments. Popular qualitative data methods include observation and questionnaires (Acton, 2002). Usability can be tested through different methods, which consist of observing actual users interacting with the site and collecting information about the specific ways in which the Website is easy or difficult to use (Benbunan-Fich, 2001). Observing the behavior of users

during the performance of Website tasks provides an opportunity for collecting measurements that will be analysed to determine whether the site is usable. Some of the most basic measures that can be used are: the time a task requires, error rate and user's subjective satisfaction (Acton, 2002; Calongne, 2001).

In terms of usability measures children are not a homogenous group for which a single theory and practice may be recommended (Markopoulos and Bekker, 2003). Carter (1999) describes different users as having different needs based on the tasks they perform and their own unique characteristics. Nielsen (2002) found that usability findings for children are often different from those typically found when testing adult users. Some of the differences that Nielsen found were that animation and sound effects were positive design elements for children - they often created a good first impression that encouraged users to stay with a Website. Children were willing to mine-sweep, scrubbing the screen with the mouse either to find click able areas or simply to enjoy the sound effects that different screen elements played. Geographic navigation metaphors worked: children liked the pictures of rooms, villages, 3D maps, or other simulated environments that served as an overview and entry point to various site or sub site features. Bilal and Watson (1998) contend that the use of the World Wide Web has reshaped the way children access, retrieve, and create information.

Limited methodological advice has been published to date regarding the adaptation of usability testing procedures for children of different ages (Markopoulos and Bekker, 2003). The challenge in designing for children is complex because depending on how we define children; our interfaces may or may not be supportive of their cognitive, social, or physical capabilities (Druin, 2002a). Hanna et al. (1997) claim that with respect to 6 to 10 year olds and 11 to 14 years of age, these age divisions are arbitrary, and that much behaviour will overlap. In their experience, most children younger than two and half years of age are not proficient enough with standard input devices (e.g., mouse, trackball, or keyboard) to interact with the technology and provide useful data. Children older than 14 years of age will likely behave as adults in a testing situation and should be treated accordingly (Hanna et al., 1997). Children in the age range 11 to 14 years are also very easy to include in usability testing. They will answer questions and try new things with ease. In this age range, children will be more sophisticated in the way that they can describe the things they see and do (Hanna et al., 1997). However, children do not always say what they mean and it is very difficult to get children to think aloud (Brouwer-Janse et al., 1997). Druin (2002a) is emphatic that of utmost importance is that children's ages truly matter when designing World Wide Websites specifically for them.

Designers of technologies have their own biases and assumptions about children (Druin, 1997). Some of them may be parents of children, but all of them were once children themselves with special memories of what they liked and did not like about the world. Most Website designs for children are based on pure folklore about how children supposedly behave. Or, at best, by insights gleaned when designers observe their own children, who may not be representative of the majority of children, typical Internet skills, or children's common knowledge about the World Wide Web (Nielsen, 2002). Druin (1997) feels that all of this adds up to a large amount of personal experience about children that designers may or may not choose to take into account when they develop new child-centric technologies. Children's active, extensive and rapidly growing presence on the Internet poses both a challenge and an opportunity for researchers and Web designers (Demner, 2001). Both inside and outside the classroom, children are already being called upon to navigate unfamiliar Websites and to locate information contained therein. In performing such tasks, usability is crucial. Hence it is clear that Human Computer Interaction (HCI) methodologies should address the specific needs of child users Markopoulos and Bekker (2003).

Carrying out Web-related usability testing can involve having users search for information on a particular Website (Redish et al., 2002). Cockrell and Jayne (2002) describe user

interactions with a Website while carrying out task-oriented exercises as based on the user's perspective. Butler (1996) is of the opinion that data from the user's interaction with the Website during performance of these task-oriented exercises should be recorded. Such formal user testing can range from rigorously structured to highly informal, from quite expensive to virtually free, and from time-consuming to quick (Levi and Conrad, 1996).

6. OBJECTIVES

Current research on usability still focuses mostly on adult users. Such research and practice does not focus enough on the special need of users (Markopoulos and Bekker, 2003). According to Bilal and Kirby (2002) little is known about how young people find information using Web-based systems. This study focuses specifically on Website usability for boys and girls aged between nine and eleven years old.

The main objective of this research is to study if there are any significant differences between children of different genders when searching for information on a World Wide Website. In terms of measurement, usability is separated into two specific categories. These are: actual usability and perceptive attitudes (Nielsen, 2001). Actual usability represents an objective approach to user-centred interface evaluation and involves measuring quantifiable data such as time taken to complete tasks, and error rates, as purely objective performance measures. Perceptive attitudes in comparison, represents a more subjective approach. Alternatively, or additionally, usability can be measured in such subjective terms, which measures the degree to which users like using the system. This can be achieved by soliciting opinions or through the use of a questionnaire. In general the latter involves a more interpretative methodology to assess user opinions and satisfaction with the Website (Acton, 2002). Specifically, from an objective standpoint the research proposes the following hypotheses:

H1: The time taken to perform tasks will differ depending on the gender of the child.

H2: The mean number of errors per task will differ depending on the gender of the child.

Perceptive attitudes to usability can be measured in different ways, consisting of observing actual users interacting with the Website and collecting information about the specific ways in which the Website is easy or difficult for them to use (Benbunan-Fich, 2001). Additionally, from a subjective standpoint the research addresses perceptual attitudes to searching for information on the World Wide Web, and proposes the following hypothesis:

H3: Male and female children have different perceptive attitudes to using the World Wide Web.

7. RESEARCH DESIGN

The study was carried out in three primary schools as field settings and involved 60 child participants undergoing usability tests using a single chosen Website. All participants were aged between 9 and 11 inclusive, and had used the school computing facilities for information searching on the Web. Actual usability was measured by recording participant time taken to complete tasks and error rates in completing tasks. Perceptive attitudes to usability were measured by a post-test questionnaire containing 10 questions.

The purpose of this study was to test the actual and perceived usability of the O'Brien Press Website in relation to boys and girls aged between 9 and 11 years old, who used the site to search for information to answer 6 defined tasks. The tasks were as follows:

Task 1: What is the company's e-mail address?

- Task 2: Eoin Colfer is the author of the book *Benny and Babe*. What job did Eoin have before he became a full-time writer?
- Task 3: The author Brianóg Brady Dawson wrote the book *Granny's Teeth*. Find the name of another book by this author.
- Task 4: Go to the new book pages and get the name of one new book.
- Task 5: What is the phone number to contact O'Brien Press?
- Task 6: Go to the award winner's page and name the author that won an award.

8. FINDINGS

Of the 60 participants included in the study, 30 were male (50%) and 30 were female (50%). 13.3% were aged 9 years old, 28.3% were aged 10 years old and 58.3% were aged 11. Statistical means and deviations were computed for the task timings for each task to identify variances and to determine if outlying values were significantly affecting means.

To determine whether significant differences existed between the male and female groups for actual usability, T-tests were carried out on task timing values and on the number of errors made during task completion. In each case the two groups (males and females) were compared on a single variable (for example task timings for task one, or errors made in task three). For tasks that Levene significances showed an inability to rely on equal variances amongst means, and where 2-tailed significances could not be solely relied upon to accept or reject hypotheses, further non-parametric tests such as Mann-Whitney, Kolmogorov-Smirnov and Moses tests were carried out.

For perceptive attitudes to usability, responses to the post-task questionnaire were recorded and the mean statistic for each question calculated. Specific individual values on each question were statistically independent of the others. For each individual question, the participant circled the response on a 5-point Likert scale.

H1: The time taken to perform tasks will differ depending on the gender of the child.

Hypothesis H1 was rejected. There were no significant differences found between male and female participants in terms of times taken to complete tasks.

H2: The mean number of errors per task will differ depending on the gender of the child.

Hypothesis H2 was also rejected. There were no significant differences found between male and female participants in terms of the number of errors made in completing tasks.

In measuring perceptive attitudes towards the Website, the ten-question post-test questionnaire was completed by each participant at the end of the usability tests. The Likert scale was used to measure the participant's attitude to searching for information, the Website itself and the tasks performed. The questionnaire was divided into three sections. Section one consisted of four questions that concerned perceptions on information searching. The second section consisted of four questions that concerned subjective attitudes towards the actual Website used as part of the study. The third and final section of the questionnaire consisted of two questions that concerned feelings towards the particular tasks completed as part of the study.

H3: Male and female children have different perceptive attitudes to using the World Wide Web.

Previous studies by Nielsen (2002) and Benbunan-Fich (2001) state that Web users encounter problems such as unclear navigational, inconsistent navigation options and fancy wording,

cluttered designs, poor readability and lack of comprehension, and navigation issues such as non-obviousness of buttons. The study here found that there were differences between actual test usability measures and the more subjective perceptions of usability of the Website, which ties with previous studies indicating that subjective feelings of users towards usability can conflict with measures based on actual use. However, when gender differences were examined, H3 was rejected. Although overall, participants perceived the Website more favourably than was indicated by task timings and errors made, a t-test analysis of mean perceptive attitudes showed no significant differences between sexes in terms of finding information, influence of on-screen distractions, site layout, site graphics, and levels of fun perceived in accomplishing tasks. Overall, participants found the O'Brien site fun to use, useful, easy to search and find information, well laid out, with good graphics and layout.

9. DISCUSSION

Both genders carried out the six tasks in similar times with comparable numbers errors also occurring. Performance, in terms of timed tasks and errors made, did not differ between the two groups in this study. The findings therefore suggest that children aged between nine and eleven of different gender have similar abilities when it comes to completing the selected information searching tasks on the World Wide Web.

In this study, findings indicate that boys and girls have similar perceptions of the usability of the O'Brien Press Website. Nielsen (2002) states that there are larger differences between boys and girls than are usually found when testing adult men and women. This research suggests that there are no significant differences between boys and girls aged between 9 and 11 years.

Inkpen (1997) contends that girls and boys interact differently with computers, think about computers differently, approach computers differently and have even shown differences in the ability to use them. Nielsen (2002) agrees, arguing that there are large subjective and objective differences between boys and girls. Gefen and Straub (1997) tested gender differences that might relate to beliefs and use of computer systems, and found that women and men differ in their perceptions. The findings from this study conclude that in these regards differences between boys and girls are not significant. The research undertaken here, with 60 participants in total, did not show noteworthy differences between genders. The researchers suggest that further work should be carried out as an extension of this study into gender difference using a larger sample. Designers of children's Websites need not be cognisant of gender differences in the age group tested here when creating sites targeted at children specifically, as the results of this study indicate that, designing Websites for one gender may not be necessary.

Although the hypothesis H1 was rejected, task six did show a slight (eighteen seconds to complete for girls versus twenty-six seconds for boys) difference between genders. A previous study conducted by Leong and Hawamdeh (1999) to show the difference in gender attitude to computers concluded that boys dislike reading from computer screens because they had difficulty reading long pages of text. This could explain difference in mean times for task six. This study also stated that boys spent more time scrolling through Web pages scanning for matching keywords that would provide quick answers. It was also found that boys were especially impatient when the pages contained only text instead of pictures with captions. This may be due to the habits developed while playing computer games where little reading is required (Leong and Hawamdeh, 1999). From having observed the testing, the researcher is of the opinion that boys could be somewhat more impatient than girls in trying to find the correct answer to a task. Boys became increasingly impatient as they carried out more tasks and by task six they were skipping down the screen without actually reading the text. This opinion would concur with the findings of Leong and Hawamdeh. In general, apart from task

six, the test results indicate that there is no significant difference between the genders in the amount of time it took to perform the set tasks.

Simon (2001) argues that females have a more comprehensive information processing strategy than males and therefore there should be significant differences between the genders. However Bilal and Kirby (2002), in studying the Web navigational skills of a group of school children as they searched for information, found that children were inefficient in using the Web and possessed inadequate navigational skills. Due to the high number of overall errors made by participants during task completion, and the average length of time taken to complete tasks in the study conducted here the researchers agree with Bilal and Kirby (2002) that both boys and girls were 'inefficient' in using the World Wide Web. As such, and since the children indeed experience difficulties in using the World Wide Web, designers need to make information retrieval using Web-based-systems as simple as possible. Good design can help to make Websites more usable for children of varying ability.

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