Comparing the efficacy of different web page interface attributes in facilitating information retrieval for people with mild Learning Disabilities

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Declaration

I, Peter Edward Williams, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed:

[Peter Edward Williams]

Abstract

This research aimed to determine what web page attributes facilitate optimal website design for use by learning-disabled people – a topic hitherto rarely addressed. Qualitative research developed methods appropriate for this cohort, determined attributes that impact on usability and explored ways of eliciting preferences. Attributes related to menu position, text size and images, which were then examined quantitatively by comparing web pages of different layouts. Task-times were analysed, determining which attributes have the greatest impact on performance.

The main predictor of task-time was menu position, followed by text size. Images did not affect performance. The study also found that learning-disabled people have only 'serial access' to information when searching individual pages – it being imbibed sequentially until the required content is reached. Words on the left of horizontal menus were found quicker than those in the middle or right. Information access took longer from vertical menus, possibly because of the juxtaposition of distracting body text. Images were ignored until reached 'serially'– and thus did not help signpost content. Small-text was consumed quicker than large, as the latter took up more lines and required more eye movements to negotiate.

A three category rating scale and simple interviews elicited web design preferences. The 'neutral' category proved troublesome and so a refined four category scale without this mid-point was adopted which yielded a greater variety of results. In verbally eliciting preferences, 'acquiescence bias' was minimised by avoiding polar interrogatives - partly achieved by comparing different designs. Preferred designs were for large-text and images – the reverse of those facilitating fastest retrieval times, a discrepancy due to preferences being judged on aesthetic considerations.

Design recommendations are offered which reconcile preference and performance findings. These include using a horizontal menu, juxtaposing images and text, and reducing text from sentences to phrases – facilitating preferred large-text without increasing task-times.

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Chapter One: Introduction and context

Introduction

Much literature emphasises the need for social inclusion, informed choice and the active involvement in society of people with Learning Disabilities. This includes academic and research articles (e.g. Tarleton, 2004; Cameron and Murphy, 2002; Kaehne, 2009) and material produced by organisations from the Learning Disabilities field (Proud, 2008; Lawton, 2006) . The UK government has also been active in promoting inclusion (DH, 2001; 2005), including much equality legislation (e.g. HMG, 2010; 2005, 1995). Regarding the latter, of central importance for present purposes is The Special Educational Needs and Disability (SENDA) Act of 2001 (HMG, 2001). This established legal rights for disabled students in pre- and post-16 education ensuring that such students are not discriminated against in education, training and any student-related services. The Act makes it unlawful to treat a student 'less favourably' for reasons due to disability. This means that educational establishments must deliver courses in alternative ways and provide learning and informational material in formats appropriate for disabled learners. The Equality Act 2010 (HMG, 2010) brings together different equality laws including SENDA. It places an 'anticipatory duty' on educational establishments, which means that it is not acceptable to wait until a disabled person applies to a course or tries to use a service before thinking about what reasonable adjustments should be made.

Aspirations for equality and inclusion can only be achieved by the provision and consumption of accessible and relevant information (DH/CNO, 2008). For the last 15 years, information has, of course, become increasingly disseminated and available in electronic form.

Although it is widely acknowledged that the electronic medium may greatly facilitate information provision (e.g. Florian, 2004; Adam and Tatnall, 2008), in addition to institutional and other barriers (Williams, 2011), many commentators (e.g. Bohman, 2010; Banes and Walter, 2002; Rowland, 2004) including the present writer (Williams and Nicholas, 2006) have pointed out the difficulties people with Learning Disabilities have in negotiating web pages.

This research considers the use of the Internet to provide information for this cohort, focusing on the area of usability, and seeking to determine which interface attributes best facilitate information retrieval. Research participants were the people with Learning Disabilities themselves, for whom the information may be relevant and of interest. The research used as its point of focus the presentation of 'transition' related information - that is, the transition of young people from the protective environment of school or college to the 'adult' world of supported employment or other activity. 'Transition' has been described as a 'crucial' milestone in a young person's life (Cullen et al*,* 2009: p100). However, information provision on the subject has been identified as inadequate and inaccessible (Townsley, 2004; Tarleton, 2004), despite the fact that many people find it a very difficult time (Pilknick et al*,* 2010). There is evidence that the result of this is that the aspirations of people with Learning Disabilities largely go unmet at this crucial time (Beyer et al*,* 2008; Kaehne and Beyer, 2008).

This chapter begins by defining what is meant by 'Learning Disabilities' and discusses the different models of Learning Disability and where the research reported here is placed within these viewpoints. It then discusses the theoretical framework and context before concluding with an outline of the various issues related to researching involving this particular constituency.

Definitions of 'Learning Disabilities'

The World Health Organisation defines a Learning Disability as 'a state of arrested or incomplete development of mind' (WHO, 1992: p7). Somebody with a Learning Disability has significant impairment of intellectual ability, although the term covers a very wide range of cognitive levels. This is often accompanied by some problems in adaptive, or social, functioning . Note that the term 'Learning Difficulties' also appears in the literature (most notably being used by The Warnock Committee (Warnock, 1978) since which time, the term 'Learning Disabilities' has become more favoured and hence used in this thesis. Similarly, other writers term the condition 'cognitive disabilities', 'intellectual disabilities' and still, 'mental retardation'. Whilst the latter term is considered inappropriate in the UK, it is still acceptable in the United States, where there is even an 'American journal of mental retardation'.[1] These terms are all synonyms of the preferred 'Learning Disabilities', and so quotes are taken freely from literature that uses any of these alternatives.

The low intelligence level (in terms of Intelligence Quotient, below 70) sets the term 'Learning Disability' apart from that of 'Specific Learning Difficulties' (SpLDs) which, crucially, occur independently of intelligence (Westwood, 2008). The most common SpLD is dyslexia, 'a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling' (Rose, 2009: p10). Other SpLDs include, but are not limited to:

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[1] http://www.ncbi.nlm.nih.gov/nlmcatalog?db=nlmcatalog&term=%22Am+J+Ment+Retard%22[ta]

- Dyspraxia/DCD (affecting motor coordination);
- Dyscalculia (a difficulty understanding maths concepts and symbols), and
- A.D.D/A.D.H.D. (inattention, restlessness, impulsivity, erratic, unpredictable and inappropriate behaviour) (BDA, undated, a).

The present study is limited to 'Learning Disabilities' rather than SpLDs. These are commonly categorised into 'mild', 'moderate', 'severe' and 'profound' (the latter often termed 'multiple and profound' as profound Learning Disabilities often lead to lack of motor skills and other physical impairments). Learning Disabilities in an educational context are classified as 'special educational needs'. The legal definition of special educational needs is set out in the 1996 Education Act (HMG, 1996). Children have special educational needs if they have a learning difficulty (sic) which calls for special educational provision to be made for them. Such difficulties include having significantly greater difficulty in learning than the majority of children of the same age; or a disability which prevents or hinders them from making use of educational facilities of a kind generally provided for children of the same age in schools in the area.

The degree of Learning Disability can be measured with reference to:

- Intelligence quota (e.g. Hogg and Sebba, 1986a,b);
- Performance compared with people without Learning Disabilities on normative scales such as reading ages (Ware, 1996);
- Functional skills (Presland, 1991);
- Required support (Edwards and Luckasson, 1992).

Taking the first of these, people with an IQ of 50-70, are considered to have a moderate or mild learning disability; those with an IQ of 20 – 50 a severe learning disability, and people with an IQ of less than 20 a profound disability (WHO, 2001).

Those with mild intellectual disability experience a slower rate of language, motor, and social development than those without the disability. Often physical appearance is normal and Learning Disabilities tend to go relatively unnoticed until they enter school. They enjoy basic literacy and numeric skills and, with additional support, learn in mainstream classrooms, live independently, balance finances, work, have families, and lead fairly normal lives (Beirne-Smith et al*,* 2005).

People identified with moderate Learning Disabilities tend to experience difficulties in memory and learning, language and motor development and social skills. Temperament, motivation, personality, and sensory capability are also affected. They generally require a larger degree of support in school, work, and life in general than those with mild intellectual disabilities (Beirne-Smith et al*,* 2005).

Just for completeness, although not participating in the present study, individuals with profound Learning Disabilities frequently have other impairments, usually related to mobility, communication or senses (especially sight and hearing). Chronic health problems can also be common. Thus, these individuals often have 'profound and multiple Learning Disabilities'. Ongoing and intensive support is required (Beirne-Smith et al*,* 2005).

The causes of these disabilities can be genetic, environmental, infectious or pre-natal (PHGF, 2007). The Warnock Committee (Warnock, 1978) suggested that the term learning difficulties (or 'Learning Disabilities' as mentioned above) cover specific problems with learning in children that might arise as a result of a number of different things such as medical complications, emotional problems or language impairments. The UK Learning Disability charity Mencap (2005: unpaginated) describes a Learning Disability as 'affect(ing) the way someone learns, communicates or does some everyday things'. The charity notes that 1.5 million people in the UK have a such a disability, and there are many different types, which can be grouped together into the labels mild, moderate or severe. Some people with a Learning Disability also have a physical disability, often as a result of their cognitive limitations. However, as Mencap point out, neither a physical nor a cognitive disability stops someone from learning and achieving, if they get the right support.

People with Learning Disabilities and information needs

Just like everyone else, people with Learning Disabilities have information needs. They may well want to know, just as others would, where the local football team is playing next, what's showing at the cinema and what they need to wear at work. Also as with anyone else, they are only able to understand information if it is presented in an appropriate manner according to their abilities and vocabulary. Many individuals with Learning Disabilities have difficulties in accessing and processing information because of the way in which it is presented. For example, there is a heavy reliance on conventional forms of communication, such as text, even in electronic media such as the Web, leaving them vulnerable to disempowerment. Furthermore, people with Learning Disabilities are more prone to acquiesce to the suggestions of others (Grove et al*,* 2000; Sigelman et al*,* 1981).

Up to now, there has been little research on the topic of information needs or provision for this constituency, and even less of the use of information technology to meet those needs (Holmes, 2008). Norlin (1995) blames this on several factors, including the assumption that this cohort has no information needs; that their needs are met without their involvement, or that they are unable to make use of available information because they cannot understand it. Holmes (2008), in a rare study of library provision for people with Learning Disabilities, also laments a 'current' (2008) lack of research, suggesting that little had changed in the previous decade and a half. The Road Ahead (Townsley, 2004; Tarleton, 2004) has been the only major study to date to examine specifically the topic of the information needs and provision around transition of people with Learning Disabilities. It identified a poverty of usable and accessible information about transition in formats that suited young people with Learning Disabilities.

The problem statement

As Alison Pilknick and colleagues at the University of Nottingham (Pilknick et al*,* 2010: p415) state, 'For young people with intellectual disabilities … and their carers, transition … has long been recognised as a challenging issue'. As mentioned in the introduction, appropriate information is required to aid choices and decisions at this crucial time (Tarleton, 2004). However, much relevant material is inaccessible to people with Learning Disabilities. Even that written especially for this constituency may not be readily available because of difficulties in navigation and retrieval in an electronic environment. Clearly, this is an area of great importance (and hopefully, interest) to library and information professionals, although it appears to have been neglected. Even Jennifer Holmes' (Holmes, 2008) wide-ranging article looking at libraries and people with Learning Disabilities, does not discuss website design or any difficulties with mainstream websites – choosing to emphasise the equally important issue of assistive devices. Williamson et al (2000: unpaginated), who examined 'how … people with disabilities (can) more easily share in the brave new world of instant information and communication offered by the Internet … in the context of Australian public libraries', developed an Enhancing Internet Access (EIA) tool. This was 'a specialized Web browser, suitable for touchscreen systems'. However, how the browser was adapted was not outlined, and nor was the issue of optimum page design.

In fact, there is little empirical evidence regarding what accessibility measures actually aid website use – particularly for this cohort - and some of it is conflicting. Nielson, (1996) and Bohman (2010) for example, recommend avoidance of the need to scroll. By contrast, other commentators (e.g. Sevilla et al*,* 2007) urge the use of images, video etc. Pages containing such content, however, tend to be longer and therefore require scrolling.

This leads to the question of which factors are the most important in designing for accessibility and how information can be optimally presented and organised to be accessible and useful for people with Learning Disabilities, which is the problem which this thesis sought to address.

Aims and objectives of the study

Aims

The overall aims of the study were to determine which Web page interface attributes facilitate success in information retrieval by people with Learning Disabilities. The idea was not necessarily that this cohort would be able to access information autonomously. Rather, that an accessible, usable and relevant website could be a focus around which needs and interests could be discussed between the learner-user and a supporter, but which would nevertheless foster a feeling of ownership, empowerment and achievement in the former ('this site is for me, and I am able to navigate and understand it') and enable the supporter a lighter touch than may otherwise have been the case. 'Guided autonomy' sums up the approach. Secondary aims were to explore methods by which to elicit attribute preferences, and to determine the extent to which preferences and performance matched.

The research was undertaken in three parts:

- Part One: Elicited the important interface-related attributes in play in using web pages and examined issues inherent in working with people with Learning Disabilities. Fulfilling this enabled a more specific and refined aim for the second part of the study. Methods for eliciting user preferences were also explored;
- Part Two: Examined in detail and in a more quantitative manner each of the interface-related attributes elicited in Part One;
- Part Three: Determined which *combination* of these attributes facilitate success in set information retrieval tasks, using the metric of task-time, as outlined below, and analysed using Analysis of Variance (ANOVA) and multiple regression. An attempt was made to examine whether the varying literacy levels of the participants affected performance using the various interfaces tested. This was in recognition that that people with different levels or degrees of Learning Disability may have varying usability needs and so the optimum interface for one profile may not be the same for others. Finally, this part explored preferences in greater depth, modifying the methods

in the light of findings from Part One of the thesis, and to consider the extent to which preferences reflected performance.

For the quantitative element of the research, the dependent and independent variables are shown in Table 1.

Dependent variables	Independent variables
Task-time	Text size
Interface preference	Use/absence/quality of images
	Menu layout
	Literacy level

Table 1: Dependent and independent data examined

Objectives

The objectives were split into those followed in each of the three parts of the study.

Part One objectives were to:

- Formulate a series of set tasks comprehensible to people with Learning Disabilities to undertake on various existing 'accessible' website s selected on the basis of prior work and expressed target audience;
- Elicit the issues which appear to affect access to and preferences for content (such as layout, use of images etc.) by undertaking a series of qualitative usability tests on the 'accessible' website s selected;
- Explore ways of capturing user preference data by presenting participants with these accessible sites and testing methods (e.g. such as a 'smilometer' or similar rating system) to elicit such preferences.

Part Two objectives were to:

- Examine each of the issues elicited in Part One, in isolation and quantitatively by constructing tasks that focus on each one (e.g. on finding menu items; interpreting images etc.)

Part Three objectives were to:

- Construct various differently designed 'accessible' websites taking into account the issues elicited in Part One and investigated in Part Two;
- Compare different web designs on the basis of performance (task-time) and preference, analysing results quantitatively;

- Compare the performance and preferences of users with differing cognitive profiles (determined by literacy level[2]);
- Determine from the results what the optimum web page layout might be for the various groups established above.

A discussion of scoping parameters are dealt with at the start of chapter 5.

Study beneficiaries

It is envisioned that the beneficiaries of this research will be:

- Academic researchers;
- Practitioners, in both library and information positions and special education;
- People with Learning Disabilities.

These are discussed in turn, below.

Academic beneficiaries

Academics will benefit from the research for two reasons. First, there is a paucity of research evidence drawn from actually working with people with learning disabilities in the area of web usability (Lepistö and Ovaska, 2004). Expert opinions abound in this area (Hudson, et al 2005; Mariger 2006; Mirchandani 2003), but evidence to support these opinions is scarce (Freeman et al., 2005). Paul Bohman (2007) could only find seven journal articles that dealt with web usability design by directly observing people with cognitive disabilities. Second, no research in the area has been undertaken using the proposed method of data analysis. The comparison of various website designs and statistical analysis undertaken appears to be unique in the field. The study, therefore, will provide future researchers with a new method by which to explore not only web usability, but that of other ICT applications – and not only in the learning disabilities field. Indeed, it is worth noting that, as the research will be cross-disciplinary, a wider range of researchers will benefit generally than might be the case with a narrower approach.

Academic beneficiaries may come from the fields of:

- Information science
- Human-computer interaction
- Cognitive psychology more generally

[2] It was not possible, on ethical grounds, to seek further information – such as about specific cognitive defects or educational attainment levels etc.- that might have enriched this element of the study.

- Special education
- Education more generally (the method could be used to study possible learning differences with regard to the presentation of information online or to match different learning styles to the most appropriate interfaces)

Professional beneficiaries

Two main beneficiaries of the research are anticipated:

- Library and information specialists, and in particular, those who are developers of web-based information;
- Education professionals, particularly, of course, those working with people with Learning Disabilities or in Special Educational Needs or Functional Skills units.

Regarding the first of these professional beneficiaries, CILIP (the Chartered Institute of Library and Information Professionals) has recognised that 'poor literacy skills impact on people's education, health, employability, wealth and well-being', and that 'public libraries help address these literacy problems' (CILIP, 2011: unpaginated). Ann Harding, a trainer and consultant in the field of children's librarianship who has a special interest in the needs of those with disabilities, however, cautions that, 'many library resources are inaccessible to large numbers of young people [with Special Educational Needs] without additional support. The organisational systems that underpin library operations can themselves be a barrier to information retrieval' (Harding, 2010: unpaginated). Although this was with regard to the Dewey Decimal Classification system, she may well have been considering online public library catalogues and other web-based resources. It is hoped that the present research will inform the compilation and presentation of such electronic resources. As outlined later in this thesis, research has shown that information provision is both lacking and what is available, inappropriately written or presented for the cohort under study (Tarleton, 2004; Holmes, 2008; Norlin, 1995). The current research should at least inform information specialists in terms of appropriate provision and presentation of information.

With regard to education professionals, the author might modestly suggest there has already been an impact. When results were discussed with the education professionals with whom he worked, it was clear that these resonated with them and they appeared pleased to have their opinions and experiences vindicated by empirical research. Some also said they would consider more carefully how they create and present educational materials in the future. The issue of the nature and value of images was of particular interest.

People with Learning Disabilities as beneficiaries

It is hoped that people with Learning Disabilities will benefit also – indeed, the great motivation for the study, is to better facilitate information provision for this cohort. It is also hoped that they have already benefitted in one sense by being involved in the project and possibly enjoyed feelings of self-worth by participating and contributing.

Models of disability

Disability (of any kind, not just learning) is viewed from two main perspectives, known as the medical and the social models (Drake, 1999). Although the present study was carried out from the perspective of the social model, the medical model is also considered for comparative reasons. It is this to which this chapter now turns.

The medical model of disability

The medical model, as might be expected, 'concentrates on disease and impairments. It puts what is wrong with someone in the foreground, [and is] concerned with causes of disease. It defines and categorises conditions, distinguishes different forms and assesses severities' (British Red Cross, 2009: unpaginated). Importantly, 'the definition essentially refers to the location of the disability in the person, [and] … as a characteristic of the person' (Thomas and Woods, 2003: p15). Disability rights activist Mike Oliver points out that the medical model considers that barriers faced by disabled people can only be mitigated by treating the individual, rather than making adaptations for them (Oliver, 1990, 1992, 1996). This contrasts greatly with the social model of disability, discussed next.

The social model of disability

The social model eschews focusing specifically on the person or looking at impairments as only affecting the 'disabled' individual. Indeed, the model posits that people with impairments need not be 'disabled' at all. It thus shifts the burden from the individual who has to overcome disabilities, to society which ethically (and practically) needs to make suitable adjustments to 'enable' people. An example given by a recent Red Cross briefing paper (British Red Cross, 2009: unpaginated) is that of 'a deaf person wanting to attend a conference'. The paper explains:

> 'If no sign language interpreter is there, or no loop for a hearing aid, … the person is excluded – disabled. But with a signer … or a loop, the person can take part just the same as anyone else. They still have the same hearing impairment. But they are not disabled'.

From this it is clear that, importantly, the adjustment in the environment enables inclusive participation. Abbott (2008: p11) adds that 'we have seen a far-reaching change in the understanding of people who are not learning effectively. This has been characterised by a move away from the medical model of Learning Disabilities ("this child has learning difficulties") to the social model ("this classroom/school is set up in such a way that it is difficult for all children to learn") and a focus on the teacherly practice that can bring this about'.

Where this thesis sits within models of disability

This thesis is rooted in the social model of disability. The research proceeded on the basis (and, indeed, from empirical evidence [Williams and Nicholas, 2006; Minnion et al 2006]) that it is possible to provide meaningful information to people with Learning Disabilities through the medium of the Internet, given an appropriate level and style of writing, accessible website design and considered support. In other words, the disability is minimised by the adapting of the (in this case, information) environment. The approach throughout the study was that the optimal construction (or adaptation) of web resources enable people who might otherwise be excluded, to have access to information, advice and opportunities for self-advocacy.

The theoretical framework and context

Participatory action research

The social model of disability lends itself to 'participatory action research' or PAR (Hult and Lennung, 1980), the tenets of which were adopted in the present study. PAR emphasises the participation of all those involved in the research process. Whyte et al (1989) said that 'in participatory action research … people in the organisation or community under study participate actively with the professional researcher throughout the research process from the initial design to the final presentation of results …(and) are actively engaged in the quest for information and ideas to guide their future actions' (Whyte et al, 1989: p514; quoted in Sample, 1996: p319). Similarly, Kaplan and Alsup (1995: p41) define PAR as being 'active and democratic community participation … a focus on empowerment and … a tool for change'. Such research should not be disinterested and 'objective' but should, as Walmsley and Johnson (2003: p31) put it 'involve a responsibility on the part of the researcher and participants to ensure that it is used to positive effect in the society or organisation in which it is undertaken'.

The methods by which the present research involved study participants ore outlined in the section below, on , under the heading 'Participants as research partners' (page 91).

Issues related to research involving people with Learning Disabilities

Self-advocacy and research

Self-advocacy is at the heart of participatory research. The term has been defined as an individual's ability to effectively communicate, convey, negotiate or assert one's own interests, desires, needs, and rights. It involves making informed decisions and taking responsibility for those decisions (VanReusen et al*,* 1994). The aims of research promoting self-advocacy include empowerment (e.g. Oliver, 1992), inclusivity (e.g. Walmsley, 2001), and self-reflection (Porter and Lacey, 2005). As Test (et al 2005: p43) point out, 'Literature in both disability and educational research has identified the development of self-advocacy skills as crucial to the successful transition of students with disabilities into adult life'. Of course, self-advocacy skills do not come naturally – people need instruction in acquiring them (Test et al, 2005; Lehman, et al*,* 2000).

David Test and colleagues at the University of North Carolina at Charlotte (Test et al*,* 2005) reviewed the literature on self-advocacy, from which they constructed a 'conceptual framework' of self-advocacy for students with disabilities. The framework includes four components: knowledge of self, knowledge of rights, communication, and leadership. It is worth quoting the framework description at length:

> '*Knowledge of self* and *knowledge of rights* [original emphasis throughout] are viewed as the foundations of self-advocacy … The next component … is *communication* …. through negotiation, assertiveness, and problem solving … *Leadership* enables a person to move from individual self-advocacy to advocating for others … with common concerns' (p45).

Having defined and discussed self-advocacy, it is important to look at how such principles can be applied to a research context. Walmsley and Johnson (2003: p54) opine that 'Without self-advocacy, there would be no possibility of organised groups [e.g. of learning-disabled people] to work on research projects'. They cite several papers which describe how joint research has happened. Examples are:

- People with Learning Disabilities initiating their own research (Williams, 1999)
- Researchers and service-users working in partnership (Rolph, 2000)
- The co-writing of papers between researchers and study participants (Souza and Ramcharan, 1997)

- People with Learning Disabilities bidding for research funding (Swindon People First, 2002)

It is worth noting here that, as Valerie Williams and colleagues at the Nora Fry Research Centre at the University of Bristol point out, research aiming to benefit the lives of those with Learning Disabilities 'does not have to be carried out *by* the people whose lives are affected, but it places them in a position of control' (Williams et al*,* 2006: p297).

Ethics and researching with people with Learning Disabilities

The inclusion of people with Learning Disabilities in a research project, be they 'active' participants or the passive recipients of a particular intervention or treatment, raises the ethical problems of consent and choice. As noted by Lois Cameron and Joan Murphy (Cameron and Murphy 2007), obtaining consent to participate in research presents particular ethical challenges to researchers in the field of learning disability. The writers (p113) quote Dean and colleagues (Dean et al*,* 1998: p58) who point out that valid consent 'requires a person to appreciate the current situation, possess sufficient information, understand the information given, be able to weigh up the pros and cons, communicate a choice voluntarily and free from coercion'. Clearly, these are not aspects of giving consent that come easily to people with Learning Disabilities. Indeed, many people of average or even higher cognitive ability may find some aspects difficult.

Judith Scott and colleagues at the University of Edinburgh (Scott et al*,* 2006) draw from three sources (Harth and Thong, 1995; Doyal, 1997; Lowrance, 2002) to formulate issues inherent in obtaining informed consent from this constituency. These include the person's competence to give consent, the extent to which the research is in the person's own best interests; and whether the public interest will be served by research (Scott et al*,* 2006).

Cameron and Murphy (2007: p114) describe the consent issues that arose during the recruitment and consent procedure for a study on the efficacy of 'Talking Mats' (Murphy, 1997), 'an inexpensive, low-tech visual communication resource that helps people with communication difficulties to express their thoughts' (Cameron and Murphy, 2007: p114) The researchers used non-verbal indicators as signs of consent (e.g. eye contact, body language) in addition to spoken agreement. It was felt that 'face to face explanation is crucial in order to pick up both verbal and nonverbal signals from the participants' (p116). Carers were also consulted on participants' responses.

Another issue was non-participation. The researchers were careful to note this, as 'recording non-participation rates is one way of checking whether compliance is occurring through the power relationship which inevitably exists in a research project' (p116). Finally, the extent of real choice was questioned, as carers did not all appear to understand participation was totally voluntary, and that no coercion was to be applied.

Lewis and Porter, (2004) formulated a set of guidelines for critical self-evaluation by those engaged in collecting the views of children and young people with Learning Disabilities. In line with Cameron and Murphy (2007), they also included communication as an important aspect of Learning Disability research, about which they write, 'researchers have to establish the best medium through which communication takes place [and] conceptualize the message in a way that is meaningful to the recipient' (p195). They also discuss the following, of relevance to the present project:

- Research aims: The writers emphasised the need for the research to contribute positively to the lives of people with Learning Disabilities;
- Sampling: One of the main issues here is that carers or other adults without Learning Disabilities may give access only to particular individuals, as they 'will have their own views about the value of research and who should, or could, contribute to it' (p192);
- Confidentiality/anonymity: A number of factors may make it relatively easy to identify participants. For example, minority populations, which are heterogeneous in their characteristics, make it harder to make the promise of anonymity. It is incumbent upon the researchers to bear this in mind;
- Feedback: The authors feel it is essential that participants are offered information from researchers about study findings. With regard to this requirement, 'there is recognition of the importance of disseminating the findings of the study in a format that is accessible to those who have taken part and to their peer group' (p193).

The section below, on ethical considerations, below, describes how the research for this thesis addressed issues of informed consent, understanding the research, sampling, anonymity and feedback.

Difficulties inherent in research involving people with Learning Disabilities

Despite the many successful research projects undertaken with and by people with Learning Disabilities, many of which are cited in this thesis, there are nevertheless difficulties inherent in this approach. These centre around:

- People with Learning Disabilities as active participants
- Interviewing people with Learning Disabilities

- Administrative and bureaucratic considerations

People with Learning Disabilities as active participants

This refers to people as being actively involved in the research – perhaps even suggesting ideas, receiving feedback and other information on research progress and otherwise being an integral part of the research process – rather than being merely the passive 'subjects' of research, even if it is for their benefit. Of course, this is not easily achieved. Walmsley (2001) points out how difficult it is for people with Learning Disabilities to lead or shape research, given the level of expertise necessary. Porter and Lacey (2005) mention this and other problems in a brief review of the literature. They cite Kiernan (1999), for example, as saying that even where research might be of benefit to people with Learning Disabilities, it may require a level of thinking too difficult for them. They also point out, (citing Atkinson, 2002) that personal skills are needed in research, which, again, may not be within reach of the person with Learning Disabilities. Teaching and coaxing these might, prohibitively extend any research project (Riddell et al*,* 2001). Finally, Heron (1998: p28: quoted by Redmond, 2005: p77) warned against appearing to be inclusive whilst not actually taking the views of research participants into consideration in any meaningful way. He wrote that such a situation would leave such participants '. . . liberated on the ground floor while being excluded from participating on the upper floor'.

Interviewing people with Learning Disabilities

There are special difficulties inherent in interviewing (however informally) people with Learning Disabilities, and as such, there is a growing body of literature on this. Much of it (e.g. Brewster, 2004; Booth and Booth, 1996) concerns interviewing people with little or no speech – a feat not attempted for the research reported in this thesis. Even people who are able to communicate reasonably well may have problems in articulation and be unresponsive when presented with open questioning (Booth and Booth, 1996) although Lewis (2004) warns against the constraints of question and answer formats. One solution for those who find it particularly difficult to communicate, is the visual aid of cue cards (Lewis et al*,* 2008) or Talking Mats (Murphy, 1997; Murphy and Cameron, 2002).

For those with whom an informal interview might be possible, two problems are highlighted in the literature. The first is that of being mis-represented by interviewers (intentionally or otherwise), and the second, interviewees' possible 'acquiescence bias'. Regarding the first of these, Antaki et al*,* (2002) showed in their analysis of interviews undertaken by care staff, some staff members rejected various comments offered by their Learning Disabled charges and reformulated other remarks, to put their services in a more favourable light. The authors opine that these practices, also observed in assessment interviews between clinical psychologists and people with Learning Disabilities (Rapley and Antaki, 1996), result in interviewees being 'shepherded into producing pseudo-acquiescent responses' (p.213). 'These practices reformulate service user responses to the extent that they conform to the interviewer's "guess or stereotype" of the interviewees' beliefs' (p.216).

This leads to the second problem in interviewing - that of 'acquiescence bias'. This is the phenomenon of agreeing with a researcher (or, indeed, anyone in real or perceived authority) with little heed taken of the question. Meisenberg and Williams (2008) found that individuals who demonstrate an acquiescence bias tend to be less educated and intelligent, and Heal and Sigelman (1995) note a tendency for this cohort to concur with closed questions – a phenomenon succinctly put by Carol Sigelman and colleagues (Sigelman et al*,* 1981) as 'if in doubt, say yes'. As Finlay et al (2008: p354) note, drawing on a nine-month ethnographic study of choice and control in residential services, 'when understanding is uncertain and verbal communication limited staff have to decide whether a person is really exercising a choice, is simply choosing what they know or is responding to some feature … irrelevant to the choice being offered'.

In their review of the literature on response bias in research with people with Learning Disabilities, Heal and Sigelman (1995: p339) found that in some studies 'acquiescence by mentally retarded respondents was circumvented by recasting yes/no questions into an either/or or multiple-choice format'. The authors go on to say that, 'although, either/or questions induced their own bias - a disposition for respondents to select the latter of two choices regardless of content— this bias was not so large as the acquiescence bias. Moreover, enhancing the yes/no or either/or choices with accompanying picture representations of the choices was beneficial in increasing the likelihood of responses and in reducing the tendency for respondents to choose the latter of two either/ or choices' (p339).

Administrative and bureaucratic considerations

A completely different barrier was highlighted by Scott et al*,* (2006). The writers point out that being multidisciplinary, Learning Disability research has to satisfy numerous regulatory bodies. 'Almost all stages of research are affected, from participant recruitment to storage of data, eating into researcher time and consuming significant resources' (p273). The writers describe how it took 25 months for them to overcome all of the bureaucratic hurdles they faced in obtaining multi-agency approval for a study examining the cognitive development of children with Learning Disabilities.

Chapter Two: Web accessibility and usability guidelines

Definitions

Although there seems to be extensive literature on usability[3], according to Dey Alexander at Monash University, (Alexander, undated: p1) 'no single authoritative definition exists for either usability or accessibility'. Yu-Hui Chen and colleagues (Chen et al*,* 2011), and Pack (2003) make similar points. In its Web Content Accessibility Guidelines (WCAG), the World Wide Web Consortium (W3C), described below, does not formally define accessibility. The word is not even included in the glossary (W3C, 2006). Further obscuring the field, Heather Mariger at Utah State University (Mariger, 2006: unpaginated) points out that, 'many users and developers mistake usability for accessibility and vice versa' and provides a simple contrast, explaining that 'whereas usability considers how easy a site is to use and understand, accessibility is concerned with whether you can get there at all'. She argues that excellent accessibility might not make a site usable nor vice versa: 'a website that has a consistent and understandable visual design but without proper tags and tab functions may be usable but would be completely inaccessible to a person using a screen reader. Conversely, a web page that had all of the proper accessibility functions but featured 150 links on one page and required extensive scrolling would be considered highly unusable'.

Jim Thatcher, a practitioner in the field, provides a very simple definition of accessibility: 'Technology is accessible if it can be used as effectively by people with disabilities as by those without'. (Thatcher, 2004). The sentiment, if not a formal definition, was echoed by the World Wide Web Consortium (W3C) in its first set of guidelines:

> 'Following [these guidelines] will also make Web content more available to *all* users, whatever user agent they are using (e.g., desktop browser, voice browser, mobile phone, … etc.) or constraints they … [are] under (e.g., noisy surroundings, … in a hands-free environment, etc.)' (W3C, 1999: emphasis added).

Moving to the concept of 'usability', there have been – by contrast – many and varied definitions in the context of information technology. Jakob Nielsen defines the term as 'a quality attribute that assesses how easy user interfaces are to use'. (Nielsen 2003). For Whitney Quesenbery, usability can be defined by 'five Es': effectiveness, efficiency, engaging, error tolerant and easy to learn (Quesenbery 2002). For Asil Oztekin and colleagues (Oztekin et al*,* 2010: p455), usability signifies, 'the facility with which one can

[3] Searching the bibliographic database Web of Knowledge for: Topic=(usability) AND Topic=("World wide web" OR internet) yielded 1,526 returns, on 14.06.10

get something doing what it is intended to do … [and] … the extent to which an application is learnable and allows users to accomplish specified goals efficiently, effectively, and with a high degree of satisfaction' (p455).

Kasper Hornbæk quotes the International Organization for Standardization (ISO), which mentions 'effectiveness, efficiency, and satisfaction'. The ISO standard, helpfully, defines effectiveness, efficiency and satisfaction. The former is 'the "accuracy and completeness with which users achieve specified goals"; efficiency is the 'resources expended in relation to the accuracy and completeness with which users achieve goals'; and satisfaction is the 'freedom from discomfort, and positive attitudes towards the user of the product''(Hornbæk, 2006: p82, from ISO, 1998, p2). The standard emphasizes that usability relates to '*specified* users … in particular environments' (Hornbaek, 2006: p82, from ISO, 1998, p2: emphasis added). In other words, the degree of usability depends on the characteristics and needs of the users. A website that may be perfectly usable for web experts and/or an excellent level of literacy, may be extremely difficult to negotiate for others.

More simply, Benjamin Keevil (Keevil, 1998) describes usability as concerning how easy it is to find, understand, and use the information displayed on a web-based system, and Brian Shackel describes it even more simply as 'the capability to be used by humans easily and effectively' (Shackel, 1991, p. 24).

Web usability is a pre-occupation of governments – unsurprisingly when one considers that, for example, 'The [USA] federal government is the largest single producer, collector, consumer, and disseminator of information in the United States.' (DHHS, undated a): unpaginated). It is therefore no surprise that The USA Department of Health and Human Services has also defined the concept: 'usability refers to how well users can learn and use a product to achieve their goals and how satisfied they are with that process' (DHHS, undated b: unpaginated). In the UK, the Central Office of Information has developed general guidelines for web developers and web content editors across government covering the basics of usability (see COI, 2011) – surprisingly, however, without defining the term.

These definitions enable us to consider the relationship between accessibility and usability. According to Alexander (undated: p3), 'The goal of usability is a better experience for the user; better in terms of efficiency, effectiveness, and satisfaction. In contrast, the goal of accessible design is the removal of barriers to access based on disability, technical or environmental limitations. Considering this, accessibility has been described as a subset of usability (Brajnik, 2000). Krug (2006) goes as far as to say that a website is not usable unless it is accessible. However, the contrary is not necessarily true (Brajnik, 2000). A web page may have a vertical list of 100 hyperlink 'menu' items. If they all conform to accessibility standards, in terms of consistency, readability (i.e. colour contrast, font type etc.) and other requirements, the page may pass any accessibility checklist - however hard it is to use. Of course, these considerations have to be even more carefully considered when designing for people with Learning Disabilities. It is important to note that what might improve accessibility for one particular cohort or individual might introduce difficulties for another. For example, there is no 'typical' dyslexic Internet user (McCarthy, 2010) and that one particular text or background colour that is helpful for one person's access to information might hinder another's.

Difficulties faced by Learning Disabled people

In order to cater for people with Learning Disabilities, it is necessary to understand the difficulties they face when using electronic media. Cyndi Rowland (Rowland 2004) attempted to categorise these, and found four areas of concern:

- Perception and processing;
- Memory;
- Problem-solving;
- Attention span.

Perception and processing: This refers to 'an individual's ability to perceive and integrate information (e.g., visual or auditory) into 'meaningful chunks'. Reading falls into this category, although this skill also appears in other areas.

Memory: Rowland (2004) suggests that meaningful content has a greater chance of being remembered. In addition, in her view, users would benefit from many technical considerations including:

- Navigation that is consistent across the site and over time;
- The use of obvious 'breadcrumbs' (a list of the menu hierarchies from the 'home' to a current page, usually across the top of the page and often using arrows);
- Consistent use of style to denote hypertext links such as a blue underline.

Problem-solving: Rowland (2004: unpaginated) gives the examples of 'a 404 error', a bad link, or a link that does not take them where they thought they were going' as typical problems web users face, and urges developers to minimise these.

Attention span: 'Distractions such as scrolling text and blinking icons' are not conducive to people with low attention spans, and can make the Web environment difficult to negotiate (Ibid).

Kanta Jiwnani (Jiwnani, 2001) outlines specific difficulties including:

- An inability to use the mouse or other input device;
- Understanding complex screen layouts (e.g., multiple windows);
- Auditory output being confusing or difficult to understand;
- Difficulty with sequential operations;
- Problems if required to rely solely on textual labels … and controls.

By contrast, Brown and Lawton (2001), in their paper on designing web pages for cognitively disabled people, set out to consider the skills required to carry out these activities. They offer solutions to some of the barriers faced by people with a learning disability. These include:

- *Language skills*: which could be enhanced by browsers to convert text to speech, alternatives such as symbols and simultaneous signing tracks.
- *Motor Skills for computer control and information input*: special input and output devices could compensate for difficulties;
- *Interrogation and Retrieval Skill*: The authors suggest that research and development is needed in this area.

Website design for people with cognitive disabilities

As Paul Bohman (Bohman, 2004) observes, most accessibility guidelines and commentary are concerned with physical disability generally, with a large subset addressing visual impairment. Harryson (2003, p.2) agrees, pointing out that accessibility guidelines 'almost entirely … support people with low vision, while [those] for people with cognitive limitations are almost non-existent'. This is despite the fact that, at least according to Bohman (2004), there are far more users with cognitive disabilities than all the other types of disabilities combined, if one includes Learning Disabilities, reading disorders, attention deficit disorders and other common conditions comprising SpLDs.

Bohman and Anderson (2005) list a number of reasons why web design does not generally include consideration of Learning Disabilities. First, there is a scarcity of generally-accepted recommendations for access to the Web by this cohort. There is also a vagueness and subjectivity in recommendations which do exist - an example is that of Banes and

Walter (2002), who exhort web designers to make pages 'uncluttered' and the text 'simple and short'. Finally, designing computer algorithms for these recommendations is extremely difficult. Bohman and Anderson (2005: unpaginated) ask, citing guidelines they have found, 'how can "clear and simple text" [for example] be defined?' Automatic accessibility checkers do not help in this area. They 'can check for obvious accessibility problems, such as images missing alt text, data tables missing headers, forms missing labels, and so on, [but] … the focus of … these tools is on only one type of disability: blindness' (Ibid: unpaginated). Bohman and Anderson (2005) propose a conceptual framework for accessibility tools, in using functional cognitive disability categories. The guidelines they propose from this can be found below.

Lisa Seeman, in her plea for 'Inclusion of Cognitive Disabilities in the Web Accessibility Movement' (Seeman 2006: unpaginated) suggests other reasons for the neglect of this cohort in web design. She feels that cognitively disabled people are not within a site's target audience, and that designing for the cognitively disabled presents an undue burden on the content provider (from its perspective). Regarding the first point, Seeman points out that cognitive impairments do not necessarily signify an overall 'low intelligence', and that, therefore, educational site developers should not assume that such users would be excluded from their target audience. With regard to designing for cognitively disabled people, Seeman opines that all accessibility techniques are difficult 'until one understands their implementation and is familiarised with them. …. With practice … accessibility techniques for the cognitively disabled should no longer present an undue burden'.

Internet guidelines and frameworks

General guidelines

This section looks at the standards and guidelines written by various organisations and commentators, including those from authors cited above, which are relevant to the Learning Disabledcommunity. They are edited slightly to remove multiple entries across different sub-headers and guidelines that are too vague to be useful (e.g. 'Ensure that tables are carefully and appropriately used' – Pearson and Koppi, 2003, p26).

The most well-known and authoritative guidelines that currently exist are those developed over the last 15 years by The World Wide Web Consortium (W3C). This is an international consortium where Member organisations, a full-time staff, and the public work together to develop Web standards and guidelines. Since 1994, W3C has published more than ninety standards, called W3C Recommendations and, according to Brian Kelly and colleagues (Kelly et al*,* 2009: p212), 'has played a leading role in promoting accessibility of the Web for people with disabilities'. The W3C have taken account that there is a wide variety of individuals and organisations that create or commission web pages, including Web designers and developers, policy makers, teachers, and students. In order to meet the varying needs of such disparate groups, several layers of guidance are provided including overall principles, general guidelines, testable success criteria, with examples, links and coding.

Four principles provide the foundation for Web accessibility, according to WCAG's second version of the guidelines (W3C, 2008). Twelve guidelines provide the basic goals within these principles that authors should work toward in order to make content more accessible to users with different disabilities. The principles and accompanying guidelines that may apply to learning-disabled people are:

Perceivable: This means that users must be able to perceive the information being presented (i.e. it can't be invisible to all of their senses). The guidelines here are:

- Provide alternatives for time-based media (including audio or video);
- Make it easier for users to see and hear content including separating foreground from background.

Operable: Users must be able to 'operate' the interface. Guidelines include:

- Make all functionality available from a keyboard;
- Provide users enough time to read and use content;
- Provide ways to help users navigate, find content, and determine where they are.

Understandable: (i.e. to a 'target audience'). Guidelines include:

- Make Web pages appear and operate in predictable ways, e.g. by using consistent navigation.

The forth principal 'Robustness' relates to the content being interpretable by a wide variety of browsers, including assistive technologies, currently and in the future.

In addition to these universally applicable rules, WCAG suggests that people with Learning Disabilities need clearly structured content that facilitates overview and orientation, and consistent labelling of forms, buttons, and other content parts.

Current draft guidelines W3C (2011: unpaginated) go on to say that:

> 'People with cognitive … disabilities use different types of web browsing methods, depending on their particular needs. For instance, some people use text-to-speech software to hear the information while reading it visually'.

The same document also describes scenarios of people with Learning Disabilities. However, despite this and other references to this cohort, the guidelines have been cricisised. One formal objection stated that: 'the success criteria requirements for making content understandable largely [sic] ignore the needs of people with learning difficulties and cognitive limitations'. (Seeman, 2006: unpaginated). The complainant (and 40 co-signatories) makes the point that 'there are guidelines published by other groups that will make content much more accessible to these users. However, with the WCAG claim to address learning difficulties and cognitive limitations, people will not know that they need to look further'. In fact, there appears to be a paucity of research evidence on the efficacy of these current guidelines, although at least one study addressed this issue. Jeon Small and colleagues (Small et al, 2005) examined WCAG 1.0-compliant websites with 27 users with various cognitive disabilities. The problems participants encountered led the authors to argue that the cognitive disabilities analysed in the study were not accounted for in WCAG 1.0. However, it is important to note that the disorders included in the study were cerebral palsy and obsessive-compulsive disorder, the first of which may not necessarily result in Learning Disabilities (Fennell and Dikel, 2001), whilst the latter is not related to IQ (Peterson et al, 2001) and therefore not to Learning Disabilities either.

Brian Kelly and colleagues (Kelly et al*,* 2009: p213) argue that pages that conform to the WCAG accessibility guidelines may still not be suitable or appropriate for those with Learning Disabilities:

> 'due to limitations of their skills or their browsing or assistive technology. In addition, not all users have the same functional requirements but they are not offered any way to determine if their individual needs are met, or to find resources that suit their needs, regardless of how those resources may or may not suit the needs of others'.

The writers go on to argue from this, that 'the specifications are … all about testable technical attributes of resources. [However] … such technical attributes alone cannot … solve all … accessibility problems'. (Kelly et al*,* 2009: p213-214).

Both Brian Kelly (Kelly et al*,* 2009) and also Sotiris Fanou (Fanou, 2008) point out that the web now includes the phenomenon of 'social media', and as such 'is being transformed from "Read Only" to "Read/Write" … into being a platform on which content can also be created, edited and shared' (Fanou 2008: p354). Fanou claims that this is an element of the web that is missing from current WCAG guidelines, to the detriment of people with Learning Disabilities:

> 'Web accessibility guidelines [are] oriented more towards a [traditional] Web 1.0 based model where content is created by Web authors and consumed by Web surfers and … prioritise the needs of sensory and mobility disabilities while paying less attention to cognitive and learning difficulties'. For these reasons, 'people with Learning Disabilities are almost completely absent from using Web 2.0 technologies such as wikis and blogs' (Fanou, 2008: p354).

Finally, there are a number of general criticisms of the guidelines. Although these are for the most part peripheral for present purposes, it is worth mentioning that by Trenton Moss, who is particularly critical of the language used. He claims that although the W3C has defined terms, 'the definitions are just as jargon-filled and difficult to understand as the term being defined!' (Moss, 2006: unpaginated). He goes on to give some examples, including the phrase 'Programmatically determined', which is defined as 'Determined by software from data provided in a user-agent-supported manner such that the user agents can extract and present this information to users in different modalities'.

Paul Bohman argues that 'the cognitive disability sciences have not yet yielded a well-defined set of recommendations for Web developers' (Bohman, 2004: unpaginated), and attempts to redress the balance with his own set, based on 'a combination of existing research, commonly-assumed best practices, and thoughtful speculation'. Bohman is careful to note that 'not everyone in the cognitive disability field is likely to agree on the validity or accuracy of these recommendations'. Bohman categorises his recommendations include content to be:

- Transformable and multi-modal (e.g. adjustable text size, audio equivalent to text);
- Sensory and content focus (e.g. Include 'white space' around the content; emphasise important text);
- Consistency and conciseness, within and throughout pages.

Cyndi Rowland drew up a list of recommendations resulting from Bohman's (2004) framework. She suggests that a 'human factors' approach may be a useful starting point for web design, as 'developers often benefit from understanding … the user point of view'. (Rowland, 2004: unpaginated) Taking this perspective, she attempted to organise specific design considerations across areas that present common problems for individuals with cognitive disabilities. Sixteen considerations are listed, in tabular form, linked with four areas in which problems are encountered:

- Perception and processing;
- Memory;
- Problem-solving;
- Attention span.

The recommendations are presented in a table, in which the website elements are mapped onto the Learning Disabilities outlined. As an example, the recommendation to 'Ensure ample white space in your design rather than condense or clutter information onto your pages' is said to aid perception and memory, problem solving (although how is not made clear) and attention. An edited version appears in Table 2:

Samples of some areas that possibly affect users with a cognitive disability	***Perception and Processing***	***Memory***	***Problem-Solving***	***Attention***
Use the simplest language possible for the content.	Yes	No	No	No
Allow for text to be enlarged.	Yes	No	No	Yes
Pair icons or graphics with text so that contextual cues are available.	Yes	Yes	No	No
Avoid time-based elements (auto refresh, redirects, shut outs) unless the user is prompted to ask for additional time.	Yes	No	No	No
Insure that any "on-mouse" command has a large clickable area.	No	No	Yes	No
Use consistent and predictable navigation that is consistent throughout the site.	No	Yes	Yes	No
Provide demonstrations or audio descriptions whenever possible.	Yes	No	Yes	Yes
Use obvious breadcrumbs in your design.	Yes	Yes	Yes	Yes
Use descriptive headings and other organisational techniques (e.g., bullets) to chunk your material.	Yes	Yes	No	No

Table 2: Examples of website design-elements affecting people with learning difficulties, mapped onto cognitive problems they exhibit

Singh et al*,* (1998) review the special linguistic needs of 'language-disordered' people in terms of their potential as web users. They argue that for the web to be a true information highway, there must be facilities to enhance the comprehension of users who have special requirements, but would nevertheless 'benefit enormously from appropriately aided access to the web'. The authors suggest that designers should:

- Remove the need for reading and writing skills in web exploration through graphic representations and point and click interfaces;

- Reduce information overload, by simplifying text or providing options for abbreviated content;
- Provide the opportunity for audio and video representations to cue subject recognition.

Banes and Walter (2002) highlighted a number of the key issues in designing web pages, and made a list of recommendations which would make them more accessible to people with disabilities. None of these add to those elements already discussed above, although they do make the point that people with different disabilities may have different difficulties understanding the information on the web pages. They can be supported according to the level of their difficulty by, for example, altering mouse setting to make mouse and pointer easier to use or enhancing links using speech and sound navigation aids.

Cunningham and Coombs (1997) looked at various computer access approaches for individuals with different kinds of disabilities including visual, mobility, learning, and speech and hearing. In the case of Learning Disabilities the authors opine that there can be different approaches, strategies and solutions regarding to each usability barrier or difficulty faced by this group. They outline the following barriers and possible approaches:

Barrier: Individual has difficulty finding place on screen or in visually tracking text.
Approaches/solutions:

- Show only one line or word of print on screen at time;
- Experiment with various type sizes and fonts and margin and line width;
- Use a screen-reading program with speech synthesis.

Other problem areas covered relate to user input (e.g. spelling) which are beyond the scope of the present study.

The Disability Rights Commission commissioned the British Standards Institution to produce a Publicly Available Specification (PAS) document to help those who procure web design services to ensure that they are able to commission accessible sites. Much reference is made to WCAG guidelines, usability testing, automated checking tools, etc. There is a section for people with Learning Disabilities and another for those with 'cognitive impairments', containing similar advice to that outlined above. Recently (2010) PAS 78 has been replaced by BS 8878 2010 Web Accessibility Code Of Practice British Standard, which describes a process to ensure that websites and online services provided by an organization are accessible to all web users including persons with disabilities.

Matausch and Peboeck (2010) discuss the need to add an element of web usability in any consideration of how websites can be tailored for people with Learning Disabilities, ‘as the accessibility of content requires a strong usability aspect’. This consists of an examination of text content and layout. The authors offer several ways in which content might be made readable by people with Learning Disabilities, including some that they claim were designed for use in a print environment, but are suitable for internet requirements These include:

- Use sans serif fonts;
- Use short sentences;
- Speak to people directly;
- Never use a picture or a pattern as a background.

The authors mention other recommendations that may be applicable to a web environment, ‘with restrictions’, including the use of ‘large writing’. They point out that ‘accessible web design requires scalable font size. The combination should include a presetting of medium or large font’ (Matausch and Peboeck, 2010: p645). Finally, there are print guidelines which are not suitable to use in an internet environment, such as ‘Avoid cross references’. As the authors point out, ‘the internet subsists on hyperlinks’, so this recommendation would not be practicable (although, clearly, care should be taken in the organisation of hyperlinks and site structure).

Mencap, the mental health charity, has written guidelines intended to provide help for web designers when developing their sites, to ‘ensure that the web is truly accessible for all’ (Mencap, undated: p1). The guidelines they have produced mirror advice already outlined earlier. However, they are unusual in that they recommend testing any site with a range of people with a learning disability. The organisation cautions that ‘You will quickly discover that things you had assumed were easily understandable can be confusing to people with a learning disability’ (p3). Mencap is also notable in offering a comprehensive set of guidelines for the actual writing of content, outlined in the next section.

To conclude this resume of accessibility and usability guidelines, it is clear from the account above that many are similar, if not identical. The major differences are in the categories selected – usually dependent upon the basis on which the guidelines have been formulated. For example, Brown and Lawton (2001) choose categories which reflect their regard to cognitive factors inherent in web usage, whilst the BBC (Hassell, 2005) concentrate more on technical and site content specifications.

Table 3, below, is an attempt to summarise and integrate the guidelines described above. The headings reflect the most common used in the literature, and describe various aspects of websites (navigation, content etc.) rather than specific cognitive deficiencies/aspects to consider.

Topic / guideline	**Source(s)**
Design issues	
Transformable content focus.	Bohman (2004)
Use at least medium size text on each page,	Mencap (undated) Hassell (2005)
Make sure you do not use absolute font sizes so that users can adjust their browsers to make text larger if needs be (Ensure page layout supports enlarging of text).	Bohman (2004) Coyne and Neilsen (2002) BSI (2006) Hassell (2005)
Provide adjustable display image size.	Jiwnani (2001) Hassell (2005)
Insure that the user can view with their own styles and turn off colour and images if desired.	Rowland (2004) Hassell (2005)
Provide all content in a text format so that it can be read aloud by text-to-speech synthesisers. This guideline is mentioned extensively regarding web use by visually impaired people, but applies equally in a Learning Disabilities context, taking into account poor literacy skills.	Bohman (2004) Jiwnani (2001) Hassell (2005)
Multi-modality focus	Bohman (2004)
Illustrate concepts with drawings, diagrams, photos, audio files, video clips, animations, and other non-textual media. Coyne and Neilsen (2002), however, suggest minimal use of graphics, and Banes and Walter (2002) and Hassell (2005) suggest symbol support for plain text.	Bohman (2004) Singh (1998) Jiwnani (2001) Mencap (undated)
Provide audio for text content, and, by contrast, captions and transcripts for any audio or video. Many sites written for people with cognitive disabilities do this, including: Mencap: www.mencap.org.uk Sparktop: www.sparktop.org/dbtv/index.html Brown and Lawton (2001) also suggest 'descriptive audio' rather than just text-to-speech', but this is more for visually impaired people..	Bohman (2004) Jiwnani (2001) Pearson and Koppi (2003) BSI (2006) Mencap (undated) Fidgeon (2006) Brown and Lawton (2001)
Pair icons or graphics with text, and when graphics contain information, also provide the information in text.	Rowland (2004) Coyne and Neilsen (2002) Pearson and Koppi (2003) Brown and Lawton (2001)
Keep auditory presentations brief.	Jiwnani (2001)
If using animated graphics, scripts/applets etc., make sure that they can be turned off easily to allow users to focus on the site content.	Mencap (undated) Hassell (2005)
Sensory focus	
Limit the types of font faces in a document, and eliminate the use of italics or ALL CAPS.	Bohman (2004) BSI (2006)
Avoid background sounds that distract the user's attention (e.g. background music). Interestingly, the website of the Dyslexia	Bohman (2004)

Topic / guideline	Source(s)
Association (www.dyslexia.uk.com/) have beat-type music as a background on its site. Also, Brown and Lawton (2001) suggest use of auditory cues for 'function, meaning, or structure', including tones and music clips. Clearly the audio here needs to *attract* rather than *distract*.	
Include 'white space'—non-content space—around the content, between paragraphs, between headings, and links and buttons, and ensure sufficient spacing between lines of text	Bohman (2004) Coyne and Neilsen (2002) Fidgeon (2006) Hassell (2005)
Minimise the need for scrolling. This is in contrast to the BBCi standards (see Hassell 2005), which recommends scrolling rather than use of multiple pages	Coyne and Neilsen (2002)
Provide visual cues for function, meaning, and structure, such as colour, section dividers etc. Brown and Lawton (2001) suggest that colour 'is an excellent way to structure information, associating meaning with a visual cue'. They also point out that, by contrast, the WCAG Guideline 2 'effectively discourages the use of colour through the language used to define it'.	Brown and Lawton (2001)
Use high contrast between text (or graphics) and background – and use a plain background	Jiwnani (2001) Coyne and Neilsen (2002) Pearson and Koppi (2003) Mencap (undated) Hassell (2005)
Avoid using pop-up windows, cascading menus and new browser windows	Coyne and Neilsen (2002) Mencap (undated)
Interaction focus	Bohman (2004)
Navigation	
Provide multi-modal navigational cues (e.g. text + graphical/visual highlight + auditory instructions + animated demonstration). This might lead to 'information overload', however. If site navigation were made as simple as possible, the animated demonstration might not be needed. Brown and Lawton (2001) recommend a visual map, which may be more effective.	Bohman (2004)
Use obvious breadcrumbs in your design.	Rowland (2004)
Use consistent methods of indicating hyperlinks (e.g., blue underlined text) and make them descriptive (e.g., avoid "click here" and "more").	Rowland (2004) Coyne and Neilsen (2002) Mencap (undated)
When users must make a choice, keep all possibilities in the same vicinity	Coyne and Neilsen (2002)
Use the same navigation bars in the same place on your pages, and a clear linear route through, so that users can become familiar with what other information is contained in the site	Mencap (undated)
Align content in sequence (next/previous)	Brown and Lawton (2001)
Limit the number of links on a page	Coyne and Neilsen (2002) Hassell (2005) Brown and Lawton (2001)
Search	
Offer a search engine that is forgiving of spelling errors.	Coyne and Neilsen (2002)
Do not rely solely on a browsing interface for your site's search capabilities.	Coyne and Neilsen (2002)
Help facilities	
Make it clear on the home page who you should contact if you are having difficulty accessing the site or need to contact the organisation by telephone or letter. An email address is not sufficient if you are having difficulty using the Internet.	Mencap (undated)
Include large, clear, home and help buttons on every page of the site, and in the same place on each page	Mencap (undated) BSI (2006)
Design and layout.	
Carefully plan the layout of the home page so that it is	Coyne and Neilsen (2002)

Topic / guideline	Source(s)
immediately obvious what service or information is being provided.	Mencap (undated)
Have a consistent, clear layout of pages. Some commentators state that left-aligned text is easier to read than justified text, which in turn is easier to read than centre- or right-aligned text (see e.g. webcredible (2005) and Hassell, 2005)	Banes and Walter (2002) Coyne and Neilsen (2002) Pearson and Koppi (2003) Hassell (2005) BSI (2006) Fidgeon (2006)
Ensure that similar interface elements and similar interactions produce predictably similar results.	Bohman (2004), Jiwnani (2001)
Provide an obvious way for users to get back to simpler content if they find themselves on a page above their reading level	Fidgeon (2006)
Create a navigational scheme that is consistent across pages within a site or within related sections of a site.	Bohman (2004)

Table 3: Web design accessibility and usability guidelines, aggregated and tabulated

It is worth mentioning the existence of automatic accessibility checkers. As Bohman and Anderson (2005) point out, several tools can check for obvious accessibility problems, such as images missing alt text, data tables missing headers, forms missing labels, and so on. All of these issues are important to accessibility. However, the focus of the vast majority of the algorithms in these tools is on only one type of disability: blindness, with the most neglected category being that of cognitive disabilities.

Guidelines specifically related to content

A number of recommendations relate specifically to content, and in particular, text. The 'WCAG 2.0' guidelines state that 'the information … must be understandable to a target audience'. Towards this end, one should:

- 'Make text content readable and understandable' (there is much on the use of abbreviations, jargon and general reading level);
- 'Make Web pages appear and operate in predictable ways [e.g. by using consistent navigation etc.];
- 'Help users avoid and correct mistakes [offer instructions, include error identification etc.].

Regarding WCAG and people with Learning Disabilities, the guidelines advise 'Simpler text', a requirement echoed by Banes and Walter (2002) and Singh et al, (1998), with the latter additionally suggesting that writers provide options for abbreviated content.

Mencap has produced possibly the most comprehensive guide, going well beyond general exhortations to use 'simpler text'. Its guide 'Making your website accessible for people with a learning disability' (Mencap, undated: p1) states that:

‘As a general rule, use clear and simple English with short sentences, simple punctuation and no jargon.

- Use headings, bullet points and summaries to make the main points clear.
- … Cut out unnecessary detail and present the important information in a logical sequence;
- Try to write as you speak. Don’t use jargon … or abbreviations. ….;
- Keep sentences short … have only one main idea per sentence ….;
- Use simple punctuation. Avoid … sentences broken up with too many commas;
- Use active and personal language. Using ‘you’ and ‘we’ makes your writing more direct and understandable;
- Be consistent … use the same words and phrases consistently even if it sounds repetitive’.

Bohman (2004: unpaginated) further suggests:

- Plac[ing] the …[key points] of a paragraph … in the first sentence;
- Organis[ing] content into well-defined … chunks, using headings, bulleted lists, and other visual-semantic organising schemes;
- Emphasis[ing] important text—or the headings to sections of text—with bold font faces or larger text size’.

Fidgeon (2006) adds:

- Avoid using words in their non-literal sense (e.g. “it's raining cats and dogs”)
- Avoid abstractions (e.g. provide a link to a telephone number rather than to ‘Contact us’)
- Provide simplified summaries of pages’ content at the top of the page.

Finally, the international ‘Easy-to-Read’ Network, a loose affiliation of organisations promoting accessible information content, has more advice. Its guidelines add that ‘well written Easy-to-Read text is simple but it is written in an adult and varied manner’ (Easy-to-Read Network, undated: unpaginated). This last point is extremely relevant. The present writer and colleagues found in previous research (Minnion et al*,* 2006) that older teenagers with Learning Disabilities were given age-inappropriate material to read, as there was little that met their chronological age available.

An aggregation of these language and text-related guidelines can be seen in Table 7, in the section ‘Preparing content for website use’ below. The extent to which both the general and the more specific text/linguistic guidelines were followed with respect to the websites constructed for this research is described in the section 'Creating the website' on page 100.

Chapter three: Literature review

Several aspects of this topic are appropriate to explore:

- The information needs of people with Learning Disabilities, in order to provide a context for the research;
- The use of ICT by people with Learning Disabilities,
- Studies factoring in help offered by supporters.

The information needs of people with Learning Disabilities

Before reviewing studies which concern the use of information technology by people with Learning Disabilities in accessing information, this section begins by examining the evidence accrued around the information needs around transition of this cohort. Much of this, of course, is similar or the same as for any young person at this stage in life, discounting particular topics such as support services and similar disability-targeted information. These included transport, housing, leisure and money (Minnion et al*,* 2008).

In an earlier study with which the present writer was involved personalised digital profiles of participants were established, in which participants:

> 'used the … Internet to affirm their personal allegiance to popular forms and cultural icons that helped them to shape and represent their identities. They collated images in personal [digital] collections, as do typical mainstream teenagers, to share their likes and preferences with peers, family and staff. … Personal pages helped give individuals the same "kudos" enjoyed by their fellow Internet-active teens' (Minnion et al*,* 2006: p11).

However, it is clearly the case that, as the authors pointed out:

> 'despite having interests and needs that are the same as other people, the particular circumstances of the lives of people with Learning Disabilities, suggest that, in some situations, their cognitive difficulties make it necessary for carers and family to access, evaluate and use information on their behalf (such as that required to successfully negotiate a particular benefit, for example). … an inclusive "social" model of disability dictates that the principal goal in terms of information provision [is to] promote … autonomy rather than … dependence' (Minnion et al*,* 2006: p11).

That this is not always the case is illustrated in a study by Irene Tuffrey-Wijne and colleagues in the Department of Mental Health at the University of London (Tuffrey-Wijne et al*,* 2006). The researchers studied the information needs of people with intellectual disabilities affected by cancer (either by having cancer or having a close relative with it), and found that their research participants had not been provided with adequate information about the condition even though they expressed considerable desire for it. This was because their families were concerned such information would cause unnecessary stress.

Few other studies have looked at information needs and people with Learning Disabilities. Indeed, 'The Road Ahead' (Townsley, 2004; Tarleton, 2004) has been the only major study to date to examine specifically the topic of information needs in general for this group. The major focus of the research was on 'transition' information and was undertaken over a six month period between October 2003 and March 2004. Data gathering methods consisted of:

- Focus group interviews with young people, their parents and supporters;
- A systematic review of the literature on transition;
- A review of the information already available for young people, parents and professionals, including an evaluation of materials by young people and parents (Tarleton, 2004, p. 2).

Below is a bullet-point summary of the thematic information needs identified in 'The Road Ahead', including references to literature examined in the literature review (Townsley, 2004) that formed part of the investigation:

- Safety and risk (Ward et al*,* 2003);
- Health services/Health Action Plans;
- General health and diet (Pearson et al*,* undated);
- Rights to services and support from adult social work teams;
- Travel - access to transport and equipment;
- Money and benefits – age-related benefits; carers' needs assessments; earning money; learning about money management; having a bank account (Ward et al*,* 2003; O'Sullivan, 2001);
- Education and learning opportunities, activity centres, etc.;
- Careers and employment, employment agencies, supported work, etc.;
- Housing and accommodation – living alone; living with a family in a placement, etc.;
- Sexuality and sexual relationships (Morris, 2002);
- Friendships – importance of friends; leaving/moving school, college or home; making new friends;
- Leisure options and activities.

One may feel that information on Leisure activities may not be as important as that on benefits, health or education. However, Morris, (2001) points out that activities such as sports or evening classes are an excellent way to meet and make friends and, hence, overcome social exclusion. Also, these are activities that are undertaken under adult supervision with young people, but which become more autonomous as 'transition' occurs. Also, as Townsley (2004: p4) states, leisure is a 'big issue for all young disabled people'.

The Road Ahead also identified a poverty of usable and accessible information about transition in formats that suited young people with Learning Disabilities. Models of content that user testers with Learning Disabilities identified as useful were particularly those created by young people themselves and content using rich media (animation, photos and graphics) to share people's individual experiences.

The Transition Information Network (TIN) is one of the few organisations addressing this issue. TIN is an alliance of organisations and individuals who work together with the aim of improving the experience of disabled young people's transition to adulthood, and it maintains a website for parents, carers and people who work with and for disabled young people in transition to adulthood. The topics TIN uses are similar to those identified in The Road Ahead, although it does not have a specific section on safety/risk.

As mentioned earlier, information technology (and particularly, of course, the world wide web) is widely recognised as having the potential to facilitate the dissemination of and access to appropriate information, in this case on the topics outlined above. This section now turns to the literature examining the research on the usability of the Web for this purpose.

Studying web usability with people with Learning Disabilities

Expert opinions abound in the area of accessibility and usability of web technology and content for individuals with Learning Disabilities (Mirchandani 2003; Hudson, et al*,* 2005; Mariger 2006; SEDL 2003). Although these contributions have drawn increased attention to the information and technological needs of individuals with specific cognitive challenges, empirical evidence to support and validate these expert opinions is scarce. Armando Rotondi and colleagues at the University of Pittsburgh undertook an extensive literature search and review of guidelines addressing 'cognitive deficits' (Rotondi et al*,* 2007: p205) and found that 'design recommendations for persons with cognitive deficits were based on the authors' knowledge and experience with persons who had physical and sensory disabilities' (i.e. rather than intellectual or Learning Disabilities). The authors also found from their same review that 'there has been no usability research on the types of designs that are effective for … persons [with cognitive deficits] … Virtually all published website usability studies have focused on people with standard information-processing abilities' (p204). Not surprisingly, calls have been made for increased study in this area (Bohman and Anderson, 2005, Shneidermann, 2000, Friedman 1996).

One approach to the issue has been to test the usability of two versions of a website - a 'conventional' site and one adapted on the basis of 'easy-to-read' guidelines. Karreman et al*,* (2007) undertook such a study, with two groups of 20 participants. One group had intellectual disabilities but could read, and the other group did not. The investigators tested whether the easy-to-read website was more accessible and usable for the participants with intellectual disabilities. All 40 participants were 'frequent' Internet users (using it at least once a week).

Two versions of a website for a welfare and care organization were developed, including a home page with some general information about the care provider and four other sections. 'The content was based on a leaflet that was written for the care provider organization, describing its main services and activities in standard well-written text. The conventional (or, 'non-adapted' as it is described) website contained the leaflet information. For the adapted site, the text was made easier to read on the basis of the easy-to-read guidelines,' (pp.511).

Each of the two versions was used by a group of test participants with 'intellectual disabilities' and by a control group (those without intellectual disabilities). The two versions of the website were tested for;

- Efficiency (searching and reading time);
- Effectiveness (comprehension);
- Satisfaction.

Participants undertook five search tasks on one of the two websites (such as to search for information about courses and discussion groups). They then had to answer 14 questions about content. Seven of these could be answered with text-based information, while the others had to be deduced from information in the site (inference questions). The 14 questions were also given in two different formats. Eight of the questions were open questions; the other six being multiple-choice. The two formats were equally divided over text-based and inference questions.

As the researchers note, (citing Kintsch, 1988) studies of reading processes have shown that making inferences requires a deeper form of processing and comprehension than just recognition of information. The aim of using two types of questions was to see whether the adapted text increased comprehension of verbal content both at the recognition and the inference level. Satisfaction with the website was measured with an adapted version of the validated Chen and Wells' (1999) instrument for measuring, as it is titled 'Attitude Towards the Site', consisting of statements about the site, scored on a five-point rating scale, from definitely disagree (1) to definitely agree (5).

Results showed, as noted above, that people with intellectual disabilities 'need more time to read the text than a control group of people without identified intellectual disabilities, even when that text is easy-to-read'. They also 'need more help to find the pages in a site, again also when the verbal content is adapted to their needs' (Karreman et al, 2007: p514). In fact, in these terms, there were positive effects in writing the information in an accessible way – there were almost no differences observed between the two versions of the site. In terms of site comprehension, the accessible (easy read) site was significantly better than the other site, in that it helped increase comprehension, both for the participants with intellectual disabilities and for the 'mainstream' participants.

Regarding site satisfaction, 'participants with intellectual disabilities preferred the adapted website while participants without identified intellectual disabilities preferred the non-adapted website. In other words: each group liked the website best that was geared to their reading and intellectual levels' (p517). This result leads the authors to recommend stating why the site is adapted, 'in order not to alienate non-disabled visitors of the site'(p518). There also a suggestion that there could be a 'carefully attuned mix of adapted and non-adapted verbal content' and that 'information which is visible at high-level pages could be made easy-to-read, with links to more specific, non-adapted information for those who want to know and read more' (p518).

Importantly, the authors conclude by saying that 'Designers and writers of verbal site content can assure that they have met the WAI guideline about the clearest and simplest language only by involving test participants with intellectual or language disabilities' (p518).

Sevilla and colleagues (Sevilla et al, 2007) at the University of Valencia were also interested in information retrieval. They examined contents item choice and browsing by a group of 20 participants, each having a degree of mental retardation ranging from mild to severe (age range 24 to 46). The authors created a simplified web browsing system and two types of pages: those that allowed the user to choose among several options, and those that allowed the user to browse the selected options. The browser consisted of:

- 'Back' and a 'Home' buttons only on the toolbar – large for easy usage;
- Highlighted images on 'mouse-over' (when the cursor is on the image) and descriptive text;
- No scrollbar (e.g. there is no content below screen level on a standard browser).

The constituent pages consisted of:

- Captioned images (using large text);
- A maximum of five content items;
- Highlighted images on 'mouse-over' and descriptive text;
- A 'selection' pictogram (a pointing hand image) indicating both the action to be done (choice) and the kind of page currently viewed.

This is shown more clearly in Figure 1, below.

Figure 1: Simplified web browser and contents page (From Sevilla et al**, 2007)**

The study was intended to demonstrate that:

- The web design was usable for people with cognitive disabilities;
- The philosophy and underlying architecture of this design is appropriate for giving steps towards a testable protocol on cognitive accessibility;

- For the end-user group targeted, the level of usability of the accessible design is higher than the level of a typical website .

Twenty participants were presented with the accessible and a ‘conventional’ web page, the former being an adaptation of the latter (apparently set-up specifically for the experiment, rather than being pre-existing). Unusually, they were not given any tasks, but simply observed as they browsed the sites. The following three steps were undertaken by all participants (Sevilla et al*,* 2007: p15):

- ‘1st step: Teacher-directed navigation;
- 2nd step: Free navigation with teacher support when requested;
- 3rd step: Free navigation without teacher support’.

Success was measured in terms of specific events observed, such as simple actions (use of the back button) or less well-defined behaviours (showing understanding of the site). Three measures were taken: efficacy, efficiency and satisfaction. Efficacy and efficiency were calculated in terms of measures of understanding of the website (based on interaction with the observers), number of ‘visits’ (including intended and unintended); use of navigational buttons etc. Neither term was defined, and measures of each overlapped considerably. Indeed, in the few measures where they did not – the use of navigational buttons counted only towards a measure of efficiency and not efficacy – it was difficult to determine the reasoning. Satisfaction was measured by noting cues such as the number of gestures of complaint or of lack of interest; number of positive and negative comments etc. Part of the observation schedule can be seen in Table 4. That relating to teacher support is discussed below.

	USABILITY MEASURES	
EFFICACY	Understanding of the web	Number of times the user shows he/she understands the web − Number of times he/she does not understand the web
	Total number of visits	Voluntary visits Mistaken visits Visit through indication of the teacher Resources of more than one minute (cinema video trailers or music audios) Publicity pages Step-by-step structured pages
EFFICIENCY	Autonomy	Voluntary visits − Visit through indication of the teacher
	Success trials minus errors	Voluntary visits − Mistaken visits Resources of more than one minute − Publicity pages clicked by error Step-by-step structured pages Home button Back button
SATISFACTION	Motivation and interest	Number of smiles − Number of gestures of complaint or of lack of interest Number of positive comments − Number of negative comments Number of times he/she shows he/she would like to repeat − Number of times he/she wants to withdraw
INTERACTION WITH THE TEACHER		
	Support and requests	Number of support actions carried out by the teacher Number of support requests made by the participant

Table 4: Observation schedule (detail) used for calculating the measures of usability (from Sevilla et al**, 2007)**

Findings indicate that participant search performance improved significantly ($p<.05$) in areas of both efficiency and efficacy when the accessible site was used. Also relevant to note, unlike findings of use with conventional web browsers, participant performance did not correlate with level of cognitive ability. No reason for this finding is offered, but it may be that as the site was accessible for all ability levels, other variables came into play.

Harrysson et al, (2004) observed a small sample of users (seven) as they navigated between different web pages using a standard web browser. Subjects, who ranged in age from 15 to 44 years, were set a series of web navigation tasks, on a selection of chosen websites. Results suggested that the group were adept at navigation. They used the forward/back buttons without difficulty, and recognised (and used) hyperlinks. However, where text-input was required, the users had difficulty - in writing a URL or a search term, for example. The researchers concluded that the ‘the processing of text can impede accessibility to the Internet for people with cognitive disabilities' (p141), and suggest that screen-readers, and text-scanning technology would support this user group.

Davies et al*,* (2001) examined the potential of a prototype accessible web browser, which they called 'Web Trek'. This incorporated various 'accessible' features including:

- *Audio prompts:* 'where a message was played describing the use of a button when the cursor arrow was placed over it (without clicking)' and 'error minimization" cueing, in which a message was played following a user-initiated event (such as a click) to guide the user to the next -most-likely step in a task .....
- *'Reduced screen clutter.* Only basic features being tested, plus a few others such as a print or exit button, were provided on the Web Trek interface, minimizing screen clutter.
- *'Personalisation and customisation*: The capacity of Web Trek to display the user's name on the Start button and Start Page appeared to be helpful to users.
- *'Use of graphics*: [including an (unexplained)] picture-based search feature
- *'Error minimization methodologies*… include[ing]… concepts such as consistent placement of familiar buttons from screen-to-screen, automating steps when possible' (p110).

Twelve adult individuals with 'mental retardation' (intelligence scores ranging from 50 to 72) and no previous Internet experience, performed several typical Internet access tasks with an accessible and also a standard (Microsoft Internet Explorer) web browser. Three tasks were undertaken, which involved searching for Websites, saving Websites to a favourites list, and retrieving saved sites from such a list. Measures of success included frequency counts for the number of prompts required to complete the tasks for each browser, number of errors made with each browser, and number of task completions.

In addition to these measures, informal assessments were made of participants' level of engagement and enjoyment. In this respect, the authors note that 'all participants reported that it was a pleasurable experience for them to use the Internet and demonstrated their enjoyment by asking to do so again' (p110). The main findings of the paper were that 'the prototype web browser required significantly fewer prompts for people to use independently' (p111) suggesting – as with other literature reviewed here (e.g. Sevilla et al*,* 2007) that real benefits accrue if electronic interfaces are made more accessible.

The picture based search feature (in which website contents were depicted by images) was 'very helpful to users' (p111), although the exploitation of this feature and information retrieval success were not explicated. Other limitations in the study are outlined by the authors. These include the use of a minimal number of research subjects and the use of only one of the browsers by each group. Despite these limitations, the researchers suggest that 'overall, results of this project provide preliminary evidence that the Web Trek browser provided better access to the Internet for individuals with mental retardation than did a widely available web browser (Internet Explorer)' (p112).

Lepisto and Ovaska (2004) undertook a similar study to that of Davies et al*,* (2001), described above. The authors set out to understand how the usability of a web interface could be improved to better suit people with Learning Disabilities, although the article confines itself to an outline of the (multi) methods used and why it is necessary to approach the issue of usability in a triangulated fashion.

Ten students with (unspecified levels of) 'cognitive disabilities' were observed using computers in the classroom as part of the normal course of a class. 'Informal walkthroughs were conducted where students showed researchers what they do on computers,' (p306). An observation sheet – again, not detailed in the article - was used to assess the performance of the participants. 'Experts' also evaluated the interface. For the latter 'the application was evaluated against the heuristics proposed by [Jacob] Nielsen (Nielsen, 1994a) was done by the researcher and her research assistant independently of each other' (p306).

Results showed that 'The expert evaluation revealed usability defects different from those found by observing users. The experts found usability defects that were not marked as usability problems in the observation of real use situations. On the other hand, the experts missed some problems revealed later in the observational study. This, and the variety of data accrued from each method, led the researchers to emphasise the 'need to collect data with several complementary methods, and to adjust the methods to suit the characteristics of the participants.' (p305)

Finally, with regard to investigations of websites in themselves – and not just individual attributes - Choi and Bakken (2010) created a multimedia educational Website for 'low-literate adults' attending a Neonatal Intensive Care Unit (NICU) in the United States. This included pictographs and photographs, and audio rendition of simplified text. The reading level of the content is stated as being 'at the 5th grade [10-11 year olds]' - although a screenshot of a page shows words such as ‘ductus arteriosus’, ‘defect’, ‘premature’ and ‘vessel’ included words which people who find reading difficult are unlikely to be able to read with ease.

Ten NICU parents were exposed given a number of information retrieval tasks using the resource, with performance being measured by the task-time and number of errors. A usability questionnaire was administered following the sessions (undertaken on a desktop computer in a usability laboratory), and field notes were taken of the cognitive walkthroughs participants were asked to perform.

Results showed that photographs were preferred over clip art ‘because these gave more realistic images’ (p572). However, by contrast, the authors note that photographs ‘are loaded with irrelevant details that are likely to attract the attention of low-literate users rather than key concepts’, although as no evidence (except references to other work) is provided, this appears to be predominantly the views of the authors. Based more on the evidence was the other problem noted by Choi and Bakken (p572) - photographs ‘are not neutral in gender and culture’. The authors found that ‘many participants perceived people in photographs as “not like me.”’ However, this area is perhaps beyond the remit of the current study, and is mentioned here simply as an example of the complexities of providing information pictorially.

Tânia Rocha and colleagues at the Universidade de Trás-os-Montes in Portugal (Rocha et al, 2012) were more focused in their research. Rather than attempt to test a website in a holistic manner, they compared web page menu entries with text and image only conditions. The authors investigated whether hyperlinks in menu lists are more perceptible with text or with images for people with ‘intellectual disabilities’, such as ‘Down syndrome, lack of attention, dyslexia and dysgraphia, classified as mild to moderate disabilities’ (p544) Results need to be treated with some caution as the participants included people with SpLDs, which, as outlined above, are not *intellectual* disabilities, as the paper appears to suggest. The study was based on direct observation, video recording, interview and an eye-tracking device. Ten participants took part in this study. They were divided into two groups and asked to find links to two specific pages on websites designed for the study. The websites presented an image navigation menu or a text navigation menu. An audio rendition of the link label was used in both conditions.

Results showed that participants found the correct links quicker when presented as images (with audio) rather than as text (again, however, with audio). As participants underwent two tasks it was possible to compare times for each to note if there was any improvement, in terms of speed of access and which condition better facilitated this. Again, a note of caution is needed, as there were only 10 participants and two tasks for each of the two conditions. That said, results suggested a greater improvement in performance with the images condition.

Away from website evaluations, Alistair Sutcliffe and colleagues (Sutcliffe et al*,* 2003) developed a prototype email system for cognitively disabled adults (aged 26 – 78) with differing impairments, described in some detail. The participants had minimal or no computer experience, and various cognitive disabilities. Four different interfaces were tested, which differed in the level of support provided for the user and complexity of facilities for composing e-mail messages.' The interfaces were:

- *Free format:* incorporating 'minimal prompts and presented with a blank e-mail message (p580)…;
- '*Idea prompt:* …a skeleton message on a particular topic was given' (p581) …;
- '*Form fill:* …provided users with a more complete message template with slots they could fill in with text of their own choosing;
- *Menu driven*: 'Similar to the Form Filling except that pull-down menus were provided for each slot, so the message was composed from five menus' (p582).

The participants were asked to complete a single task (composing an email), using the four designs in sequence. 'Notes and transcripts made from viewing …video recordings [of the sessions] were analysed to produce lists of errors and their associated causes' (p584). They were also 'interviewed to follow up on any problems they had encountered and to elicit any suggestions for improvements. They were then presented with screenshots of each design condition to remind them and asked to rate the designs for clarity, naturalness and completeness of sending a message' (p583).

Results suggested that the menu-driven option was preferred for ease of use, but the free-form interface was considered to be best for 'naturalness' (not surprisingly, as this was almost identical to a standard email client interface).

With regard to performance, three main groups of problems were elicited:

- Lack of knowledge about the functionality of keys for basic word-processing operations, such as the delete, backspace and caps lock keys;

- Poor conceptual model for mouse/cursor operation. Some participants had difficulty in relating mouse and cursor movement and in activating a cursor, and there were also problems with understanding the GUI interface metaphors;
- Poor user interface prompts.

As the authors state, 'only the poor command prompts could be identified as traditional usability problems which could be repaired within the application. Both command buttons were small … and were placed at the bottom of the screen (p587). Participants were reported to have learned about the keys, and some improved with regard to the GUI interface.

Four different types of problem were also noted with regard to the nature of the task: these were: 'first, difficulty remembering the specific e-mail task; second, difficulty in generating ideas for a message; third, lack of greeting and closure; and fourth, reduced error monitoring' (p588). With regard to the first of these, all participants were able to write a message, but four of them did not write anything on the given topic - inviting someone for a coffee. With regard to error monitoring, 'although users demonstrated knowledge of basic grammar and writing rules, they did not recognise obvious errors such as large gaps in space, repeated sentences, and missing text' (p588).

No consistent themes were identified in terms of errors observed in composing e-mail. 'For example, difficulty in generating a message was observed in both the Free Format and Idea Prompt condition, which was counterintuitive to the hypothesis that more structured conditions displaying ideas for a message would result in less difficulty generating and sticking to a set topic' (p588).

Various suggestions were made with regard to remedial measures. These were:

- 'Further training and assistance', although it was admitted that ' training will not always be the answer' (p595);
- Redesigning the keyboard, including the 'design of an explicit "Delete" key on a specialised keyword or labelling the backspace with "Delete" on a standard keyboard'. This 'could eliminate the need to remember the function of the backspace key', and 'set a limit on the repeat key function … so when users inadvertently hold down a key it does not repeat continuously' (p595);
- Redesigning the desktop, to 'make the menu options visible without the necessity to pop up the menus' or use 'specialist devices or arrow keys' which 'may make menu selection easier for some users'.

The authors note, however, that participant difficulties were 'idiosyncratic', and acknowledge that it might not be appropriate to use 'the results of our study as suggestions for usability improvements in the traditional manner' (p595). Instead, they suggest that 'it may be more instructive to investigate individual differences, so that interfaces might be tailored to a specific person's needs'.

Armando Rotondi and colleagues at the University of Pittsburgh (Rotondi et al*,* 2007) appear to be the only researchers to have compared various different 'accessible' website layouts for usability, rather than comparing an accessible versus a 'mainstream' site or one or the other individually. The aim of this study was to 'develop an understanding of the design elements that influence the ability of persons with severe mental illness (SMI) and cognitive deficits to use a website, and to use this knowledge to design a web-based telehealth (sic) application to deliver a psychoeducation (sic) program to persons with schizophrenia and their families' (p202).

Ninety eight people, all with 'a severe mental illness' took part in the research. Although the paper repeatedly talks of 'cognitive deficits', equating these with severe mental illness (e.g. 'the use of … websites, can involve complex cognitive activities, which may limit effective use by persons with cognitive deficits, such as those associated with severe mental illness' – p202) the sample included 32 participants (32.7%) who had graduated from High School and 5 (5.1%) who had an 'undergraduate degree'.

The research was carried out in three stages. First, an examination was undertaken of the design elements of websites that influence the ability of people with severe mental illness (SMI) and cognitive 'deficits' to use the Internet. These included, in particular, various aspects of language and vocabulary, with emphasis on how people with these conditions understand certain words and phrases and the ways in which they group them into themes. Second, insights gained from this first activity informed the design a of a web-based telehealth information service that delivered a 'psychoeducation' programme to people with schizophrenia and their families. Three interfaces were constructed and tested for comprehension and usability based on the results of the first stage of the study. Finally, a fourth – and definitive - interface design was created following from the feedback from the usability tests.

Considering each of these stages in more detail, for the first stage, a series of tasks was devised, as follows, with brief findings given for each:

- *Task A: Link Meaning and Predictability:* website labels (e.g., link labels, titles of resources) were evaluated. Participants were presented with a series of labels to read and declare if they had any difficulty doing so or in understanding any of the words. Results showed that compound labels ("I need to know what causes X") were hard to understand, suggesting that a simpler form ("What causes X?") would be preferable;
- *Task B: Link Meaning, Predictability, and Differentiation.* This tested the relationship between label and content. 'Each participant was given:
    - several cards, each had a label written on it … to be used to "organise" information on the website (e.g., a link from the homepage, a table of contents heading); and
    - a list of cards with titles of website resources and articles. Participants assigned each of the titles to one of the labels provided and explained the(ir) reasons' (p208).

  The main finding here was that participants took a very personalised and idiosyncratic view of the labels. For example, one title, "Getting help paying bills" was assigned to the label "information for families" instead of "Help paying bills" because the family was their first port of call when they needed money;
- *Task C: Card Sorting.* Using the title cards from Task B, participants were asked to put the cards into groups meaningful to them, and to suggest a label for each group. This task proved too difficult and was not completed;
- *Task D: Vocabulary.* Each participant was given a list of words which might appear on the web pages, and asked to define them. This was to identify words that participants misunderstood and/or preferred. 'The words included those that users showed some confusion about meaning in prior testing or that the research team judged as potentially confusing to users' (p208). Less than half of the participants understood terms such as 'relapse'. To improve the readability of the site, 'any terms participants preferred … were noted and incorporated in to the website' (p211);
- *Task E: Article Comprehension.* In an exercise similar to Task D, participants were asked to read aloud documents written for the website and to identify any words or – not covered in Task D - concepts not understood.

Ninety eight people completed the first four tasks, resulting in the link labels and vocabulary to be used to develop various website interface designs to test with participants with SMI and cognitive 'deficits' - the next stage of the study. Initially seven were developed, but these were reduced to three following what was described as 'initial testing'. Each design 'represented a different theoretical approach to organising and presenting the same resources and information' (p208).

The designs were:

- One: ‘Strict modular abstract design’: two navigational dimensions - website high level unchanging menu items across the top; context-specific items vertically (i.e. the items changed according to the page in which the menu appears); deep hierarchy of content. ‘To be effective, the variable navigational links required both more memory and context awareness … in order to comprehend one’s spatial location in the website and its relationship to these links’ (p211)
- Two: one navigation dimension. This was a table – although it could be argued that this represents two dimensions – with high level entries on the left and lower levels on the right, the latter being more descriptive/explicit. This model did not use a ‘variable navigational tool bar’ so presumably each of the pages had either the same table or only the high level menu entries displayed.
- Three: ‘flat explicit weak-modular design’: lower-level topic or labels (and therefore a higher number of modules or pages), achieved by using drop-down menus. The authors note that ‘of the three [designs], this design contained the most features focused on reducing … cognitive difficulties … It presented the shallowest structure and simplest hierarchy, making it the most difficult in which to get lost’. The link labels were ‘the longest and most explicit … requiring the least amount of interpretation’ (Ibid, p213).

Interestingly, icons and graphics were not used in any of the designs. This was not due to any fieldwork undertaken or from findings of prior literature, however, but rather because of the assumed ‘potential vulnerability to overstimulation’ (p118).

Twenty six participants undertook the website usability element of the study. For two randomly assigned versions of each of the three website homepages, ‘participants were asked to choose the link where they expected to find information on a specified topic or resource (e.g., “Where would you find information on treatments for schizophrenia”)’ (208)

‘A higher proportion’ of participants completed 64% of the usability tasks with Model Three (Flat, explicit) than with the other two designs (p = 0.03). Additionally, 57.3% of participants were correct on their first choice of answer with Model Three, with 54.3% with Model Two (Hybrid) and only 36.0% with Model One (modular) although the level of significance of this finding is not given.

Based on these findings and further feedback from participants (e.g. 'participants who did not prefer the flat design noted that the font in the menus was too small' [p214]) the third stage of the study was undertaken. This was to design a website that incorporated the most effective features of the other models and modified them according to results from stage two.

The resulting website (Model Four) contained the following features:

- Long labels for links 'thus reducing or eliminating a user's need to think abstractly' (p216). This is based on findings which suggested that participants 'made highly concrete, personal and idiosyncratic associations between the resources they were asked to find and the labels from which they had to choose' (p219);
- All site contents on one page (presumably this refers to all the links, rather than actual content, as there would be no need for links if the latter was the case) that 'reduced the amount of navigation required to access contents' (p216);
- Pop-up menus activated on 'mouse-over' (replacing arrowheads in the dropdown menus, which had proved troublesome) making it possible to navigate from the homepage to any destination with only one mouse click;
- A constant navigational bar at the top of each page (added from the previous version). The homepage used a frame which kept the tool bar at the top of the display even if users scrolled down to facilitate easy navigation.

The paper concludes (without testing the forth model) that people with 'cognitive deficits' have 'distinct design needs' because of 'problems in accurately interpreting or understanding the organization and conceptual categorization of a design and, subsequently, in locating the information they are seeking'. However, as the paper goes on to say, 'none of these are so great an obstacle that it is unfeasible to design a website that can be utilized by these populations'.

Finally in this section, Peter Zentel and colleagues at the Knowledge Media Research Centre, Tuebingen, Germany, (Zentel et al*,* 2007) also investigated a site with different attributes, but for content recall and understanding rather than usability. However, as they included symbols and audio in their tested conditions, their study is relevant. In short, the research investigated which representational formats may be beneficial to foster recognition and understanding of information, by users with Learning Disabilities. The authors argue that the more 'redundant' (in this case, repeated) information is presented, the bigger the chance that disabled users can process it according to their skills. People with reading disabilities, for example, will use spoken text or pictures to help process writing.

To investigate this issue, the authors constructed a learning environment which consisted of five pages that described basic aspects of computers and the Internet. Twenty students participated in a comprehension and recall test using the materials, from two schools for Special Educational Needs students in Germany. Their ages ranged from 14 to 22 years with an average of 19.4 years. During the presentation, participants were asked to tell in their own words what they had just read/seen/listened to on the page. The researcher varied the modality (visual, visual plus auditory) and codality (text, text plus pictures) attributes of the pages as follows:

- Condition one: text only;
- Condition two: text and audio – the text plus a computer-generated rendition of the text;
- Condition three: Written text and symbols – the information in written form plus additional symbolic form;
- Condition four: Written text, symbols and audio.

Examples of the page layouts for both text, and text with symbols, can be seen in Figure 2.

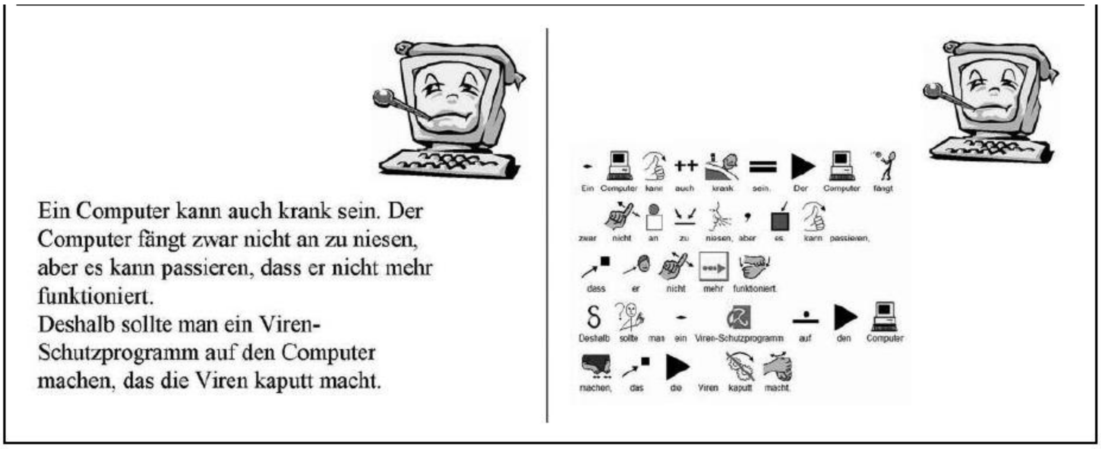

Figure 2: Web pages (detail) used by Zentel et al**, (2007) showing text-only and text with symbols conditions**

The relative effectiveness of the different conditions was measured by recall and understanding, rated by the researcher after viewing videotapes of the sessions, wherein participants were asked to describe what they had 'just' read, heard or seen (the time difference between exposure and recall/understanding task is not given in the paper).

A univariate ANOVA was carried out with experimental condition as the independent variable, and understanding and recognition as the respective dependent variables. Results suggested that 'the fourth condition which enriches written text with symbols and audio showed the highest scores for understanding and recognition, followed by the text with audio condition. The conditions which did not contain spoken text showed the lowest understanding and recognition scores.

An 'especially beneficial value seems to be due to the inclusion [with text and symbols] of audio'. The authors are quick to point out that 'it is now possible to add automatic speech support through a free plug-in for most common web browsers, a first step to make the Internet more accessible for users with Learning Disabilities could be achieved without major effort' (Ibid:p31). The authors add a note of caution, however - none of the differences reached statistical significance.

Studies factoring in help offered by supporters

A number of studies outlined above have included measures or consideration of the input and impact of supporters or researchers themselves. It has been pointed out extensively (e.g. Friend, 2005; Evans, 1993, Bozic and Murdoch, 1996), that the presence (and, indeed, quality) of support is an important factor in a special needs context. The influential Russian educationalist Lev Vygotsky goes so far as to say that undertaking an activity in a social context, with appropriate support, is a *necessary* (not simply 'preferable') step (i.e. even for people who do not have Learning Disabilities) towards being able to learn independently (Vygotsky 1978).

Given the support needs of many research participants and the vital role generally that supporters are required to play in the Learning Disability field, how supporters work with the their charges on negotiating ICT applications is an interesting area of observation. Several studies have included details of supporter involvement in people with Learning Disabilities using ICT.

In the study by Kerreman et al*,* (2007) described above, the support included in the study consisted of the interventions of the experimenter, who:

> 'offered assistance … after the participants expressed their inability to find the information more than two times. Her assistance consisted of a first question, asking the participants what they tried to achieve. .. in some cases [this] was enough to overcome the problems. When this was not the case, the experimenter

directed the participants to the page they had to visit. When the participants were on the correct page, no more assistance was given' (Ibid:p513).

Results showed that 15 (out of 20) participants with intellectual disabilities needed assistance, varying from one to seven times. Ten (also out of 20) participants 'without identified intellectual disabilities' needed assistance, on one or two occasions. On each occasion the help consisted of 'a first question, asking the participants what they tried to achieve. Just asking that question in some cases was enough to overcome the problems. When this was not the case, the experimenter directed the participants to the page they had to visit' p513). No further help was given, and no adjustment was made to the measures used (task-time).

Interaction with the teacher was also observed and measured by Sevilla et al, (2007) in the study outlined above. This was in terms of the number of support actions carried out by the teacher and those requested by the participant. Table 5, below, completes the observational schedule shown above in Table 4.

INTERACTION WITH THE TEACHER		
	Support and requests	Number of support actions carried out by the teacher Number of support requests made by the participant

Table 5: Observation schedule (part of) used for calculating the measures of usability (from Sevilla et al**, 2007)**

Results of these observations were factored into efficacy and efficiency measures of an accessible and a 'standard' web browser.

In Sutcliffe et al's (2003: p584) usability test of four email systems, described above, 'user problems could not be counted directly because the experimenter assisted the subject throughout the session'. Because of this intervention, such problems 'were defined as critical incidents (following Monk and Wright's [1993] terminology) which were apparent to the experimenter who then helped the users by explaining how the system should be operated and gave a demonstration of a command or system operation'.

Research into individual site attributes

As detailed in the results of the initial fieldwork, described below, menu position, text size and the use of images were all identified in the qualitative phase of the research as potentially important. This literature review therefore now turns to these areas to explore prior research.

Menu position

No research could be found which looked at people with Learning Disabilities. Nevertheless, outlining that which has been undertaken with 'mainstream' participants is useful, as in a sense it can be considered to be a substitute for a control group. In fact, even considering a non-disable sample, only a small number of studies have looked at eliciting information from horizontally versus vertically arranged text, as the present study attempted (Study Five and Study Seven, below). These have nearly all been with regard to reading (e.g. Coleman and Hahn, 1966, and Tinker, 1955) rather than in searching for a keyword, as would be the case in seeking a particular contents entry or in terms of the usability of technology. Other studies (e.g. Chaparro, and Liao, 2003; Yu et al*,* 2010) concern text that has been vertical orientated, rather than being standard horizontal text of only (or two) word line-lengths to be read as a list, and so do not address the issue of concern for the present study. Similarly of dubious relevance are articles which concern other alphabets which may not be read in the same way, such as Chinese (Miles and Shen, 1925; Hyojung and Lee, 2002) or musical notation (e.g. Carpenter, and Kinsler, 1995).

The present research (Studies Five and Seven) looked at what might be termed 'word access' – involving the search for individual words - rather than the reading and understanding of passages of text. Although word searches may be undertaken by serial scanning, as with reading, it is not incumbent upon the searcher to adopt this method. In other words, word seekers need not follow the left-to-right; top-to-bottom imperative required of standard reading. Thus, one might term this activity as 'random access' to words.

Helena Ojanpaa and colleagues at the Finnish Institute of Occupational Health (Ojanpaa et al*,* 2002) undertook what appears to be the only study considering both word-searching (e.g. where a single word or term has to be found, rather than the 'reading' needed to comprehend a passage) where text is presented in horizontal and vertical lists. Note that 'vertical' here and in the rest of this section, refers to horizontally orientated text, but with only one word per line, requiring the reader to scan downwards.

The aims of the study were to:

- estimate the size of the word identification span in the vertical direction, undertaken by manipulating the length of vertical word lists (and the inter-line spacing) and by monitoring the number of fixations (the eye resting on a word) used to identify the target word.;

- determine how different layouts (horizontal and vertical) manipulations affected eye movements and search speed. The lengths of both layouts were manipulated, although the horizontal condition did not extend beyond five words. More words were added, but on a new line, with the inter-line spacing also being manipulated.

Sophisticated hardware and software were used to measure search speed, eye movements (saccades and fixations, the former being the rapid movements the eye makes in reading) as participants searched for words presented on a computer screen.

Search times for vertical and horizontal lists did not differ statistically significantly. There was a longer mean fixation duration for vertical lists, but more fixations in horizontal lists, as the eye was required to scan a broader area. Overall, these two factors appeared to counter-balance each other. Subjects were able to read around four to five words arranged vertically per fixation before inter-line spacing was increased (in other words, they could find a word in a list of four words without moving their gaze). Also regarding vertical lists, the longer they were, the greater was the search time and the number of fixations per search. In the horizontal condition, the number of fixations per search also correlated highly with search time. The amount of space between lines was shown to be a factor, with significantly longer search times and number of fixations in the vertical condition, as interline space increased.

Jari Laarni and colleagues at the Helsinki School of Economics (Laarni et al*,* 2004) also compared the effect of reading vertical and horizontal text presented on a computer screen, although in this case, the activity was actually reading, rather than a word search. Participants were required to read 10 online magazine articles whose length varied from 974 words to 1308 words. There were five conditions: standard-text and four vertical text conditions (the latter being the conditions generated by combining justified and centred with hyphenated and full text). The authors argued that a vertical arrangement should have some advantages over the standard horizontal presentation. Two reasons were given – first, the reader does not need to make horizontal eye movements when reading vertical text. They should be able to shift their gaze 'quite straight' from the top of a page to the bottom. Thus, vertical reading should be 'somewhat faster'. As the authors point out, Ojanpaä et al*,* (2002) showed that it is possible in the case of vertical text for readers to extract additional information in the vertical direction – i.e., to take in the word below that which is being read in any given moment.

For the test, performance – in terms of task-time - in each condition was measured. All subjects (eight) participated in each condition, reading two articles per condition. The effect of familiarity was also examined, by comparing reading performance in the first and second reading session.

Results showed that the standard (horizontal) format was read significantly faster than the vertical formats – a result echoing a much earlier study by Coleman and Hahn (1966), who found that performance for the vertical condition was inferior to that for a standard horizontal text both under normal reading and tachistoscopic conditions (where the words are visible for a given time period only). However, there was no significant difference between the one-word-per-line formats and the hyphenated formats. Two reasons are given for the slower performance in vertical-text conditions:

- Because of need for 'frequent page shifts' (the text was arranged one page per screen, although the method of moving from one to the next is not made clear), readers have to manipulate text to a greater degree when reading vertical formats, and they have to move their eyes more frequently;
- There is a lack of practice in reading vertical text, so that 'readers have better control of their eye movements in a horizontal direction'. (p80)

There was no difference in number of fixations between the standard format and the vertical formats, although fixations were shorter in duration for the former. The authors conclude from this that reading vertically-presented text from a computer screen is 'quite efficient' in terms of the number of fixations.

It is acknowledged, that 'even though Western people read normal text horizontally from left to right, they have also practiced reading vertical text when they search for items from vertical lists, e.g. from telephone directories'. (p75) Nevertheless, the authors admit that it is possible that readers cannot take full benefit of absorbing peripheral information in the one-word-per-line condition. Curcio and Allen (1990) also posit that visual acuity falls off faster in the vertical direction than horizontally.

Of lesser relevance, but of interest, research into Chinese text reading also suggests that reading is faster for horizontally arranged than for vertically arranged texts. Hyojung and Lee (2002) found that this is due primarily to 'larger gaze amplitude for horizontal reading' (i.e. ones field of vision works best for horizontal text), resulting in a smaller numbers of saccades, or eye movements, and fixations.

Taking all of these findings in the context of web design, results suggest that there is a small advantage in adopting horizontal 'menu' list over a vertical one, even where the layout does not require scrolling when a vertical arrangement is used. There may be a greater imperative to use a horizontal menu where a vertical one would lead to some of the entries falling below the screen level.

Text size

As with menu positioning, there has been apparently no work on optimal text size (or style) for people with Learning Disabilities or low literacy levels. However, even information targeted at this cohort uses text, even if it is sometimes mainly to guide carers or supporters. Many users of the Internet may have a degree of visual impairment or dyslexia, or be lower-literacy users, all of whom will need clear, uncluttered pages (Ling and van Schaik, 2006) and an optimal font size and style. Aesthetic considerations are also important, both for usability (van Schaik and Ling, 2003) and for one's personal satisfaction. Type face and size forms a major part of page design.

Much work has been undertaken on the topic of type fonts and faces, but this has mainly been in the world of hardcopy (e.g. Tinker, 1963; Arditi et al*,* 1990; Chung et al*,* 1998). However, with the rise of the personal computer more research has looked at the electronic environment. In one major study, Jonathan Ling and Paul van Schaik from Keele University in the UK (Ling and van Schaik, 2006) report findings from two experiments that explored the influence in an online environment of font type and line length on a range of performance and subjective measures. A set of six websites was produced from which information had to be found in a series of information retrieval tasks. All sites consisted of a hierarchy of three levels. Further, each site was produced in eight versions, corresponding to four line lengths (55, 70, 85, 100 characters per line, or cpl) combined with two font types (Arial, Times).

Participants (72, all of whom had been using the web for more than a year) first undertook a practice 'round', where a series of questions were located at the top of the screen. After reading each question participants had to click on a button labelled 'Show Website '. The home page of the first site was then displayed, and an instruction given to find the answer to each question using the site. Once this was answered in a dialog box, the next question appeared. When the practice task was competed, the five other sites were brought into play in a similar manner. Participants completed a series of 40 further randomised questions (five sites, with eight questions each). Questions and answers were similar in length and complexity.

Results were described in terms of speed of retrieval, efficiency (number of pages navigated before finding the information) and aesthetic preferences. None of the main effects of line length and font type, or the interaction was significant, either in terms of average time-on-task for correct answers or for the number of pages visited before a correct answer was given. Between 96 and 98% of responses were correct, so no analysis was undertaken on incorrect answers. In other words, neither font type nor line length had any effect on information retrieval.

The same research took four items from Tractinsky et al's (2000) aesthetics scale were used to rate the eight types of web page used. The items used 7-point Likert scales, for example, 'I judge this web page to be:' with scale end points 'very ordered' and 'very disordered'. To measure preferences, participants were presented with all 15 possible paired combinations of line lengths, and asked to choose which they preferred. This procedure was repeated for font type. 'A series of …ANOVA … were used to assess the effects of font type (Arial or Times) and line length (55, 70, 85 or 100cpl) on outcome measures; where appropriate, post hoc analyses were conducted to test for specific differences between line lengths' (Ling and van Schaik, 2006: p398). Results showed a preference for shorter line lengths over longer – even though this required more scrolling - and for Arial over Times.

Michael Bernard, of the Association for Computing Machinery and various colleagues have written a number of papers on font size and style for the web (without considering line length). In an early experiment, Bernard and Melissa Mills examined Times New Roman and Arial fonts (normal, or dot-matrix and anti-aliased, or smoothed) for 'readability (accuracy in reading text material), reading time, perceptions of font legibility and sharpness, as well as general font type/size/format preference' (Bernard and Mills, 2000: unpaginated).

Participants (35) read eight passages, which were ordered by means of a Latin square design. The passages were taken from from the electronic encyclopedia Encarta, written at approximately the same reading level, were approximately the same length (an average of 1041 words per passage) and concerned the same topic – psychology. In addition to reading time, 15 words that substituted for original words were randomly placed in the passages. These rhymed with the original words, but were semantically very different. For example, the word 'sun' was replaced by 'fun', making the sentence meaningless.

Results from the study found no significant differences in error detection. However, there were 'some differences' in speed. The fastest time came from the 12-point Times New Roman and 10-point Arial dot-matrix fonts. The slowest time came from the 10-point anti-aliased (smoothed) Arial font. The 12-point Arial font was the most preferred (though not significantly so over the 12-point TNR font) and was perceived as being the most legible and sharpest font by the participants. The TNR fonts (except for 12-point) were the least preferred. One reason for this, the researchers explained, 'could be that at smaller font sizes on computer screens, the serifs stop acting as distinguishers and start becoming visual "noise." Moreover, small anti-aliased fonts may create even more visual noise because of the smoothing effects of the anti-aliased font' (unpaginated).

In a later study Bernard and several other colleagues (Bernard et al*,* 2002) extended this work by comparing 10, 12, and 14 point sizes of eight typefaces (Century Schoolbook, Courier New, Georgia, Times New Roman, Arial, Comic Sans MS, Tahoma and Verdana). They worked with 60 volunteer participants (16 males and 44 females). Ages ranged from 18 to 55, with a mean age of 24 (S.D. = 7.8 years), and 'the majority' regularly read documents from screen.

Participants read passages of about 1,000 words, again from 'Encarta'. The between-subjects measures (i.e. those where different groups were exposed to different conditions) were the three type sizes and the within-subject measures (where all the subjects were exposed to all the conditions) were the font types. As in Bernard's earlier study (Bernard and Mills, 2000) each passage contained substitution words, and participants were instructed to identify these and state them aloud. The substitutes were described as being 'inappropriate for the context of the passages' (such as 'cake' substituting for 'fake' in one passage).

A three-factor mixed ANOVA design was used to analyse objective and subjective differences between the 10-, 12-, and 14-point sizes and fonts. Reading time and accuracy were combined (time/accuracy, although the units were not detailed) and described as 'reading efficiency'. The study found that fonts at the 10 point size were read significantly more slowly than fonts at the 12 point size, but there was a speed-accuracy trade-off removing differences between sizes. Fonts that were read faster were generally read less accurately.

Thomas Tullis (Tullis, 2005) reviewed the literature on web usability from which he formulated what he called the web's 'Top Ten Mistakes' adding in his title, 'and Why They

Are Mistakes'. Tullis claimed that studies of 10-point and 12-point fonts have found either no difference in reading performance (citing Bernard and Mills, 2000) or a slight advantage for 12-point fonts (Bernard, Mills, Peterson, and Storrer, 2001). He cites one study with older adults which found that they were able to read 14-point fonts faster than 12-point fonts (Bernard, Liao, and Mills, 2001). His own prior research had similar findings, and concluded that the smallest fonts (e.g., 6 to 8 point) may hinder reading performance (Tullis et al*,* 1995). Finally, Tullis and Fleischman (2002) found that combined reading speed and accuracy for passages displayed using the Verdana font improved significantly from HTML SIZE=1 to SIZE=2, and from SIZE=2 to SIZE=3. Most of these studies also found that users generally prefer the larger fonts, at least for the ranges studied.

Taken together, results from all the research cited seem to suggest that a website targeted for a general audience should probably use a default font size of 10 or 12 points. If the website is specifically targeted for older users, it would probably be advisable to use a default font size of 12 or 14 points.

Mary Dyson of The University of Reading (Dyson, 2004: p378) pointed out that it is inadvisable to study one variable in layout – even if just considering text - without considering others. This is because the choice or modification of one feature necessarily affects others. Dyson gives the following example of line length and interline spacing: 'long line lengths are said to need more interlinear spacing to ensure that the eyes locate the next line down accurately when executing a return sweep towards the end of a line'. Of course, text size, along with other content, also influences page length, and different styles or colours can be used to separate menu items from text body. The present study, in fact, explored not only this, but how text size and other page attributes affected information retrieval.

Use of images

The use of images in particular, or multimedia in general has been promoted in much of the literature on web usability (e.g. Sevilla et al*,* 2007). However, as Forczek (2011:p3) states:

> 'The use of more and more images, sounds and video can … make our message increasingly congested, confused and difficult to follow [making] greater demands on our attention, memory and nerves. …. Fully efficient use of websites crowded with various multimedia elements requires … excellent … mental abilities and extensive competence'.

Reflecting this, Large et al*,* (1998) found that young people seldom used the multi-media resources presented to them when searching to solve school-based assignments, as it was harder to extract the exact information required. In fact, moving and still images were almost completely ignored in the quest to find text that could be printed out and used to answer a set task. Fidel et al*,* (1999: p28) found this also. The children these researchers observed 'kept exploration to a minimum', and 'ignored entertaining diversions on the screen, such as moving images' in order to complete tasks. However, there was evidence in both papers that when students were not under any obligation to find specific information, they 'often' relied on information that was displayed in a graphic form. 'They inferred from graphics what the sites were about and whether or not they were likely to be useful' (Fidel et al*,* 1999: p35).

Apart from studies showing children opting for textual information in order to complete assignments more effectively, Loh and Williams (2002) show that text may be as interesting to young people as other media even when there is no pressure to complete school work. They looked at children's perceptions of Web design elements and features they considered 'cool'. The researchers concluded that content was more important for children than presentation; the novelty colour, sound, and animation may initially draw children to a Website , but after the novelty effect faded, it was interesting content that motivated children to return to the site. Clearly, this might not apply to young people with low levels of literacy, but nevertheless, it indicates that simply adding multimedia elements may not have a lasting attraction for target users.

For present purposes, the question is whether icons accompanying text labels enhance or inhibit understanding. One way this can be addressed is by considering the 'cognitive load' or burden on working memory. This is the ability to actively hold information in the mind needed to do complex tasks such as reasoning, comprehension and learning (DaCosta and Seok, 2010). Cognitive load theory proposes that since working memory is limited, there is a threshold on the amount of information that can be handled at any one time. In learning, this suggests that if instructional materials are not properly managed, 'cognitive overload' occurs, whereby more information requires processing than is the capacity of the learner or information-seeker, preventing the development of 'schema' (the mental maps or cognitive structures used to understand the world) and thus resulting in less information acquisition (Sweller, 1988). Consequently, instructional materials should be designed to minimise cognitive load (Kalyuga et al*,* 1998).

Much research has shown that there are separate channels for processing visual and auditory information and that humans are limited in the amount of information that can be processed by each channel at one time (Baddeley 1999; Paivio, 1986; Chandler and Sweller, 1991). There does not appear to be any evidence, however, that has shown that people with Learning Disabilities find these simultaneous stimuli difficult. Indeed, the study by Zentel (et al, 2007) appeared to show the opposite, and postulated that once the redundancy of one of the channels was clear (e.g. audio and text offering the same information) people would choose one on which to concentrate.

The use of images, symbols and other pictorial representation in websites is both common practice and urged in the literature on web design (Bohman, 2004; Singh 1998; Jiwnani, 2001). A more recent development has been to adorn sites for people with Learning Disabilities with symbols that appear when the cursor hovers over a piece of text. An example of this is the website for the accessibility charity Access-Ability Communications Technology[4] . Figure 3 shows a symbol that appears when the cursor hovers over the word 'everyone'.

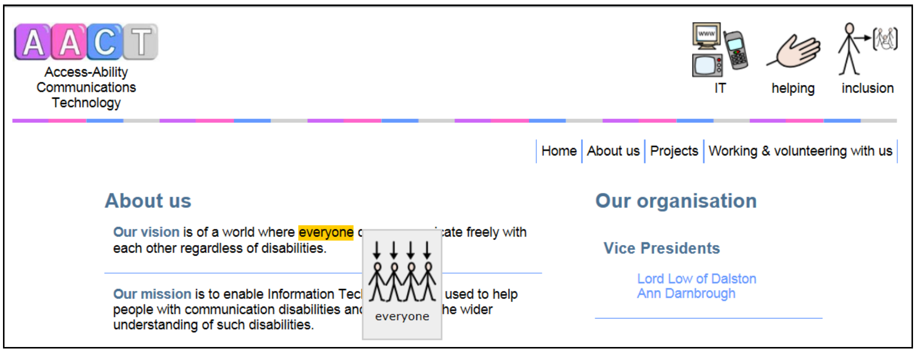

Figure 3: Access-Ability Communications Technology website (detail), showing a pop-out symbol (to represent the word 'everyone').

Images, in the form of photos, icons or other pictorial representation also accompany hyperlinks, most notably in contents or menu lists. Figure 4 shows examples of the use of photos and icons that illustrate menu links, the former from the Trafford Borough Council Adult Social Care web page[5], and the latter from Common Knowledge UK[6], a charity providing accessible and interactive information and online learning 'that can be understood by everyone' (CKUK, 2011: unpaginated). Other sites include the health information website Easy Health[7] (photos) and the transition information website Movingonup (icons). There are a great many other examples.

[4] http://www.aact.org.uk/
[5] http://myway.trafford.gov.uk/
[6] http://www.ckuk.org.uk/index.html?pid=175
[7] http://www.easyhealth.co.uk

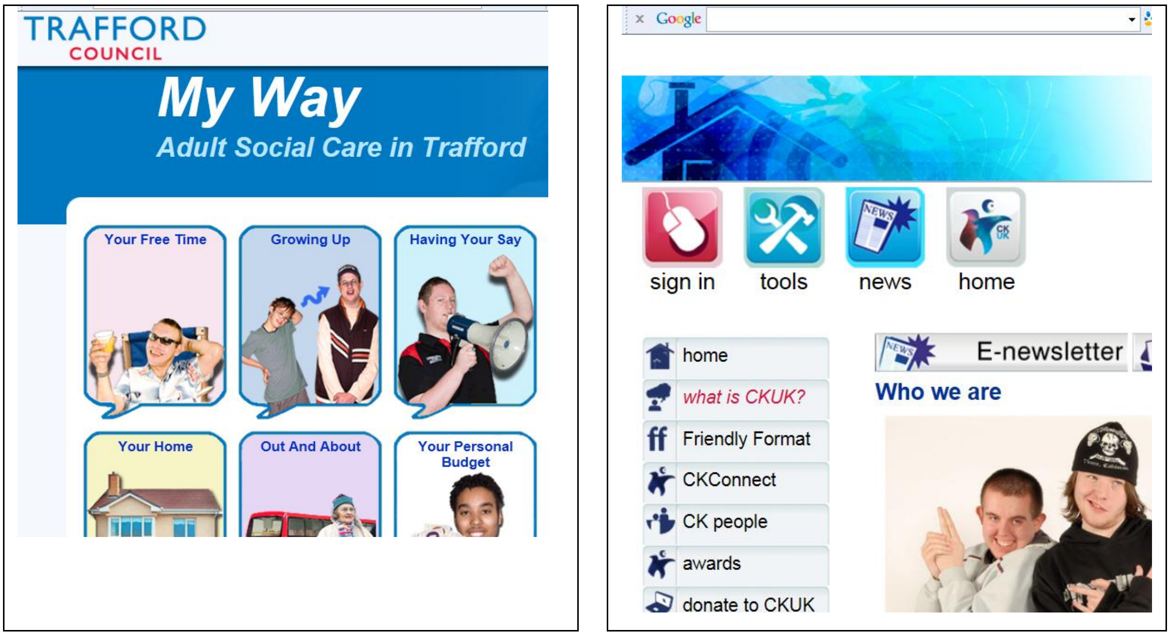

Figure 4: Two means of illustrating menu items. Left, Trafford Council Adult Social Care web page (detail), showing photos, and right, Common Knowledge UK web page (detail)

Jones et al, (2007: p546) note that ‘The idea that the addition of symbols to text can improve its comprehensibility finds support from a theory called “stimulus equivalence”’, and cite Sidman (1990) and Carr and Felce (2000) in this regard. They continue by explaining that ‘according to this [stimulus equivalence] … stimuli, including words and symbols, can be substituted for each other in a particular context without meaning being substantially altered’ (p546). They give the example of the concept ‘fruit’ being represented orally, in writing and by a simple drawing (and, indeed, though not mentioned, by an appropriate photograph) having the same meaning, if one knows the conventions, and therefore being mutually substitutable.

Poncelas and Murphy (2007: p466) note that ‘symbols have been used to increase understanding of written information for people with intellectual disabilities, yet the effectiveness of this remains largely untested’. Indeed, they claim that ‘there is almost no published research investigating whether the use of symbols does increase the understanding of written material’ (p467). Jones et al, (2007) make a similar observation, claiming that they could only find one study that approached the issue, and that which they did discover involving just four participants, who were consulted about a sample medicine information leaflet that had symbols added to it.

When one considers the somewhat narrower issue of text versus icon or versus icon with text where only labelling is considered, rather than phrases in passages of text, there does not seem to be any published research literature at all, despite this almost universal practice. Nevertheless, it is instructive to examine the literature that does exist which, whilst not addressing the exact area of interest to the present study, nevertheless offers some insight into the interplay between the written word and pictorial representations, albeit in different contexts.

Poncelas and Murphy (2007) were concerned with written passages of text and whether the addition of adjacent symbols or icons was an aid to understanding. To address this, they tested whether a symbol-based passage of text, in the form of a simplified political manifesto increased the understanding of this material for people with intellectual disabilities. 'Two versions of [the] manifesto were produced: one text-based and the other symbol-based (with text)' (p466). Participants were randomly assigned to two groups, each receiving one of the versions, and asked a series of questions about the material, both immediately after exposure, and then again and a short time afterwards.

Neither version was well understood by the participants. The group whose text was accompanied by symbols showed no better understanding than the group with text only. This was true whatever the level of understanding. For example, those with better language comprehension scores and those with better reading skills tended to show a higher understanding – but this was true of both conditions. Unsurprisingly, those in the symbols group who said they had seen symbols before also showed significantly better understanding of the material when questioned after the 'short time' (of unspecified length) the researchers left in order to test recall. The conclusion of the study overall was that 'the addition of symbols to simple texts does not necessarily improve people's understanding of it' p466).

Published in the same year and, as mentioned, also lamenting the lack of prior research, Jones and colleagues (Jones et al*,* 2007) had the similar aim of testing whether adding symbols to written text improved its comprehensibility for adults with Learning Disabilities. Their results, however, were markedly different to that of Poncelas and Murphy (2007). They worked with 19 adults with 'mild or borderline' Learning Disabilities, whom they asked to read four short passages of text. These were from the Neale Analysis of Reading Ability (NARA) test (Neale et al*,*1989) two of which had Widgit symbols added to them. In total participants read 12 passages of text with symbols and the same number without. Following their reading of each passage, they were asked four comprehension questions (pre-constructed from NARA) to test their understanding of the text, their answers being scored using the test's own mark scheme. After the questions, they were then shown the next passage and the process was repeated.

A Wilcoxon Signed Ranks test[8] for matched pairs revealed that they scored significantly better on the comprehension tests on the symbolised text condition than on the plain text one ($p < 0.05$). This was particularly true for participants with lower reading ages, suggesting the symbols helped them more. The authors conclude that 'adding symbols to written text can make comprehension easier for some adults with mild and borderline Learning Disabilities' (p545).

The stark contrast in these results might be due to the choice of materials used. These were passages from a graded reading test – at the lowest two levels – by Jones et al, (2007) compared to a simplified political party manifesto by Poncelas and Murphy (2007). Although the political party manifesto 'was rewritten in clear, simple language [and] … reviewed by a speech and language therapist' to ensure that it used language familiar to people with Learning Disabilities, the actual topic may have been more challenging (although, of course, one could argue that this was the same for both the with-symbols and text-only conditions). Second, it is not clear which text was rendered into symbols. Jones (2007: p547) symbolized only 'words with a high degree of visual imagery (e.g. bird, cat) … while the other words (e.g. to, for, my) remained without them'. Poncelas and Murphy (2007) said only that they symbolized 'keywords'. Given the topic of the materials, these may have included attempts to symbolise abstract concepts.

Matti Hannus and Jukka Hyona at the University of Turku, Turku, Finland (Hannus and Hyona, 1999) studied the effects of illustrations on learning authentic textbook materials among 10-year-old children of high and low intellectual ability. The researchers found that comprehension scores were improved by the presence of illustrations for high-ability children, but not for low-ability children. In a second experiment, eye movements were measured during learning of illustrated textbook passages to study how children divide their attention between text and illustrations. The results suggest that learning is heavily driven by the text and that children inspect illustrations only minimally. In fact, the authors (p119) makes the further suggestion that 'illustrations may, in fact, be harmful for poorer learners. They were found to spend more time away from the task of studying text and illustrations, particularly in the case of the most visualized passage'. The authors note that, 'this observation is in line with the notion proposed by Harber (1983) that pictures distract low-ability learners' attention away from the actual learning task and that pictures may, in fact, be a hindrance to learning' (p119).

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[8] A non-parametric test, as the distribution of the results was not normal

Much other work in the area of the use of pictures (or photographs) as aids to recall or understanding has been in the area of health information pamphlets and leaflets. Houts et al*,* (2006) reviewed the research literature which examined this, with a particular interest in how materials drew attention to the messages; people's understanding and recall of it, and compliance to its advice or instruction. For present purposes, of interest is that of understanding and, in particular, the authors' goal of providing 'quantitative data on how pictures affect different populations, especially minority and people with low literacy skills' (p:175)

The review found that even patients with well-developed language skills found it difficult to process medical information for a variety of reasons, including unfamiliarity with the terminology and emotional effects (p. 174) and surmised that these problems would be confounded for people with a low literacy level. A number of studies were cited that supported the use of images to enhance the appeal of medical hand-outs, specifically in the areas of recall and comprehension. One such study is that by Michielutte et al*,* (1992) which examined women's comprehension of information on the prevention of cervical cancer. Study participants (217 women) were randomly allocated a health education brochure – an experimental group one with pictures and a control group a version containing text only. Questions were asked on the content, and performance related to scores on the 'Wide Range Achievement Test', which is a standard test of basic skills in reading. Results suggested that the use of pictures, at least in the context of health education materials, improves understanding of information for adults with poor literacy skills. In addition, material with pictures was more positively rated than the text-only condition.

Paul Austin and colleagues at the East Carolina University School of Medicine (Austin et al*,* 1995) undertook a similar study. The researchers recruited 101 patients receiving emergency treatment for lacerations to examine whether illustrations enhanced comprehension of discharge instructions. As with the study by Michielutte and colleagues, subjects were randomly given information which either contained or did not contain pictures. They were then interviewed on site before they were discharged or telephoned 'within 48 hours' and tested on the information they had received. Patients who received the illustrated instructions were 1.5 times more likely to answer correctly on at least 50% of the questions than those who received just text – a very significant finding (p = 0.033). This effect was greater among patients with no more than a high school education – suggesting, in the present context, that people with Learning Disabilities may also benefit from suitable images.

Leila Mansoor and Ros Dowse at Rhodes University, South Africa (Mansoor and Dowse, 2003) looked at patient information leaflets and labels, in this case specifically with people who had a low level of literacy, again using experimental (text and pictures) and control (text only) groups. The 60 subjects were given the material to read and then asked comprehension questions. As with the research already cited, those in the 'with pictures' group had significantly more correct responses to two comprehension questions, which concerned how and when to take medicines: 47% correct for text only versus 93% correct for text with pictures, and 3% versus 73% respectively for the second question.

Daniel Morrow and colleagues principally at the University of New Hampshire (Morrow et al*,* 1998) assessed comprehension by asking 72 subjects to answer questions to which the exact answer was not written. The authors created eight sets of instructions, 'each describing how to take medications for [various conditions]. Each instruction was presented in two versions, one with [a] timeline (icon/text condition) and one without the [timeline] (text-only condition). The content and organization of the text was identical in both versions' (pp.243-244)

Along with other questions about the conditions whose answers were directly accessible in the text, subjects were also asked how many pills should be taken in a 24 hour period. In the article it is stated that the answers to this question 'must be inferred by combining dose ("take two pills") and time ("take four times a day") information' (p241) although whether undertaking some basic arithmetic calculations can be described as 'inferring' is debatable. Nevertheless, it is true that the answer to the question cannot be explicitly found in the text. Figure 5 shows the text and drawing condition for one particular condition.

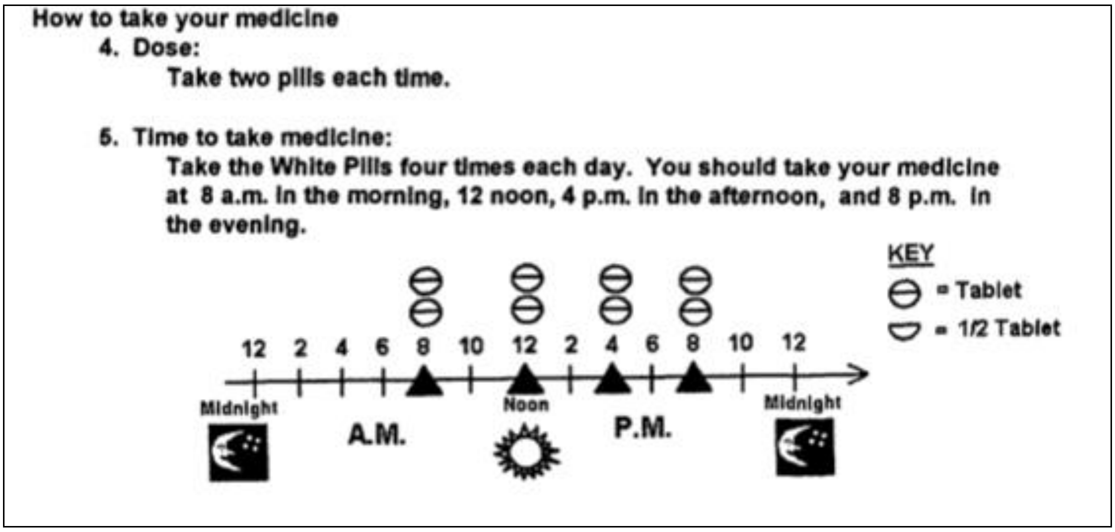


Figure 5: Text and picture condition from Morrow et al**, (1998)**

Results showed that a mean of 90.3% of the responses to the text plus picture condition were answered correctly compared to 80.6% of responses to just the text. The authors concluded that the picture helped in calculating the total number of pills to be taken.

A second experiment replicated the first except that the pill icons were missing from the timeline - although the timeline itself is still described as an icon and therefore falls within the 'with-images' condition. As such this was described as the text and images as being 'not integrated' as opposed to the icon with the pills as being 'integrated'. Results of the second experiment were that comprehension of the non-integrated drawing was the same as the text-only condition. The authors concluded, therefore, that the integration function of the drawing was what aided comprehension more than the simple presence of the picture.

Despite the general conclusion that the use of images can be helpful in understanding text, there is also evidence – as in educational research – that they can be counter-productive. Not surprisingly, this occurs where the text is beyond the comprehension of the reader. Houts et al, (2006:p180), note that this situation may apply particularly 'among beginning or very poor readers'. This may not necessarily simply relate to reading age of the information seeker, but as importantly, be that the concept encapsulated in the text – even if it can be read - is too difficult or erroneously understood. To give an example, a study by Michael Gittelman and colleagues (Gittelman et al, 2004) tested public understanding of 11 commonly used medical terms (including 'lethargy', 'dehydration' and 'fever') and found 'a large disparity between a caregiver's perception [of such terms] and the[ir] actual definitions' (p754).

With regard to this issue, Fillippatou and Pumfrey (1996) suggest from a review of literature from 1973 to 1995, that when a picture is used to 'integrate' or support information the reader does not or only poorly understands, the picture will be meaningless. By contrast, pictures that integrate easily understood information help comprehension: 'Simple pictures … used with easy to read captions will minimize these problems for everyone and especially for people with low reading skills' (Houts et al, 2006: p180). One is nevertheless tempted to ask what value a picture may have if accompanying information that is anyway 'easy to read'.

Of course, the mere presence or absence of an image is not the only issue with regard to the depiction of information. Some research has looked at the effects of different kinds of pictorial representation on comprehension. For example, Moll (1986) examined 404 patients with osteoarthritis and 233 control subjects (i.e. who did not have the condition) who participated in a study examining the 'communicational value' of five styles of illustration and two levels of text ('easy' and 'hard') in educational booklets about osteoarthritis. The illustration styles were:

- cartoon;
- matchstick;
- representational (a life-like drawing);
- symbolic;
- photographic.

Three measures were undertaken:

- Understanding was measured using a multi-choice reading comprehension exercise
- Preference choices were also made for illustrations.
- A subgroup was given various psychometric tests and measured for reading age.

Three findings are relevant to the current study. First, pictures with text – in all the formats used - enhanced comprehension, in that the groups using booklets with illustrations scored higher on the test than the non-illustrated book group. This was most marked with the matchstick and cartoon groups. Second, photographs were the preferred style of illustration overall, although 'cartoons scored particularly well when presented as booklet illustrations' (p207). Finally, simplifying text did not significantly enhance communication, although it should be stressed here that no information was given regarding the reading ages, IQ or any educational level of the subjects and – not surprisingly -no mention is made of people with any form of Learning Disability or impediment. Thus, the finding that simpler text did not aid understanding may not apply to such groups, who by definition would require simple text.

Readance and Moore (1981) undertook an early 'meta-analysis' of education research exploring the effect of different types of accompanying pictures (line drawings versus photographs; colour versus black and white) on reading comprehension. Sixteen studies met the inclusion criteria used. These were the use of pictorial illustration other than a table or graph; the reading passage could be comprehended without pictorial information, and sufficient statistical information was reported so that measures of association could be recovered. From the study, line drawings appear to facilitate reading comprehension more than photographs. Shaded drawings do not seem to differentially affect comprehension when compared with either line drawings or photographs. With regard to colour, a 'medium overall effect' (p221) was indicated, suggesting that colour has an impact on the effect of adjunct pictures on reading comprehension. A slight effect was also found for black-white pictures.

The overall conclusion was that 'line drawings seem to facilitate comprehension more than do shaded drawings or photographs and colour photographs seem to have a greater effect than black and white pictures' (Readance and Moore, 1981: pp.218).

Both the paper by Readance and Moore (1981) and that by Moll (1986) suggest that simple drawings are most effective in facilitating comprehension. The advantage of this representation may be due to the fact that they minimise the level of distraction. That fits with research suggesting that people with low reading skills are more likely to attend to irrelevant details in illustrations than are people with higher reading skills (Houts, 2006).

Summary and implications for the present research

In summarising the literature on usability with people with Learning Disabilities, it is worth beginning with a brief note on the characteristics of the literature cited in this section, as it is illustrative of the lack of a general body of research into this area. First, there is very little 'cross-referencing'. Of the studies that look specifically at usability (Karreman, et al, 2007; Sevilla et al, 2007; Harrysson et al, 2004; Daviess et al, 2001; Lepisto and Ovaska, 2004; Sutcliffe et al, 2003; Rotondi et al, 2007; Choi and Bakken, 2010, and Rocha et al, 2012), Rocha et al (2012) is the only study to cite three of the others (Karreman, et al, 2007; Sevilla et al, 2007, and Harrysson et al, 2004). Although Rocha et al's study was the most recent in the above list, Choi and Bakken, the next most recent, did not include any other usability studies involving a Learning Disabled or lower literacy cohort. Sevilla et al (2007) cite Harrysson (2004); Lepisto and Ovaska (2004) quote Davies (2001) and Sutcliffe et al (2003) cite a co-author of Davies, Michael Wehemeyer (Wehemeyer, 1999), who has done much work on assistive devices and self-determination.

A second characteristic of the literature is that the authors cited above come from very different backgrounds and thus bring their own different perspectives into the field. These range from a Department of Computation's Centre for HCI Design (Sutcliffe) to a University Center on Developmental Disabilities (Wehemeyer – co-author of the paper by Davies et, al, [2001] - Davies himself working for a commercial technology company). Other author locations are the Department of Professional and Technical Communication in a Faculty of Behavioural Sciences (Karreman); a University Robotics Institute (Sevilla); a Department of Design Sciences at an Institute of Technology (Harrysson); a university Department of Health Policy and Management (Lepisto) and of Computer Sciences (Ovaska); a Department of Critical Care Medicine and Health Policy and Management (Rotondi) and at a School of Nursing (Choi and Bakken). With such a diverse range of perspectives and various bodies of research and literature, it is perhaps no surprise, even with today's cross-disciplinary bibliographic databases and even greater aggregation of material via aggregators such as Google Scholar, that there is little cross-citation happening. Nevertheless, this lack of a self-critical body of researchers is indicative of the lack of research generally, of a substantial corpus of findings and of a common approach – although whether the latter is problematic is debatable, considering the range of data gathering methods, general approaches and findings accrued.

In summary, the methods by which usability has been studied with the present cohort include:

- Using a mainstream (albeit carefully chosen) website (Harrysson, 2004; Lepisto and Ovaska, 2004);
- Comparing an especially adapted website against an equivalent ''mainstream' version (Karreman et al, 2007; Sevilla et al, 2007);
- Comparing various website designs, each of which was created for a Learning Disabled user group - although only one paper utilising this method could be found (Rotondi et al, 2007);

- Comparing the performance of people with Learning Disabilities with a 'mainstream' cohort (Karreman et al, 2007);
- Researching one attribute of a website, although again, there appears to be only one example of this method – Rocha et al's (2012) investigation of the understanding of menu entries, comparing with text and image only conditions.

The present study eschewed using a mainstream site, partly due to the problems of reading and entering URL addresses identified by Harrysson (2004), and on the grounds that immersion in the field – including observation and informal chats with tutors and other supporters - strongly suggested that the participants would be unlikely to be able to use a mainstream site without considerable difficulty. This situation also precluded comparison between mainstream and adapted sites. Rotondi et al's (2007) study in which different accessible websites were developed and compared informed the present study, although the text-density (as determined by screenshots in the paper) and lack of visual content were both rejected for present purposes.

It was also decided not to include a 'control' group of 'mainstream' or 'non-disabled' people. This was for several reasons. First, the research that has taken the 'control' group approach, which has not, in the view of the present writer, been particularly enlightening (e.g. Karreman et al, 2007, found that people with Learning Disabilities need more time to read text and more help generally in negotiating a website). Second, there might have been a danger that the Learning Disabled participants would appear to be shown in a poor light, in having their performances compared to others. This could have been especially problematic when results were conveyed to them, as constituted an important part of the research. Third, it would be very difficult to compare performance measures, as the times taken by people with a 'normal' intellectual capacity on any of the set tasks would be so short as to potentially compromise the statistical analysis, and would possibly be so easy as to make the exercise meaningless. The alternative of formulating harder tasks or extending the amount of content needed to negotiate would present its own problems would also, in a different way, make meaningful comparisons difficult. Finally, it is essentially only the performance, behaviours and opinions of this particular cohort that was of interest. In fact, the method would not be appropriate anyway for the qualitative part of the study, which formed a considerable part of the research.

Data gathering described in the literature has included:

- Search and reading time (Karreman et al, 2007);
- Task-time (Choi and Bakken, 2010; Rocha et al, 2012)

- Content comprehension (Karreman et al, 2007), using inference as well as direct questions to do so;
- Error frequency (Karreman et al, 2007; Davies et al, 2001);
- Help sought or offered (Sevilla et al, 2007)
- Satisfaction, using a survey instrument (Karreman et al, 2007), smiles and gestures (Sevilla et al, 2007)
- Rating scale (Karreman et al, 2007; Sutcliffe et al, 2003)

Findings overall suggest that 'accessible sites' – such as those with fewer menu entries and buttons (Sevilla et al, 2007); audio rendition of content (Davies et al, 2001); 'easy read' text (Karreman et al, 2007) – are easier to use for people with Learning Disabilities. Only one study was identified which included a control group of 'mainstream' participants. Here, the latter performed less well answered fewer questions correctly than the control group of participants without identified disabilities. Sevilla et al (2007) used a wide ranging sample, in terms of IQ, although they were all classed as having 'mental retardation' and found a correlation between level of disability (as manifested in IQ scores) and performance. Difficulties encountered include in reading, finding content from 'a large quantity of text' (Harrysson et al, 2004: p141), managing 'pop-ups' (Choi and Bakken, 2010) and scrolling (Small, 2005).

The data gathering methods and findings informed the present study in several ways. With regard to the former, the decision to use task-time for the present study (following Karreman et al, 2007 and Choi and Bakken, 2010) is outlined in some detail in the Methodology section on page 110. Other methods outlined in the literature were rejected for various reasons. These include:

- Content comprehension (Karreman et al, 2007): Clearly, the comprehension of information is of critical importance. However, the decision not to include this as a measure follows the trend of the literature, where error counts, help sought and task completion (without comprehension testing) were more common. For present purposes, every effort was made to include on the interfaces only 'accessible' and 'comprehensible' information. Only the way the information is organised fell within the scope of the project – not people's understanding of it. Had the latter been a metric, the effect of the various layouts on information retrieval might have been obscured by the possible effect of participants struggling to extract information from pages having only inference questions as clues. The arrangement adopted lessened the likelihood that time taken to access information was the result of anything other than the site attributes under investigation.

- Error frequency (Karreman et al, 2007; Davies et al, 2001). Measuring error frequency would have been difficult, as the tasks were formulated to require only one simple action –the latter decision based partly on the literature of other researchers and partly on the prior experience and research of the present author. Regarding the first of these, both Harrysson et al's (2004) and Sutcliffe et al's (2003) participants appeared to have had considerable difficulties in undertaking some more complex tasks, raising both ethical and methodological questions. Regarding the present author's prior research, the difficulties encountered by participants with moderate learning disabilities (see Williams and Nicholas, 2006) in undertaking online game activities that only required one action, and early experiences in emersing himself in the field and observing computer use by participants and others of the same cohort strongly suggested this approach. Nevertheless, errors did – of course – occur, and the nature of these was taken into account in the study, although not quantified.
- Help sought or offered (Sevilla et al, 2007): This was treated in two ways in the literature. In Sutcliffe et al's (2003: p584) examination of a simplified email client for people with Learning Disabilities, 'the helper/experimenter intervened either to provide a hint about what to do, or give a direct prompt and demonstrate how to carry out a particular operation. Task performance times are not reported because of the uncontrolled intervention by the helper/experimenter.' On the other hand, Sevilla et al (2007) use interventions (which they describe as 'support actions') as a specific metric, counting both the help carried out by the teacher and the number of 'support requests' made by the participants. It was decided in the present study to take into account help requested or required qualitatively, in the analysis in Part One of the difficulties encountered in using web pages of different formats.

Preference data was very lacking in the literature reviewed, despite many researchers attempting to measure 'satisfaction' (e.g. Sevilla et al, 2007; Karreman et al, 2007). Rotondi et al (2007) sought preferences in terms of vocabulary used to describe sites and site design – but no apparent measures were taken to facilitate this (such as a rating scale, or carefully worded questioning), and the 'optimum' site developed was done so more from usability rather than preference considerations. Apart from this 'global' approach to design, participants in Choi and Bakken's (2010) study asked participants to choose between photos and clip-art in web information pages.

The present study chose to enrich Karreman's (2007) rating – a Likert Scale ranging from definitely disagree (1) to definitely agree (5), as it was felt to be somewhat abstract. Instead, 'smiley faces' were added (at the risk, admittedly, of appearing a little patronising) and the number of options reduced.

Regarding different site attributes, it appears both that a comparison of vertical versus horizontal menu positioning is both appropriate and necessary in a web environment. The former has been considered a legitimate subject of research for a considerable time, with varying results depending on the context. It is appropriate to undertake research in a web environment because virtually no research has been undertaken on this topic with regard to this medium. In fact, no work of any kind regarding menu position or text orientation has been undertaken with people with Learning Disabilities. From the evidence available, it appears that there is a small advantage in adopting horizontal 'menu' list over a vertical one, although whether this is true for the cohort with whom the present study worked, had not previously been tested.

As with menu positioning, there has been apparently no work on optimal text size (or style) for people with Learning Disabilities or low literacy levels, and far less work undertaken in an electronic environment than a hardcopy one. Ling and van Schaik, 2006 found that neither font type nor line length had any effect on information retrieval, although there was a preference for shorter line lengths over longer and for Arial over Times. Bernard and Mills (2000; 2002) found a slight advantage in 12pt over 10pt font sizes in on-screen readability, and that the latter were read significantly more slowly than fonts at the 12 point size, although faster-read fonts were generally read less accurately.

Thomas Tullis (Tullis, 2005) informs the present study to the greatest extent by opining that it is not appropriate to study only one variable in layout – even if just considering text - without considering others, as eah modification of one variable necessarily affects others.

Summarising the research into the value of images reveals two distinct and opposing strands. Generally, particularly with regard to literature examining the presentation of patient health information, images added to text aids comprehension. However, there is nevertheless some evidence that suggests that in certain circumstances pictorial representation may not be effective. Beginning with the latter, Hannus and Hyona, (1999) found that comprehension scores were improved by the presence of illustrations in textbooks, but only for high-ability and not low-ability children. Poncelas and Murphy (2007) were concerned with written passages of text and whether the addition of adjacent symbols or icons was an aid to understanding (for adults), finding that this was not the case. Large, (1999); Fidel et al*,* (1999) and Loh and Williams (2002) all found that, for various reasons, images were not used or valued by their study participants. However, Jones et al's (2007) results, however, suggested that adding symbols to written text can make comprehension easier for some adults with mild and borderline Learning Disabilities – a group not considered by the other papers.

As outlined, much other work in the area of the use of pictures (or photographs) as aids to recall or understanding has been in the area of health information pamphlets and leaflets. Houts et al, (2006) literature review found that a number of studies supported the use of images to enhance the recall and comprehension of patient information literature. Mansoor and Dowse, (2003) looked at patient information leaflets and labels specifically with people who had a low level of literacy, finding significantly better scores when the text was accompanied by pictures. Moll (1986) examined the efficacy of five styles of illustration and found that pictures with text – in all the formats used - enhanced comprehension, particularly the matchstick and cartoon groups. However, photographs were the preferred style of illustration overall. Readance and Moore (1981) early 'meta-analysis' of the effect of different types of accompanying pictures found that line drawings appear to facilitate comprehension more than photographs.

For the websites examined in the current study, it could be argued that line or cartoon-style drawings should have been used for Pete's Easy Read, as literature suggests that these forms are better at conveying meaning. For several reasons it was decided to continue using photographs as the chosen pictorial representation. This was for several reasons:

- It gave the thesis a more global coherence, as Newham Easy Read had been constructed in this way, and so comparisons between that site and the various manifestations of Pete's Easy Read were better facilitated by retaining photographs;
- In the minimal literature on preferences (e.g. Moll, 1986) photos appeared to be preferred over other forms;
- Results for Study Four of this thesis, in which participants expressed preference judgments on several websites, suggested much greater empathy with photographs – as they depicted 'real people' - than of the icons used by one site (movingonup);
- Study Five of the current thesis showed that, when putting images, Widgits and icons into transition-related categories, the photographs were placed far more into the intended (i.e. 'correct') category than the other representations. Also, participants, in another strand of Study Six, helped to choose which photographs best represented the various categories.

To conclude, much research needs to be undertaken in all the areas elicited in Part One of the study, with the horizontal versus vertical menu conditions, the use of images and the exploration of optimal text sizes, all needed – particularly both in the fields of web design and, more particularly and more importantly, regarding people with Learning Disabilities.

Chapter four: Preparing the fieldwork

Several steps were necessary before the study fieldwork could begin. These included ethical preparation, which entailed producing professional and accessible information sheets and consent forms and obtaining ethical permission to undertake the study. The next steps, undertaken in tandem were the recruiting of organisations and individuals and the creation of the websites and templates. These steps are detailed below.

Ethical considerations

The study, involving one of the most vulnerable groups of people in society, required a great deal of ethical preparation. This section looks at both the ethical practice required for formal ethical approval by the University College London Ethics Committee (granted on 13.01.09 – see Appendix 3) and the methods adopted to promote inclusive research practice that went beyond that demanded for ethical approval.

Preparing information sheets and consent forms

These can be found in Appendix 1 on page 296 For the potential participants, the information had to be accessible. In order to create pages that were so, for this audience, various strategies were adopted. These were:

- Consulting existing guidelines and standards;
- Liaising with the tutors, carers and supporters;
- Following guidelines available by the UCL Graduate School Ethics Committee literature;
- Obtaining the views of other experts in the field, most notably, specialist professionals and academics at the Rix Centre, University of East London, with whom much of Part One of this research was undertaken.

These strategies were also used in creating the website content, discussed later, where particular emphasis is placed on a consideration of the guidelines and standards.

Obtaining ethical permission to undertake the study

As the study involved working with vulnerable adults, ethical permission was required. Documentation for this included the accessible information sheets, an outline of the research protocol, details of potential participants, protecting confidentiality and anonymity, and an outline of any ethical issues that might arise from the study and how they were to be addressed. Of these, only the last two topics are not covered elsewhere in this thesis.

Regarding the ethical issues, those considered were the minimal knowledge the researcher would have regarding each participant, and the extent to which potential participants may feel the activity was obligatory, both of which are discussed in turn below.

The minimal knowledge the researcher would have regarding each participant: this was particularly in terms of computer skill and temperament – the latter referring specifically to the propensity of potential participants to engage with the researcher and also the kind of task participation entailed. In fact, by working closely with tutors, carers and supporters, and by having these professionals heavily involved in recruitment, the problem was minimised.

The extent to which potential participants may feel the activity was an obligatory part of their activities or schedule: To address this, teachers and carers were encouraged to press the point that the activity is purely voluntary. The researcher himself also made this as clear as possible. It is important to note that the teachers were briefed to stress that there was no obligation and that their treatment would not be affected in any way should they decline the invitation. Those agreeing to participate signed the sheet or confirmed orally. In the latter case (which only happened once) the carer signed by proxy. As the day of the test approached, the teacher reminded participants of it, and gave them the opportunity to withdraw. Indeed, they were reminded of this right at several other points in the recruitment process:

- When they worked through the information sheet (which mentions it);
- When they were reminded of the project by their tutor or supporter before the session was due to begin;
- By the researcher immediately before and, indeed, throughout the session.

In addition, the teachers or carers confirmed, from their knowledge of each individual, that informed (rather than acquiesced) consent had been given.

Protecting anonymity

Participants were only identified to the researcher by first name. Where possible, the teachers or carers provided an oral or written profile of each (approximately 100 words) detailing level of computer usage/ability and literacy level. Field note documents were password-protected (a facility available in Word) on a computer that was itself password protected. They will be destroyed four years after thesis submission. Only the researcher had electronic access, although his supervisor had the option to peruse hardcopy during tutorial sessions. In fact, this did not prove necessary.

Facilitating inclusive research practices

The nature of the project lent itself to inclusive practices as it promoted information created, as far as possible, by the target audience itself. In addition, feedback was sought from participants at each stage of the project. The specific practices adopted to facilitate inclusion are outlined below.

Promoting self-advocacy

The content of the websites created for and during the study was designed to promote self-advocacy, in terms of providing information necessary for independent living and personal choices. Participants were also involved in content creation, as detailed in the section 'User-generated content', below. This gave them the opportunity to state what kinds of transition-related information they wished to see on the website and how it should be expressed.

Participants as research partners

In order to include the participants fully in the research, they had to understand its aims, and the possible benefits they as a group or individually might accrue from it. Partly this was achieved through the information sheet – which was read out and discussed with individual participants (See Appendix 1) and partly by emphasising the important part their contribution would make to designing 'the best possible website'. Second, research findings were fed back to participants so they could see the progress that was being made. Pages that were added to the site were showcased for comment and further suggestions. During Part Three of the study, participants were told the results of the earlier research and how that built into the phase in which they were participating. It is important to note here that such feedback was offered *after* the participants had made their own contributions, so as not to prejudice their own performances and preference judgements.

Participant recruitment

Introductory note

Some of the preparatory pilot activities, and Study One of the fieldwork, were undertaken as part of a wider research project being carried out at The Rix Centre at the University of East London (Minnion et al, 2008). The Rix Centre is a charitable research and development organisation 'committed to realising the benefits of new media technology to transform the lives of people who have Learning Disabilities' (Rix Centre, 2012:

unpaginated). The web pages constituting Newham Easy Read were populated by groups and individuals working with this organisation, generally though the London Borough of Newham.

Institutional level recruitment

Recruited organisations were already working with the Rix Centre, and very keen to promote the use of computers in their teaching, support and advocacy work. The present writer worked on the wider project, and with permission from The Rix Centre and participating organisations, was able to work with the same participants for his own study. The recruitment of organisations was also undertaken independently, by direct contact with possible participant institutions. By employing both of these methods, the following institution-types were recruited:

- A College of Further Education in Hertfordshire consisting of three campuses (all of which worked with people with Learning Disabilities and participated in the study). Most of the fieldwork was undertaken on the campuses of this college;
- A Special Educational Needs School in Middlesex, whose pupils of 18 years and older participated;
- A self-advocacy group, facilitated by a London Borough Council (as these are not common, naming the council could compromise the anonymity of the participants);
- An adult educational class, run as part of a charitable Day Centre in Camden;
- A Day Centre in the London Borough of Enfield;
- A supported social club in the London Borough of Barking (whose participation was kindly hosted by the Rix Centre at the University of East London).

Participant (e.g. individual) level

Potential individual participants were identified by the following methods:

- At pre-session talks and demonstrations with their teachers, tutors and carers (i.e. the 'gatekeepers'), during which the proposed study was outlined and potential participant activity made clear. An information sheet for professionals about the study was also provided, as was an accessible version of this, as noted above, to be made available to students;
- For organisations outside of Further Education, information about the required level of literacy, based on those formulated by Moser (1999) was provided to gatekeepers for use in deciding suitable candidates;
- Preliminary observations by the researcher in situ, to see which potential participants might find the research interesting and at the appropriate reading and intellectual level.

A list of potential participants was drawn up following these consultations and observations. It is important to stress that Lewis and Porter's (2004) warning that carers and other adults may have their own views on who should participate was heeded, in that the researcher emphasised the inclusivity of the research. Also considering this approach, special provision was made for people who expressed an interest in participating but for whom the tasks were judged inappropriate, rather than risk disappointment or feelings of inadequacy. Alternative activities included showing the researcher what they liked doing on the computer and/or being led through each activity (e.g. instead of being asked to find an icon or word, being shown its location and having merely to steer the cursor to it). It is worth noting that 'inappropriate' did not necessarily imply that the activities would be too intellectually challenging. One activity, for example, presented participants with two lines of individual words arrayed either horizontally or vertically on the screen in a 'find-the-word' type game. People with poor eyesight would not have been able to negotiate this.

The teachers or carers outlined the project informally to learners at least seven days before the research session, using the accessible information sheet (see Appendix 1) which all of those interested (including those whose participation would not include the formal usability tests) took home to show their parents and carers and signed.

Creating the websites used in the research

Two main websites were used in the research reported in this thesis, both offering information related to 'Transition' . These were, first, Newham Easy Read and later, for the second part of the study, Pete's Easy Read. These are described fully below. Four other websites were used in an exploration of how preference choices might be elicited from this cohort. They are described in detail in Study Four, suffice here to say that they consisted of three dealing in information specifically for a Learning Disabled audience, and one mainstream site containing similar information. In addition to these 'full' websites, two additional web pages were created that tested, respectively, the effect of menu position and the meaning of images. These were dynamic, did not form part of the website itself, and are described in the fieldwork section, below.

Newham Easy Read

The website examined in Part One, Newham Easy Read was created by Rix Centre as part of a wider project on using technology to promote self-advocacy. The writer was, on the basis of prior work in the field (Williams and Nicholas, 2006; Williams, 2006), consulted on the interface design, although not one of those formally charged with its development.

His role was to undertake the usability testing and to help create content with the target user group. The latter activity, although interesting (and challenging) is somewhat peripheral to the present study, and so is not documented in any great detail here (see the section 'Creating / accruing website content' (on page 112). Of importance is that the site was used in work that provided a useful pilot for the present study and in Studies One to Four of Part One.

The website offers information to people with Learning Disabilities around transition, the initial topics relating to those elicited in by Beth Tarleton in her 'The Road Ahead' review (Tarleton, 2004). One of the topics, however, 'Health', was omitted as this was felt to be too personal, considering that the participants themselves were to be the main contributors of content. 'Relationships', however, was included on the grounds that Tarleton found no appropriate information on this topic in any informational resource designed to be accessible to people with Learning Disabilities, although many expressed a need for appropriate information. The categories were, thus:

- Travel;
- Safety;
- Leisure;
- Living On Your Own;
- Relationships;
- Work;
- Money;
- Support;
- Day Services;
- Education.

As can be seen in Figure 6 below, the website included a banner heading and a left-positioned vertical contents (or 'menu') list, accompanied by thumbnail photos illustrating the contents of each listed item. The link or relationship between the images and the text is worth exploring. Jana Holsanova and colleagues at Lund University (Holsanova et al, 2006) outline the different possible connections:

> First, the linkage can be indexical by using different kinds of markers: typographical … [numbers or letters] … placed next to the elements that should be linked together. Second, … by a verbal … reference to the picture. Third … by graphical markers [such as] using arrows and/or lines between elements …. Or, fourth, text and picture can stand alone without any explicit linking markers … [except] spatial proximity' (Ibid:p4).

In both websites constructed for the current research, two connectors were used: verbal in the case of the menu items, so the image was captioned with explanatory text; and in the case of the body text, spacial proximity. This arrangement can be considered fairly standard, and applies to many other sites designed for people with Learning Disabilities (e.g. Mencap and Movingonup) . The implications of adopting this arrangement are outlined in the section on methodology, below.

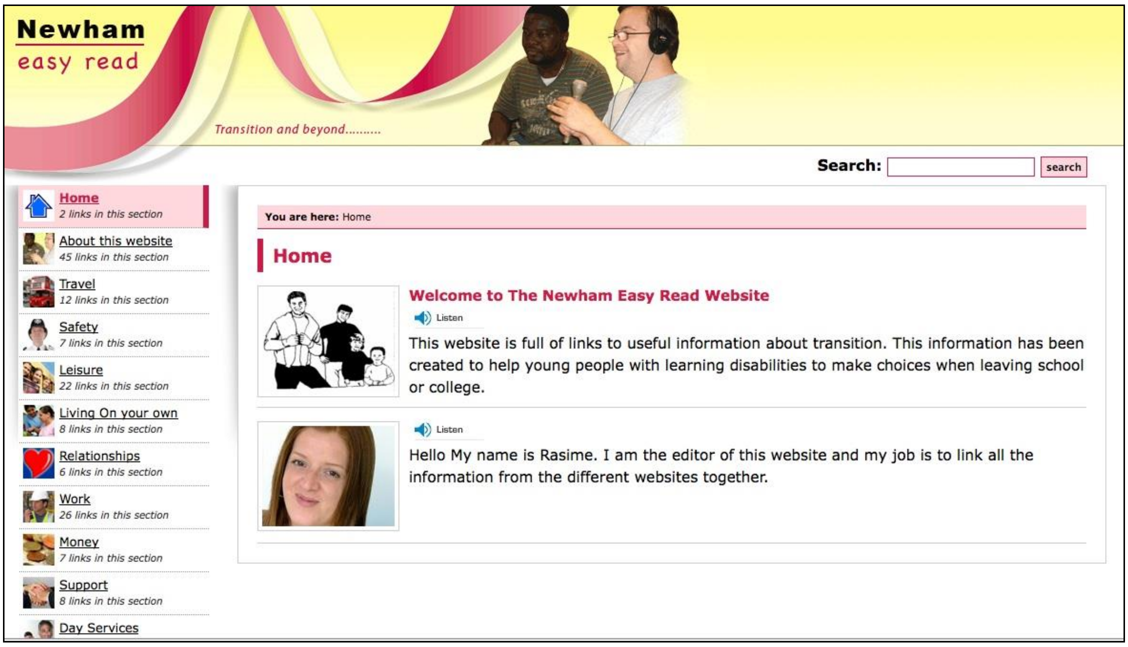


Figure 6: 'Newham Easy Read' home page

This 'Home' page represents the top of three levels, the other two being subject menu pages, accessible directly from the Home page; and the actual information pages, accessible via the subject menu pages (or directly via a search facility – but this feature was not tested for the present project). To give an example, when the main section 'Money' is activated from the Home page, a subject menu appears showing each of the pages that fall into the Money category. Figure 7, below, shows this.

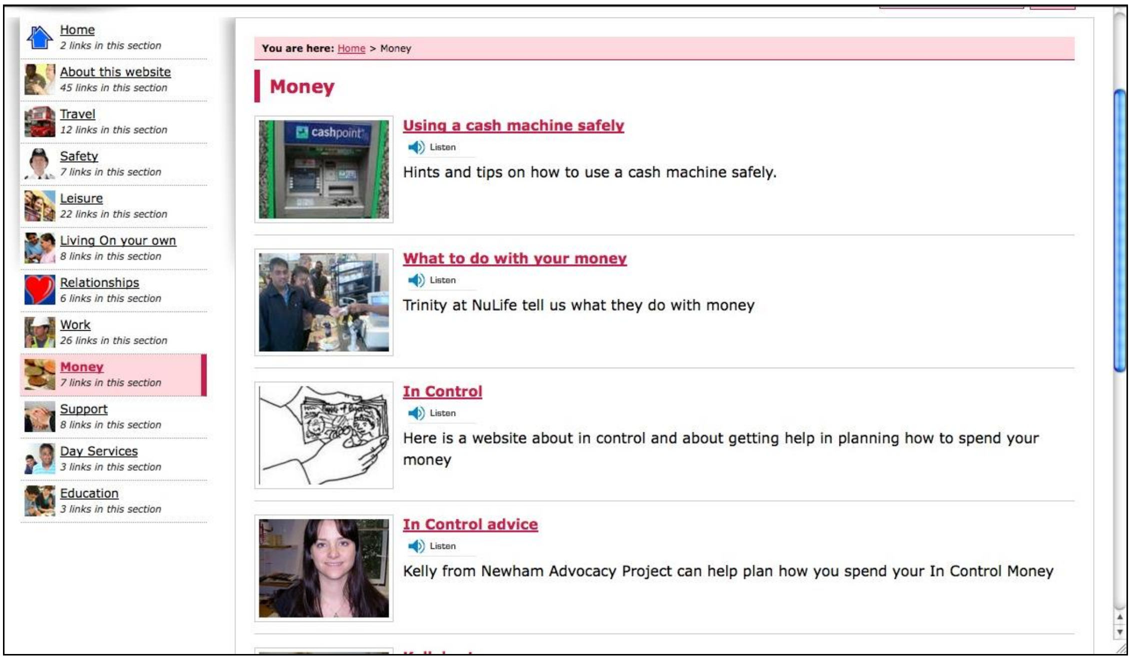


Figure 7: Newham Easy Read: Subject menu - Money

Figure 8 shows an example of an information page accessible via the Money subject menu above. It is titled 'Using a cash machine safely'. The information pages were created by different participant groups in discussions with tutors, carers or other supporters, as outlined later. Where appropriate and possible (considering safety), supporters went with the participants to take digital photographs of the activities being described. The process of eliciting appropriate information from participants is described in the section on 'User-generated content' below. As shown in the picture, the resulting text was rendered to audio for those who found the written word too challenging.

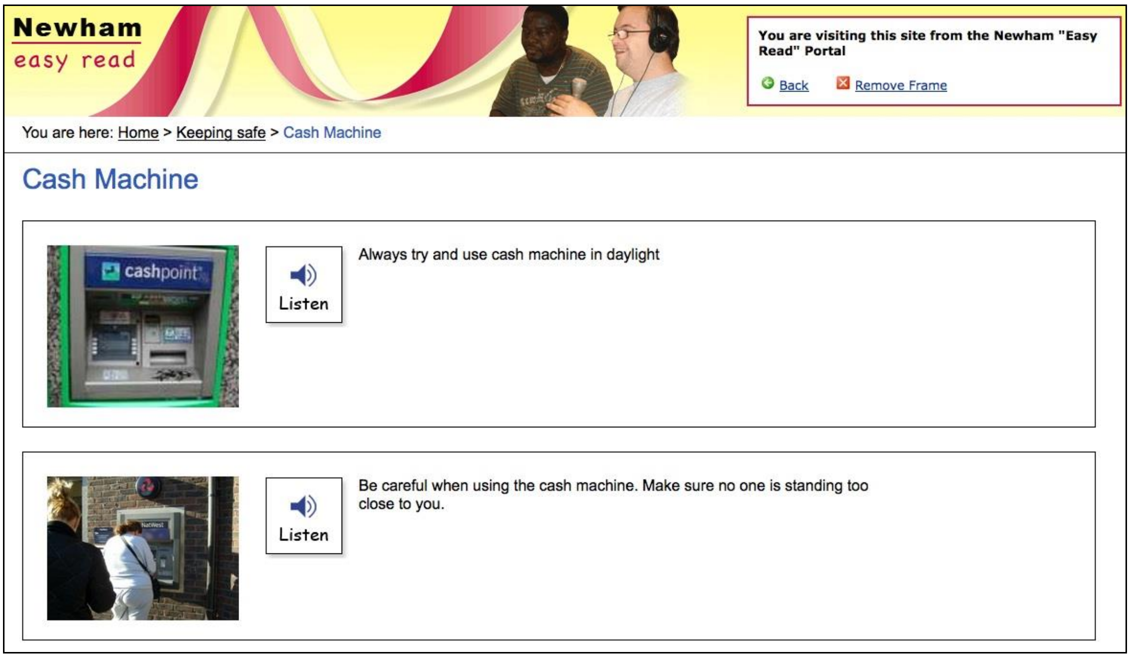


Figure 8: Newham Easy Read information page – using a cash machine

Navigation within the site was aided by a 'breadcrumb trail' (top left in the picture) and an internal 'back' button (top right).

Following Part One of the study, a new website was built by the present writer, being an experimental resource constructed specifically for the present study. It is discussed below.

Pete's Easy Read

This website, hosted on a university (UCL) server for easy access and editing, included various design modifications suggested by results from Part One. Unlike Newham Easy Read, which was designed to be a publically accessible website for long-term use, Pete's Easy Read was purely created for study purposes, at least for the duration of the research.

So many participants were interested in exploring, or creating, information about various leisure activities that for Parts Two and Three of the study, the redeveloped website contained both 'Leisure' and 'Sport and fitness' sections. Discussions with participants showed an interest in food, and so this was added. A general section on health was also added, partly because it was felt an important topic, being mentioned in the information needs research by Tarleton (2004), and partly because it was the focus of some of the transition work being undertaken by participants at the Colleges of Further Education.

Sections on rights, support and independent living were not included, for reasons related to the nature of the study. The information retrieval tasks that comprised Parts Two and Three of the study were timed, in order to obtain a quantitative value for the relative ease with which websites of different layouts were negotiated. As the exercise attempted to examine only issues related to the different conditions examined (e.g. menu position etc.) and not participants' understanding of the text in any great detail, it was felt appropriate to choose subjects that might be more accessible in this instance. The Set tasks section of Chapter five (on methodology) discusses this issue at length. In addition, a finding in Part One of the study that the menu list appeared to be too long for easy usability suggested that fewer categories be used, so it was logical to remove the more abstract sections (e.g. such as 'Independent living'). Study Six in Part Two gave an indication of which topics may be more difficult to represent.

Figure 9, below, shows the homepage of Pete's Easy Read. The grid contents design was present only for this 'portal' page.

Figure 9: Pete's Easy Read home page

As with Newham Easy Read, the site contained three levels:

- The Home page, as above, giving access to each of eight main topic pages
- A subject menu page itemising information pages on each topic and giving an introduction to the topic (around 50 words)
- Information pages on each of the subtopics.

Figure 10 shows the structure graphically.

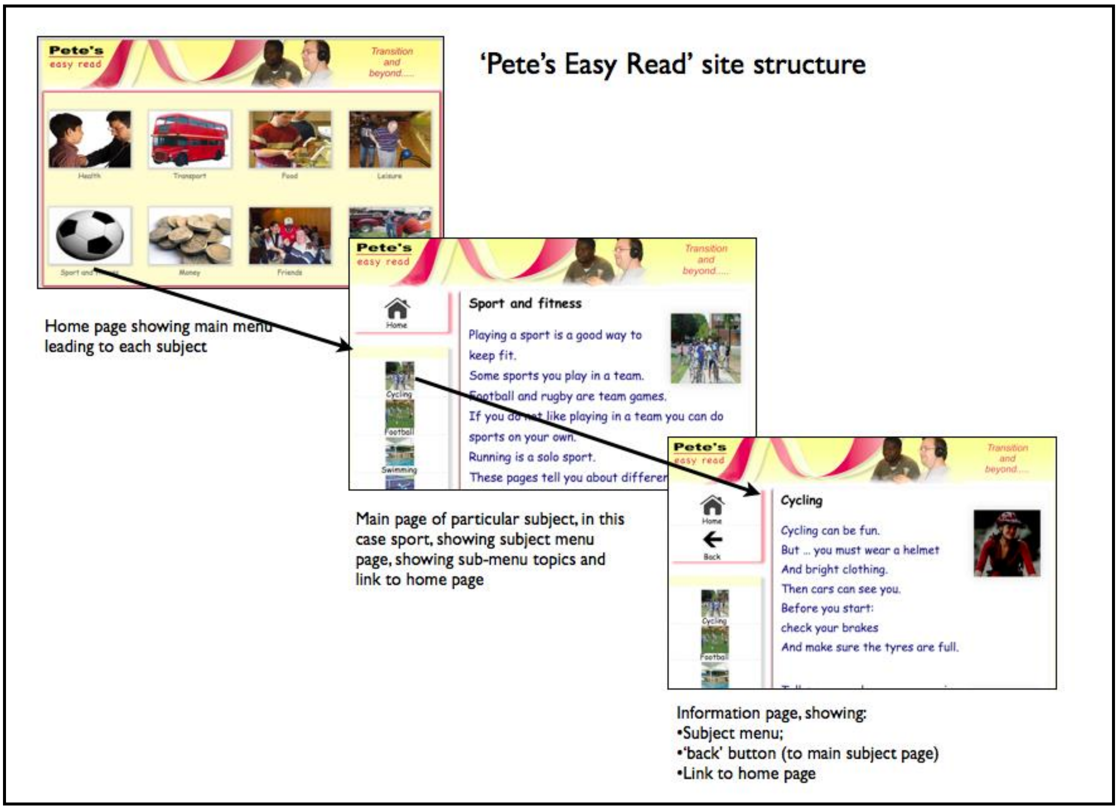
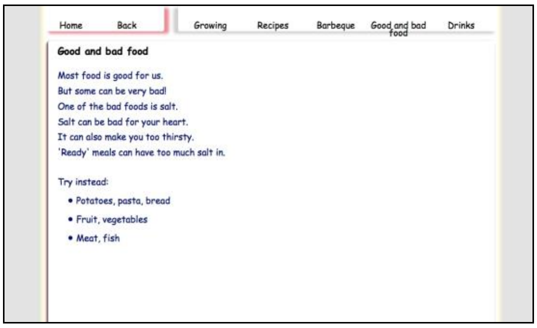


Figure 10: Pete's Easy Read site structure

As this phase of the research sought to examine the effect of different layout designs of the web pages, these pages were originally going to be duplicated in eight different ways, as detailed later, to test the effect of different page attributes on information access and retrieval. However, by using JavaScript it was possible to work with only one site and change text size, the menu position and visibility of images on that site as required (and as outlined more fully in Part Three).

Two examples of the different layouts can be seen in Figure 11 of the page within the 'Food' subject entitled 'Good and bad food'. One layout consists of small-text, no-images and a horizontal menu; the other negates each of these attributes, consisting of large-text, images and a vertical menu.



Interface 1: small-text, no-images and horizontal menu

Interface 8: large-text, images and vertical menu

Figure 11: Information page on 'Good and bad food', as presented by two different interfaces

User testing (see Fieldwork Part One) suggested that the Newham Easy Read site navigation was somewhat problematic, and so this aspect of the new website was simpler than that for the original. Apart from the menu hyperlinks, it consisted of simply 'Home' and 'Back' buttons – the latter only being present on the information pages. Thus, from a subject menu page one can return 'Home' or access an information page via the menu list. It was considered over-complicated and unnecessary to provide links directly from information pages on one subject (e.g. Food) to those of another (e.g. Work).

Website designs and accessibility guidelines

The following table shows the extent to which the websites followed the various design guidelines researched and detailed in 'Chapter Two: Web accessibility and usability ' from page 29 onwards. The design of all the websites was such as to be accessible to people whose Learning Disabilities extended to being very poor or even non-readers, although, of course, this cohort were expected to have considerable help and collaboration of a supporter or carer. Table 6, below, itemises guidelines and recommendations from existing literature and how the websites created either adhere to them, or state why not.

Topic / guideline	**Source(s)**	**Websites**
Design issues		
Transformable content focus.	Bohman (2004)	
Use at least medium size text on each page.	Mencap (undated) Hassell (2005)	The text size was medium for Newham Easy Read, but varied for Pete's Easy Read as it became an experimental condition.
Make sure you do not use absolute font sizes so that users can adjust their browsers to make text larger if needs be (Ensure page layout supports enlarging of text).	Bohman (2004) Coyne and Neilsen (2002) BSI (2006) Hassell (2005)	Relative font sizes were used

Topic / guideline	Source(s)	Websites
Ensure that the user can view with their own styles and turn off colour and images if desired.	Rowland (2004) Hassell (2005)	It was not felt necessary to turn off images or colour, although the presence and absence of images became an experimental condition for Pete's Easy Read.
Multi-modality focus	Bohman (2004)	
Illustrate concepts with drawings, diagrams, photos, audio files, video clips, animations, and other non-textual media. Coyne and Neilsen (2002), however, suggest minimal use of graphics, and Banes and Walter (2002) and Hassell (2005) suggest symbol support for plain text	Bohman (2004) Singh (1998) Jiwnani (2001) Mencap (undated)	Concepts were illustrated with photos, which were considered more accessible than symbol support. For the Newham Easy Read site this had the added advantage of being created by the target users.
Provide audio for text content, and, by contrast, captions and transcripts for any audio or video. Many sites written for people with cognitive disabilities do this, including: Mencap: www.mencap.org.uk Sparktop: http://www.sparktop.org/dbtv/index.html Brown and Lawton (2001) also suggest 'descriptive audio' rather than just text-to-speech', but this is more for visually impaired people..	Bohman (2004) Jiwnani (2001) Pearson and Koppi (2003) BSI (2006) Mencap (undated) Fidgeon (2006) Brown and Lawton (2001)	All content for Newham Easy Read was provided in text and audio.
Pair icons or graphics with text, and when graphics contain information, also provide the information in text.	Rowland (2004)Coyne and Neilsen (2002) Pearson and Koppi (2003) Brown and Lawton (2001)	For Newham Easy Read the menu lists were provided in images and words, paired. Results from Part One of the study, however, suggested that the images were not as helpful as hoped, and so for some page layouts in Parts Two and Three (Pete's Easy Read) the labels were not linked to images.
Keep auditory presentations brief.	Jiwnani (2001)	Each audio clip was of no more than one phrase or sentence.
If using animated graphics, scripts/applets etc., make sure that they can be turned off easily to allow users to focus on the site content.	Mencap (undated) Hassell (2005)	No animated graphics were used.
Sensory focus		

Topic / guideline	Source(s)	Websites
Limit the types of font faces in a document, and eliminate the use of italics or ALL CAPS.	Bohman (2004) BSI (2006)	Only one font face was used for each site – the Arial family for Newham Easy Read and Comic Sans for subsequent pages.
Avoid background sounds that distract the user's attention (e.g. background music). Interestingly, the website of the Dyslexia Association (http://www.dyslexia.uk.com/) have beat-type music as a background on its site. Also, Brown and Lawton (2001) suggest use of auditory cues for 'function, meaning, or structure', including tones and music clips. Clearly the audio here needs to *attract* rather than *distract*.	Bohman (2004)	No background sounds were used because of the audio rendition of text on the site.
Include 'white space'—non-content space—around the content, between paragraphs, between headings, and links and buttons, and ensure sufficient spacing between lines of text	Bohman (2004) Coyne and Neilsen (2002) Fidgeon (2006) Hassell (2005)	White space was included
Minimise the need for scrolling. Of note here is that this is in contrast to the BBCi standards (see Hassell 2005), which recommends scrolling rather than use of multiple pages.	Coyne and Neilsen (2002)	As far as possible, for the Newham Easy Read site, scrolling was minimised, but as images were to be used to illustrate every sentence, many of the pages fell below screen level. For subsequent web pages, scrolling became an experimental condition.
Use high contrast between text (or graphics) and background – and use a plain background	Jiwnani (2001) Coyne and Neilsen (2002) Pearson and Koppi (2003) Mencap (undated) Hassell (2005)	Black or (for headings) purple text was used on a white background initially, and then black or dark blue on white.
Avoid using pop-up windows, cascading menus and new browser windows	Coyne and Neilsen (2002) Mencap (undated)	These were all avoided.
Interaction focus	Bohman (2004)	
Navigation		
Provide multi-modal navigational cues (e.g. text + graphical/visual highlight + auditory instructions + animated demonstration). This might lead to 'information overload', however. If site navigation were made as simple as possible, the animated demonstration might not be needed. Brown and Lawton (2001) recommend a visual map, which may be more effective.	Bohman (2004)	This was felt unneccessary. Navigation was flagged in all web designs by text underline, the 'hot spot' area changing colour (see Figure 12). See below also.

Topic / guideline	Source(s)	Websites
Use obvious breadcrumbs in your design.	Rowland (2004)	This was undertaken for Newham Easy Read. For the subsequent site, only a 'Back' and 'Home' button were required.
Use consistent methods of indicating hyperlinks (e.g., blue underlined text) and make them descriptive (e.g., avoid "click here" and "more").	Rowland (2004) Coyne and Neilsen (2002) Mencap (undated)	Hyperlinks were indicated in a consistent manner.
Use the same navigation bars in the same place on your pages, and a clear linear route through, so that users can become familiar with what other information is contained in the site	Mencap (undated)	Newham Easy Read pages employed the same (vertical) navigational layout. However, as the website was a portal, where various organisations contributed web pages, internal pages from these sites adopted a horizontal design, to distinguish them from the main portal content. For Pete's Easy Read, menu positioning became an experimental condition.
Limit the number of links on a page	Coyne and Neilsen (2002) Hassell (2005) Brown and Lawton (2001)	Twelve links appeared on the original portal homepage. However, the usability studies undertaken on the site (in Part One) suggested that fewer links would make the site more usable. Only five were used in subsequent designs.
Search		
Do not rely solely on a browsing interface for your site's search capabilities.	Coyne and Neilsen (2002)	A search engine was used on the Newham Easy Read site, accessible from the main portal pages. This was not felt necessary for the later designs.
Offer a search engine that is forgiving of spelling errors.	Coyne and Neilsen (2002)	This proved technically too demanding.
Design and layout.		

Topic / guideline	Source(s)	Websites
Carefully plan the layout of the home page so that it is immediately obvious what service or information is being provided.	Coyne and Neilsen (2002) Mencap (undated)	The first paragraph on the Newham Easy Read site states that 'This website is full of links to useful information about transition. This information has been created to help young people with Learning Disabilities to make choices when leaving school or college.' The 'Home' page of Pete's Easy Read provides a grid showing content.
Have a consistent, clear layout of pages. Some commentators state that left-aligned text is easier to read than justified text, which in turn is easier to read than centre- or right-aligned text [see e.g. webcredible (2005) and Hassell, 2005)]	Banes and Walter (2002) Coyne and Neilsen (2002) Pearson and Koppi (2003) Hassell (2005) BSI (2006) Fidgeon (2006)	Left-aligned text was used throughout.
Ensure that similar interface elements and similar interactions produce predictably similar results.	Bohman (2004), Jiwnani (2001)	The only elements on the site were the audio links, each of which was representated by the same icon and functions in the same way, and the hyperlinks, which were similarly uniform.
Provide an obvious way for users to get back to simpler content if they find themselves on a page above their reading level	Fidgeon (2006)	All of the pages on all sites were at a level that should be accessible to even a very poor reader.

Table 6: The extent to which the initial website adhered to accessibility and usability guidelines

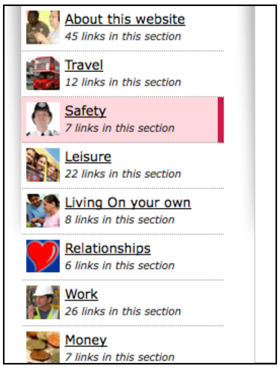


Figure 12: Newham Easy Read menu list, showing 'hot spot' highlighted.

As documented in Table 6 above, guidelines and recommendations were adhered to where possible and where they were considered appropriate. In one case where a recommendation was not initially followed (limiting the number of links on a page), usability tests suggested that this was a mistake. The issues elicited related more to aspects of the site about which guidelines do not advise – such as problems associated with a vertical menu bar. Parts Two and Three address these.

The actual content for the website was created as part of the fieldwork, and is described in the methodology section, below.

In sum, this section has outlined the key activities and processes required to prepare for the study fieldwork. It has included accounts of the actions required to ensure the informed consent and general protection of potential vulnerable participants; how institutions and individual participants were recruited, and how the websites to be used in the study were developed and how they met pre-existing accessibility guidelines. It could be argued that not only was each of these activities essential for the research to proceed, but that each was inter-related with the others. For example, it was necessary to create information sheets and consent forms in order to be able to go ahead with recruitment, as participation was predicated upon informed choice. Similarly, the websites were developed according to both ethical considerations regarding their accessibility and usability, and early or 'template' versions demonstrated to potential participants in pre-session meetings and email information exchanges.

Having detailed these preliminary measures enabling the research, this thesis now turns to an account of the overall methodology.

Chapter five: Methodology

This chapter gives an overview of the methodology of the research, including an account of the scope (the participants, technology, research focus and measures used), the methods adopted, including preparatory work such as building and populating the study websites, those used during the usability sessions themselves and ways in which preference data were gathered.

Scope

Participants

Although the information created and hosted on the websites under examination related to ‘transition’ (i.e. from school or college to the more adult life of supported employment and more independent living), for a Learning Disabled cohort this does not necessarily signify the narrow ‘young adult’ age group it would for a ‘mainstream’ one. The study locations therefore catered for people at any age from late adolescence to over 60 years. Following the inclusive ethos of the current study and the continuing relevance of the informational material to such a wide range of ages, it was decided not to restrict the age range of participants, although ethical approval was only sought and obtained for a cohort of ‘adults’ – 18 years and older. The particpants ranged in ages from 18 to 63, although the majority were in the 18 to 30 age group. Finally, regarding this demographic, it was decided not to examine difference in performance or preferences with regard to age. This was because in addition to a chronological age, differences in ability levels and social skills, and varying experiences with computing (and life generally!) all suggested that ‘age’ in itself was not an appropriate attribute to consider. It is worth noting, to emphasise this point, possible difference between chronological, reading and developmental ages (e.g. Franck and Brownstone, 1994). For the record, the study was also ‘gender-blind’.

Regarding ability level, the research began by encompassing a wide range of potential participants, from those having ‘mild’ Learning Disabilities at one end, to ‘moderate’ at the other, as defined earlier in this document (WHO, 2001; Beirne-Smith et al*,* 2005). However, it principally included only those who had a certain, albeit in some cases, minimal, level of literacy. This was for three reasons:

- Non-literate participants required a degree of support that would be difficult to factor into a usability study where text is a fundamental part of the resource’s contents and means of communication (Text need not have been used, of course, but working only or even primarily with multimedia would have changed the nature of the enquiry, taking it into the area of examining the efficacy of using video to impart information.

This would be a legitimate area of research, of course, but outside of the scope of the present study);

- The methods could be repeated with other groups such as non-disabled children or elderly people, and the results from the present study could be directly testable against these cohorts;
- Text volume and size appeared to be an important element in information retrieval, and hence worth exploring.

Literacy levels were taken from definitions provided from two sources. The first is from the report chaired by Sir Claus Moser (Moser, 1999) which investigated levels of literacy and numeracy amongst adults and young people in England. The second is from the Department for Education and Skills (as the current Department for Education was named before the 2010 election) (DfES, 2009) which extended this work to include people at a level lower than that described by Moser. The 'Moser' report, 'Improving Literacy and Numeracy: A Fresh Start', was commissioned by the then Secretary of State for Education and Employment, David Blunkett, defined the basic skill levels that have been used since in schools and, more widely, Colleges of Further Education. There are three main levels:

- 'Entry Level', subdivided into Entry Levels 1, 2 and 3;
- 'Level One';
- 'Level two'.

The majority of study participants fitted that described by Moser's (1999) working group as having reached 'Entry' level. The Teacher Reference File for the Skills for Life Curriculum (DfES, 2003) sets out the criteria learners have to meet during the course of their studies at each of the levels. Learners who are at Entry One are working towards being able to:

- Respond appropriately to some familiar social sight words [words often encountered in everyday life] for example; in public signs and notices (entrance, exit, bus stop);
- Identify the purpose of some texts from their format;
- Indicate where to insert personal information on simple forms, for example; name and address;
- Read and follow written instructions to complete an activity;
- Read a piece of text and gain meaning from it;
- Track texts in the right order, for example; from left to right.

At Entry Two learners work towards being able to:

- Trace and understand the main events of text;

- Recognise the different purposes of text ('at this level');
- Use illustrations and captions to locate information;
- Read and understand linking verbs and adverbials.

By Entry Three, learners work towards being able to:

- Read and understand simple text (up to six sentences or one paragraph);
- Follow simple instructions (up to six steps, one per step);
- Get the main idea from a simple graphical or tabular source, (e.g. safety signs with a single message);
- Find specific pieces of information from simple tables (no more than two variables)
- Use a simple list.

Finally, Level One learners work towards being able to:

- Read and understand a variety of text (e.g. a letter up to one page long, short features in a newspaper or magazine);
- Follow written instructions – each step could contain up to three short sentences;
- Understand and act on a graphical source up to one page long (e.g. a town map, price list, sign with multiple messages);
- Find information from complex tables, with at least two variables and with additional sources/keys);
- Consult a reference source to obtain simple information (e.g. Yellow Pages, dictionary).

In September 1999, following publication of the Moser report, the government set up a working group to look specifically into the literacy and numeracy needs of adults with Learning Disabilities. The resulting report, *Freedom to Learn* (DEE, 2000) recommended the development of a pre-entry curriculum so that learners at this level would be able to progress towards the main Skills for Life material.

As a response, the 'Adult Pre-Entry Curriculum Framework' was created (DfES, 2009), consisting of eight levels, known as 'Milestones', which lead on to Entry One. The top level of these, 'Milestone 8', describes the lowest attainment level of the study participants. At this level learners are able to:

- 'Understand that print conveys meaning;
- Understand and use the conventions of reading, following text from left to right and top to bottom (the text adds 'or as culturally appropriate' but for present purposes this does not apply, as English is the language of the website);
- Understand that individual words are grouped together to convey meaning and

information, using rules and structures;
- Recognise the letters of the alphabet by shape, name [or] ..sound;
- Recognise/read a growing repertoire of familiar words, signs or symbols … encounter[ed] in daily life' (DfES, 2009: unpaginated).

In order to accommodate learners at this level (who participated only in Part One of the research) the original website was very light on text and included audio rendition of all content. In addition to the range of literacy levels outlined above, potential participants needed:
- Experience of using the Internet and of accessing different pages;
- Being amenable and able to work with a different person (the researcher) without anxiety or a decline in performance;
- A positive attitude towards computers (it would be unethical to force people to undertake a usability session if they have no interest in the technology).

It is important to note that the participants did not have any physical disabilities which may have affected mouse control or other aspects of their computer interaction. In particular, they had no visual impairments. Thus, results outlined later regarding text size and performance effect relate only to people with reasonable vision (as affirmed by participants, tutors and researcher observation).

Technology
The study focused on web-based interfaces and PC and laptops using standard mouse pointers. Mobile platforms and other devices with small screens were not included. This was for three reasons. First, public institutions still predominantly use PCs and laptops with service-users, and this in more likely to be what people with Learning Disabilities would use at home. Second, small screens make websites difficult to negotiate. Finally, different input methods (e.g. numerical pad) would make the type of analysis undertaken impossible using mobile interfaces (Lewis, et al*,* 2009).

Focus: information retrieval
The study focuses primarily on the retrieval of information via electronic means, rather than information creation or communication. Whilst the project supports and is situated within the approach of 'inclusion' and 'self-advocacy', which perhaps implies more emphasis on *communication*, the study takes the viewpoint (as implied by Tarleton, 2004), that successful retrieval of information also aids the goals of facilitating these ideals. Having said that, it is important to clarify exactly what 'information retrieval' signifies in

the present context. Definitions of of the term include a wide range of activities related to the accessing of information, such as cataloguing, classification, indexing and database creation along with the act of actually retrieving or eliciting the information itself (Jarvelin and Vakkari, 1992). As noted by Kagolovsky and Moehr (2003: p401), information retrieval 'is a very complex field, combining expertise from computer science, engineering, cognitive psychology, library science, information science, and other disciplines, [and so] terminology and definitions used emphasize different aspects of IR [information retrieval]'. Part of that complexity is the fact that, since the Internet has stimulated growth in 'end-user' studies, there has been much research integrating research in information retrieval with the even broader topic of information seeking more generally (Beaulieu, 2000). Indeed, information retrieval behaviour not only forms part of the wider practice of information seeking behaviour, as modelled by, notably, Ellis (1989), Wilson (1997) and Kuhlthau (1993), but can also be subdivided or dissected to include, for example, information 'extraction'. This is the point at which 'an information seeker applies skills such as reading, scanning, listening, classifying, copying, and storing information' (Marchionini, 1995: p57) after a document or resource has been acquired. For present purposes, 'information retrieval' is used to mean the accessing of pre-requested information, in the form of 'hard facts', from menu item selection and the scrutiny of a resultant accessed page. The activity is thus broader than that of 'extracting information', but narrower than the full activity of information retrieval consisting of query term formulation and, of course, much narrower than that of 'information seeking'.

In terms of the media comprising the information, the research focused on text and images, although for one study (in Part One) a website with audio rendition of text was used.

Measures used

Different measures were used at different stages of the research, as detailed below.

Part One: This focused on the issues that arose in negotiating various pages of interest, and the barriers to successful information retrieval (as also undertaken by Harrysson et al*,* 2004 and Davies et al*,* 2001). Such issues included the overall understanding of task (elicited by actions undertaken - such as use of navigational buttons - questions asked and task success/failure); and the understanding and use of interface elements, such as navigational buttons, scrolling and awareness of non-visible content etc., as outlined in greater detail in the section on methodology. Formal quantitative measures were not used.

Instead, the issues that arose, either in general usage or in set tasks were documented, which fed into Part Two.

Parts Two and Three: One of the studies in Part Two, that exploring participants' understanding of images, included a quantitative comparison of the extent to which people categorised pictorial and iconic representations of different concepts in the same manner as the researcher and a small group of professionals. For the other studies task-time and interface preference measures were taken. The reasons for adopting these measures are outlined below.

Time on task ('task-time'): it could be argued that the time taken to access information does not matter. Indeed, some literature on Learning Disabilities (e.g. Kennedy, 2008) emphasises the importance of *process* (e.g. the *undertaking* of an activity) rather than *product* (the *result* of that activity). However, there are a number of reasons for adopting this measure:

- *The nature of the task:* Process measures often involve the creation or communication of information (e.g. Minnion et al, 2006). The present research, however, looked at obtaining (or retrieving) information. As such, speed of access may be more important than with the more creative pursuit of information creation;
- *Short attention span:* People with Learning Disabilities are known to have short attention spans (see, e.g. LDAA, 2010) and therefore it is important to ensure information is readily to hand for this cohort, to avoid them desisting;
- *Precedent:* Task-time has already been used so much in usability studies that one could argue it has become a standard measure (see e.g. Choi and Bakken, 2010), including research with people with Learning Disabilities (see e.g. Karreman et al*,* 2007, who measured searching and reading time);
- *Ethical considerations:* The tests were formulated such that the great majority of participants would be able to undertake them successfully. This was to avoid the embarrassment of 'failing'. Thus, task-time was used as a measure of task difficulty, rather than the simple binary measure of 'correct/incorrect' performance. An example from the literature is that of Davies et al*,* (2001).

Preferences: Clearly, a website or other resource that is not considered attractive or interesting will not be used to the same extent as one that does appeal, again potentially causing the information seeker to desist. There was also a more philosophical reason for including preference data. 'Inclusion' encompasses the idea of self-advocacy and choice, and it was felt inadequate to examine the efficacy of various websites without taking preferences into account. This has been attempted before, by Sevilla et al, (2007) who ambitiously captured satisfaction measures elicited from the number of smiles, gestures and comments made when negotiating a pre-existing commercial website and a cognitively accessible equivalent constructed by the researchers.

Methods

Creating / accruing website content

Content for the website was created in three ways:

- User generated
- Supporter, carer advice and resources
- Literature from other accessible websites

User-generated content

Respecting the inclusive ethos of the project and the ultimate goal (beyond the life of the research reported here) of a 'completed' information resource, as much information as possible was generated by people with Learning Disabilities themselves. This was undertaken with the help of tutors and supporters in order to obviate any communication problems as. Measures taken to facilitate user-generated content included:

- Mapping out the subject area: This included discussing ideas that defined the concept of 'transition', such as: 'things we can do now we are not at school' … telling other people how to do them … things we need help with …';
- Asking questions about personal experiences and knowledge: These included questions such as 'What do you do for fun?' rather than ask polar interrogatives (Hudson, 1975), which are questions with 'yes/no' or other such 'binary' answers such as 'Do you like computer games?';
- Asking for facts: A good example of this was when, in a small group session, someone expressed a liking for going to the cinema. This afforded the opportunity for the researcher to ask 'Ok, so what does someone need to know so they can go to the cinema?' This prompted responses such as 'How to get there', 'How much it costs', 'What time it starts', and other information for anyone wishing to make their first foray to a cinema. To elicit some of the points made a gentle nudge was offered - such as pointing to a wrist watch to remind participants of the need to know the start time of a film.

Supporter, carer advice and resources

Staff at the various locations used for the fieldwork were not only involved in eliciting information from the user cohort, but also themselves asked about what information they felt would be useful to include. In this regard, of interest was the extent to which topics related to transition mapped on to the curriculae they use that they considered important with this user group. Resources used by tutors, such as the DfES (as the current Department of Education and Employment was called) Skills for Life pack 'Literacy' at Entry Level, also provided material.

Literature from other accessible websites

As outlined earlier, the lack of information provision for people with Learning Disabilities has been well documented (e.g. Tuffrey-Wijne et al, 2006; Tarleton, 2004). However, there are various websites which do provide accessible information. One, in particular, Movingonup (http://www.movingonup.info/) is specifically for transition-related information. It advertises itself as being for 'young people from minority ethnic communities' although there is little that is not applicable to anyone with a Learning Disability. Other resources used include:

- Mencap: www.mencap.org.uk
- Friendly Resources: http://www.friendlyresources.org.uk/
- Easy Health: www.easyhealth.org.uk
- Making Money Easier: http://www.making-money-easier.info/
- Common Knowledge: http://www.ckworks.org.uk/index.html?pid=1

Preparing content for website use

Although the information accrued was either written specially for people with Learning Disabilities, or created by them, it was felt necessary to both confirm that it met certain criteria for 'easy reading' and to standardise it for use in Parts Two and Three of the study (where time taken on task was compared across different website layouts using different text passages). Three criteria were used to test for accessibility and standardisation:

- Adherence to published guidelines;
- Keeping content at accessible readability levels;
- Approval by tutors and other educators.

Adherence to published guidelines

'Raw' potential content was tested for accessibility by inspecting text against guidelines formulated by the individuals and organisations cited in the section on web accessibility guidelines above. Grouped in tabular form these were:

Guideline	Source
Organisation/layout	
Place the important parts of a paragraph (key points) in the first sentence.	Bohman (2004)
Provide clearly signposted, simplified summaries of pages' content at the top of the page (This does, however, take up space and means that there is a danger that the page might become cluttered or that the user has to scroll too far to read or see all of the contents).	Fidgeon (2006)
Organise content into well-defined … chunks, using headings, bulleted lists, and other visual-semantic organising schemes. However, Bohman (2004) suggests not to use different fonts, and to avoid making text too variable.	Bohman (2004) Mencap (undated) Fidgeon (2006)
Emphasise important text—or the headings to sections of text—with bold font faces or larger text size.	Bohman (2004)
Linguistic content .	
Use clear and simple language.	Bohman (2004), Jiwnani (2001) Banes and Walter (2002) Mencap (undated) BSI (2006) Hassell (2005)
Reduce information overload, by simplifying text or providing options for abbreviated content	Singh (1998)
Avoid using words in their non-literal sense (e.g. "it's raining cats and dogs") and abstractions (e.g. provide a link to a telephone number rather than to 'Contact us'). (Brown and Lawton (2001), however, recommend 'analogy' and 'alternatives', which others may think unhelpful).	Fidgeon (2006) Brown and Lawton (2001)
Use concrete nouns and explicit descriptions.	Brown and Lawton (2001)
Use short line lengths and paragraphs, and limit the amount of text on each page	Hassell (2005)

Table 7: Web accessibility guidelines as related to text/linguistic content, aggregated and tabulated

Measuring readability levels

Readability has been variously defined as encompassing how easy it may be to understand text (Dale and Chall, 1949); its clarity and the ease of reading words and sentences (Hargis, 2000), the extent to which it is interesting (Dale and Chall, 1949), considering a particular target audience or 'class of people' (McLaughlin, 1969). Just as many of the guidelines in the section above apply to both electronic and hardcopy content, the readability of text (in terms of its linguistic difficulty) can be said to be similar for both media. Readability formulae assume this although, perhaps surprisingly, there is evidence that the medium *can* have a slight effect (see, e.g. Muter and Maurutto, 1991). However, for present purposes this does not present a problem as interest is only in, first, keeping the level below a particular threshold, where any slight difference occasioned by the medium is of no consequence; and second, in standardising text.

Given such a wide range of factors contributing to 'readability', it is perhaps no surprise that there is no shortage of readability formulas from which readability levels can notionally be measured. Indeed, one definition of readability refers specifically to it as being: 'the determination by systematic *formulae* [emphasis added] of the reading comprehension level a person must have to understand written materials' (Albright et al, 1996: p139). According to William DuBay (DuBay, 2004: p2) 'by the 1980s, there were 200 formulas and over a thousand studies published on the readability formulas attesting to their strong theoretical and statistical validity … which have proven their worth in over 80 years of application'.

DuBay acknowledges that there have been many critics of such formulae, who have been 'honestly concerned about the limitations of the formulas and some of them offered alternatives such as usability testing' going on to add that 'Although the alternatives are useful and even necessary, they fail to do what the formulas do: provide an objective prediction of text difficulty' (p3). Nevertheless, one particular caution should be noted. As Bruce Arnold (Arnold, 2004) points out, readability tests 'are indicative only (readability online can be significantly affected by placement and format of the text) and that simply writing for a low score will not, in itself, improve the comprehensibility of a page'. (Arnold, 2004: unpaginated).

The most widely used reading tests include those of Rudolf Flesch, Robert Gunning and Harry McLaughlin. Flesch (1948) developed his 'Flesch Reading Ease formula' which used a scale from 0 to 100, with 0 equivalent to the US 12th grade (approximately) and 100 equivalent to the 4th grade (actually, where there are short sentences containing only words of one syllable, the scale can go higher. 'The cat sat on the mat' for example has a formula score of 116).

The original formula was:
Reading Ease score = 206.835 − (1.015 × ASL) − (84.6 × ASW)
Where:
ASL = average sentence length (number of words divided by number of sentences)
ASW = average word length in syllables (number of syllables divided by number of words)

Flesch Reading Ease scores can be rendered into a table as follows (with the difficulty level being an original part of the test):

Flesch RE score	Reading age	Difficulty level	Example for UK readers
90-100	10-11 years	Very easy	Children's stories
80-89	11-12 years	Easy	Women's fiction*
70-79	12-13 years	Fairly easy	Popular novels
60-69	14-15 years	Average	Tabloid newspapers
50-59	16-17 years	Fairly difficult	Introductory textbooks
30-49	18-20 years	Difficult	Students' essays
0-29	Graduate	Very difficult/very confusing	Academic articles
*This example may seem somewhat derogatory to women. Although the choice is not explained, a possible alternative label might be 'Romantic fiction' a la Mills and Boon series. As a further example, the present writer found articles on the BBC Learning English website in its 'Words in the News' were written at this level.[9]			

Table 8: Flesch Reading Ease scores and their difficulty levels (Colman, 2001)

The Flesch Reading Ease formula became one of the most widely used, especially in journalism, and the one most tested and reliable (Klare, 1963). In 1951, Farr, Jenkins, and Patterson changed the syllable count (Klare, 1974-5). The modified formula became:

New Reading Ease score = 1.599NOSW – 1.015SL – 31.517

Where:

NOSW = number of one-syllable words per 100 words and

SL = average sentence length in words, (Farr et al*, 1951).*

For the record, this gives a score of 122.2 for 'the cat sat on the mat'.

The Reading Ease formula was later recalculated again to give a grade-level score. The new formula is now called the Flesch–Kincaid Grade-Level formula. Although it is designed to calculate Grade levels, the extremes go to at least 25.3 (said to be the Grade Level of James Madison's speech on December 5, 1815 – see Yau, 2013) down to a meaningless −3.40, although possible, where every sentence consists of a single one-syllable word. Calculated Grade Levels correlate 0.91 with comprehension as measured by reading tests (DuBay, 2006), a common method of validating readability formulae.

In the 1940s, Robert Gunning founded the first readability consulting firm dedicated to reducing what he described as the 'fog' in newspapers and business writing (DuBay, 2006). Gunning claimed that only two qualities were critical to determining readability: the average number of words in sentences and the percentage of 'hard' words (those with more than two syllables) that might cause a reader to stumble. In 1952, he published his

[9] For example 'The world's brightest city', posted on 25.03.13 at: http://www.bbc.co.uk/worldservice/learningenglish/language/wordsinthenews/2013/03/130325_witn_light_pollution.shtml

own, so called 'Fog Index' (Gunning, 1952). This also computes grade levels, and is calculated as follows:

Grade level (of text) = 0.4 (ASL+ %HW)

Where:

ASL = average sentence length

HW = Hard Words (words with more than two syllables) (Gunning, 1952)

Following 'Fog', Harry McLaughlin coined the term SMOG (Simple Measure of Gobbledygook), which multiplied, rather than added, word length and sentence length. His SMOG formula represents grade levels in a sense, as it estimates the years of education needed to understand a piece of writing:

SMOG grading = 3 + $\sqrt{PS}$

Where:

PS = polysyllable count (number of words of more than two syllables in a sample of 30 sentences) (McLaughlin, 1969)

The SMOG formula correlates 0.88 with comprehension as measured by reading tests (DuBay, 2006).

For present purposes, text was subject to all of the tests outlined above, namely:

- Flesch Reading Ease formula (0-100+)
- Flesch–Kincaid Grade-Level (Grade level)
- Gunning Fog Index (Grade level)
- SMOG Formula (Years of education)

All text was modified to be 100 or greater (Reading Ease formula); between 2 and 3 for Grade level (equating to 8 to 9 year old 'mainstream' learners) and 5 to 6 SMOG level (equivalent to the number of years of 'mainstream' education). These calculations were easily undertaken using the online readability calculator accessible on the website Edit Central[10].

Seeking expert advice from tutors and other educators

In addition to recommending sources for content, tutors or other educators of the project participants were also asked to read content that had been created in any of the ways outlined above. They were thus able to modify any text further, considering their own particular learners, and give the content some professional credibility (about which

[10] http://www.editcentral.com/gwt1/EditCentral.html#style_diction

adherence to readability guides or formulae do not in themselves guarantee relevant or even accessible content). Where tutors modified content the readability of the amended text was re-calculated to ensure that it remained within the parameters determined earlier (it was decided to raise the level upward if it fell below a 2.0 Grade Level or above 110 Readability score, to keep it standardised with the other topics).

Studying usability

The main focus of the study was that of establishing what attributes of websites (and, in particular, individual pages) facilitated easy usage by the participant cohort described earlier. Part One approached the issue qualitatively, working with a pre-existing website interface (Newham Easy Read that had been created – as mentioned earlier – for a larger project). Usability tests were undertaken using small samples of participants who were observed and interviewed as they carried out various short tasks on the website constructed prior to the study. These methods are discussed in detail below. Parts Two and Three of the study adopted similar methods, but with a far larger sample group which allowed for a quantitative analysis. Part Two compared different website attributes, with Part Three combining these to create a series of different interfaces.

Before any fieldwork at all was undertaken, the researcher first had to become familiar with the environment within which learning and information provision took place with people having Learning Disabilities. The following detailed account of the methods entailed in studying usability begins with this process, moving on to examine usability sessions themselves and the procedure involved in carrying out set tasks and other activities.

Familiarisation in the field

The research began with a series of participatory observations 'in the field' in order to understand the context with which information technology was undertaken by the participants, their general practices and uses of computers. As Brewer (2000) notes, observation is an inherent part of many types of research. For this project, as was undertaken in prior work by the researcher (see Williams and Nicholas, 2006 and Williams 2006) observation was undertaken of the use of the Internet or other ICT system during the normal course of a class lesson (that is rather than as part of a formal usability session).

As with the prior work cited above, it was necessary for the researcher to immerse himself in the environment, not only to understand the context of the use of computers and information technology but also to help establish a relationship with potential research participants (Aitken and Millar 2002; Rogers 1999). During this process classes were observed and staff and young people interviewed, with the latter consisting of questions about using computers in class, and general likes, dislikes and difficulties. This element functioned as a pilot for methods for ascertaining prior knowledge during the more formal usability sessions, and is discussed further below.

Aside from the informal interviews mentioned above, the participatory aspect of observing the environment was kept to a minimum, to minimise the effect of the presence of the researcher. Ground rules were:

- Interaction in the normal classroom environment was confined to summoning the attention of the teacher or teaching assistant if the learner called attention to a problem (followed, of course, by non-participant observation of the learner and helper together and their strategies for resolving the problem);
- In the experimental setting, participation was broadly confined to asking about understanding of the task, repeating instructions and offering constructive feedback. The researcher demonstrated how to undertake a particular task where the subject was unable to complete it.

Day-to-day use of information technology was noted, with consideration being given to barriers, constraints and difficulties in usage, as well as to how computers might be enhancing teaching and learning. Where this independent system use by supporters was examined, such as teachers searching for materials for their students or uploading a new student profile, the researcher engaged far more, as there was no danger of ‘contaminating’ any natural interaction between supporter and student.

Usability test procedure

The literature reviewed in the previous section, and in particular works by Sevilla et al*,* (2007); Karreman et al*,* (2007); Harrysson et al*,* (2004), and Lepisto and Ovaska, (2004); plus the researcher’s own prior experience of undertaking usability studies with people having Learning Disabilities (Williams, 2006; Williams et al*,* 2006) and others (see Williams and Nicholas, 2001; Williams et al*,* 2002, 2004) all suggested that five stages could be usefully involved in the first round of usability sessions:

- Participant briefing;
- Ascertaining prior knowledge;
- Free browsing of site;
- Set task completion;

- Post-task feedback/interview.

Some or even all of these stages are fairly common practice in usability evaluations with mainstream participants (e.g. Rosenbaum et al, 2008; Hutchinson et al, 2005; George, 2008), and only two modifications were considered necessary for Part One of the research. First, the prior knowledge was ascertained in a practical way, with the participants showing their computer activities and talking the researchers through them, rather than by self-reported descriptions. Second, the post-task feedback was incorporated more into the task session, so that participants would not be required to remember their actions afterwards. Tasks were, of course, of a less complex nature than might be expected with people not having Learning Disabilities, as detailed below.

Participant briefing

Following the familiarisation process, the formal usability sessions began in each case with a participant briefing. The sessions began with a short introductory talk from the researcher, in which the following were discussed:

- The meaning of the word transition and what information might be needed;
- How the Internet could provide such information;
- Why it may be difficult to access information on the Internet and hence…
- The nature and purpose of the study. Here the information sheet was referred to and (again) explained.

The website (or sites) was shown on a data projector. It was stressed that it was the usability and functionality of this, and not participants' abilities that was being examined. The considerable value of their contributions was also stressed, as was their right to decline the invitation to participate. Additionally, to show that the researcher understood why certain people might not want to participate, he said that there were several reasons why they might not want to – a certain shyness; a desire to continue with one's normal planned activities, a dislike of computers and – said in a somewhat flippant manner, not wanting to work with a man who "isn't even one of your tutors!"). This was a fairly high-risk strategy in that it could have actually dissuaded participation(!) However, it was felt imperative to make both participants and non-participants feel comfortable. The price of possibly seeking further venues or taking alternative measures to reach a significant participation number was felt to be a small one.

Following this introduction, participants were invited to ask questions. Very few were forthcoming, and supporters sometimes asked on behalf of participants. Questions included “will it be easy?”; “How long will it take?” (asked by a supporter with no prompting from any participant) and “Did you make the website?”. There were also, perhaps unsurprisingly, a few off-topic questions , including asking about the researcher’s hobbies, place of residence and means of transport. Rather than say that these were not relevant, they were answered honestly and with good humour – again, to maintain a positive and inclusive atmosphere. Once all questions had been answered to participants’ satisfaction, the first stage of the session began.

Ascertaining prior knowledge

The aims of this activity were to gain insight into:

- Attitudes towards the Web
- Experience and regularity of Web and related technology use
- Any assistive technology normally used or required

Participants were asked to show the researcher what kind of things they undertook on a computer. This was both to help them relax (i.e. by showing things they enjoyed and could do easily) and also to enable the researcher to evaluate knowledge and experience and, in particular, to elicit any problems that participants might have in using a computer.

This part of each session was less about establishing ability or familiarity than with helping participants relax and gain confidence by using and showing their computer activities. Of course, it did also help the researcher ensure participants were, indeed, able to undertake the tasks. For this reason a simple observational checklist was used to aid him in assessing potential participants. A version with post-research notes can be seen in Table 9. Areas to consider were the abilities to use a mouse, activate links, read simple text.

Action	Methods	Notes
Directing or positioning cursor	Three methods may be available - using a mouse, a mouse-pad or (less commonly) arrow keys.	Things to note included the speed of the cursor and if this is appropriate; and whether there were any erratic or apparently aimless movements.
Scrolling	Again, more than one method could be employed. In addition to those noted above, the PGDN and PGUP buttons and a mouse wheel could be used.	One area of interest was to see whether there was a recognition that the screen might not encapsulate all of the page or the information within it. Bohman (2007) in particular, noted that over half of the people with Learning Disabilities with whom he worked were not aware of the need to scroll. Any difficulties, such as with dragging the scroll bar, were also noted.
Recognising and activating a link	A mouse or mouse-pad 'clicker' are the key methods. The right (context) menu can be used to elect to open the linked page in a new window or new tab.	One common problem is that of performing the click action, which people with less dexterity may find difficult (and has been described as being a 'conceptual block' for some users (Sutcliffe et al*,* 2003: p586)
Recognising common icon, including an audio icon accompanied by or without a label		Some icons that may be straight forward for a non-disabled user could cause problems for those with Learning Disabilities. Poncelas and Murphy (2007) found icons accompanying text did not increase the understanding of people with Learning Disabilities.
Reading text		As mentioned, the study did not seek to specifically examine understanding. It was useful, however, to identify any problems such as with the amount of text or its size and positioning.

Table 9: Observational schedule

The researcher made notes on these topics and any other any area of interest that arose, while observing participants' chosen interaction with their computers. In almost all cases this was a demonstration about leisure activities, although occasionally – particularly where current educational work was being undertaken at the time of the session – formal tasks required for their tutors were shown.

Questions asked included, depending on the circumstances and level of the participants:

- How much do you use a computer (every day, most days etc.);
- Where do you use it? (at home, the library, college, friend's house etc.);
- What do you do on the computer? E.g.:
    - *Watch / listen to media:* Watch TV; YouTube, Flickr etc.;
    - *Shop*: food and groceries; books, CDs, clothes; Use eBay or other auction sites;
    - *Communication:* Use email, chat/messenger software;
    - *Social networking:* Use Facebook, MySpace, BeBo etc.;
    - *Creating:* Make your own pages and sites – where and how (a quick demonstration

was requested where appropriate);

- *File sharing / downloading:* music etc.;
- *Research:* using search engine, reading, studying.

Participants were not asked specifically about 'the Internet' or 'the Web'. This was in case they were unaware that their activities constituted accessing the Internet (as might be the case where, for example, they watch television clips on YouTube). It was felt more effective to ask questions regarding their behaviour and activities. Another point regarding questions is the omission of the question 'How long have you been using a computer?', the answers to which may have been useful. This was not used, however, due to concerns that people with Learning Disabilities may find it difficult both to remember when they started using a computer, and also to have a good notion of the concept of time (Clarke et al*,* 2005).

Free browsing

This part of the tests invited participants to freely browse the website in question, offering a 'running commentary' on their actions where possible, and evaluating the site as they do so. This technique is commonly called 'Think-aloud' (Branch 2000) or, more formally, 'protocol analysis' (Ericsson, and Simon, 1993) and has been undertaken before in exploring website use, both with young subjects (e.g. Branch 2001; Madden et al*,* 2006) and adults (e.g. Benbunan-Fich 2001). In a rare example in the context of Learning Disabilities Lepisto and Ovaska (2004), use the phrase 'informal walkthrough', and describe it as a method where 'the test moderator … lets the participant explore the system in his or her own pace and order' (p306). Another advantage is that, 'because all cognitive processes travel through short-term memory, the conscious thoughts of the subject can be reported at the time they are processed … the cognitive processes that generate verbalizations ("think alouds") are a subset of the cognitive processes that generate behavior or action' (Johnstone et al*,* 2006). As Van Someren et al*,* (1994) observe, commentary that takes place as cognitive processes are occurring will not be subject to the errors in recall that occur when people reflect later on their actions. With this group, of course, the difficulties entailed in articulating their thoughts limit the benefit of the method, although as the actions being described constituted browsing rather than problem solving or other higher level activity this was not considered an acceptable limitation.

Although apparently informal, free browsing was designed to give the researcher another chance to examine any potential problems. Users were encouraged to ask questions as they proceeded (an obvious one being ‘How do I get back to the previous page?’). This part of the test lasted as long as it engaged each individual participant. When it was clear that either the site was familiar enough to continue or that it was not holding the participant’s attention without the structure of set-tasks, the activity switched to Part three.

Again, the researcher noted user behaviour by taking notes. It was not considered necessary to use any ‘screen-capture’ software, as it was relatively straightforward to track user movements whilst they undertook the set tasks, and with the free browsing their general usage of the Internet and the sites they found interesting were of more importance than each individual action.

Studies One and Seven did not include this stage – the former because the activity was designed only to examine the use of icons and involved only minimal navigation; and the latter because tasks undertaken on different interfaces were being compared, and familiarisation with one or two interfaces would have biased task-time results.

Set tasks

The inclusion of ‘formal’ set tasks was made on several grounds. First, it follows the author’s previous work, both with similar Learning Disabled cohorts (Williams and Hanson-Baldauf, 2010). Second, the experience of watching potential participants as they undertook free browsing of websites suggested that they appeared to move rapidly from page to page without apparently absorbing more than a small fraction of any information each page might contain. As such it did not seem appropriate to adopt a method of, for example, asking post-hoc questions about what they had read or looked at (the latter including images) as it might have resulted in many people being unable to demonstrate any acquired information – a formal structure was clearly needed. Finally, the ultimate goal of the websites created was to provide information that would be useful and would answer specific questions, such as ‘what do you need to know before you can go bowling?’. Thus, the tasks were developed to ask this and other similar questions, as might occur in a more naturalistic setting and which the person with Learning Disabilities might seek information, guided by a parent or supporter but in as autonomous a manner as possible.

As noted above (on page 93), the websites examined were designed to be as accessible as possible, so that information could be retrieved with the minimum navigation. An issue identified by both the present writer (Williams and Nicholas, 2006; Williams 2006) and others (e.g. Lepisto and Ovaska, 2004) is that of task understanding. For the studies reported here, the ‘cognitive load’ (Chandler and Sweller 1991) was made as light as possible - tasks were broken down into discrete units which, at their simplest, required only one action for completion.

Examples of the actions required are:

- Clicking an arrow button;
- Placing the cursor on a particular part of the screen and 'clicking';
- Scrolling a page.

These actions were required to undertake the following task-types:

- To find a particular icon (which substituted for text information);
- To access a different page;
- To find text to answer a specific question.

It was recognised that some of the students would find it difficult to perform tasks where there was a sophisticated information goal to be achieved (i.e. such as to compare information on two pages or to infer facts from information given), as may be normal in usability studies. This would have been particularly difficult if it required multiple user actions. Tasks were therefore formulated to avoid requiring participants to have to consider the text in any great detail - the task was not one of testing for language comprehension.

It is worth exploring question-types in detail, as the practice of formulating set-tasks, and within that, the nature of the questions to be asked, formed a crucial part of the study. Benjamin Bloom put the art of questioning into the context of levels of intellectual behaviour in learning. He developed a classification system to define these, called Bloom's *Taxonomy of Educational Objectives*, (Bloom, 1956) which can be used by educators to recognise and formulate their various levels of question-asking (Krathwohl, 2002). The system comprises of six hierarchical levels, moving from the lowest to the most advanced level of cognition (Fredericks, 2005):

- Knowledge;
- Comprehension;
- Application;
- Analysis;
- Synthesis;
- Evaluation.

Knowledge is the lowest level of questions and requires students to recall information, usually in roughly the same form as it was presented.

Similarly, Lynn Erickson articulates and discusses three types of questions which can also be used to test various levels of cognition: *factual, conceptual, and provocative.* The former can be answered with definitive, and comparatively simple answers (Erickson, 2007) and are, essentially, knowledge-based questions. His *conceptual* questions require more sophisticated levels of cognitive processing and thinking, and his *provocative* ones are ones that cannot be answered easily – and that may, indeed, have no right or wrong answers (e.g. such as moral questions).

For current purposes, the most basic question type was needed. This was that asking for 'knowledge', as described in Bloom's taxonomy (Bloom 1956), or facts - Erickson's (2007) preferred term. Questions were chosen where the answers were not only explicit in the text, but where the text used the same words as the question. Thus, in a section on transport, one question was 'when does it cost a lot to travel by train?' In the text the phrase offering the answer to this question is 'It costs a lot to go in the "rush hour"'. Such questions were both free from the risk of 'acquiescence bias' and relied only on a literal comprehension of the text. Such questions can be answered directly and explicitly from the text (Day and Park, 2005; Haupt, 1977). This quality was a requirement of the present project, as the emphasis was focused on the effect of screen layout and the layout attributes on the retrieval of information and not on comprehension of text. For this reason, questions requiring participants to infer answers (conceptual questions in Erickson's terminology) were not included.

Finally on the set tasks, one area of interest was the extent to which pictorial representations and images generally aided participants. As mentioned earlier, these were linked to the text verbally, in the case of menu entries (i.e. by captioning) and by spacial proximity. These are shown in Figure 13, where the left hand side shows a detail from a page on 'Good and bad foods' with a picture of a salt cellar next to text describing salt; and the right hand side shows some of the menu entries for the topic, each one being a captioned image.

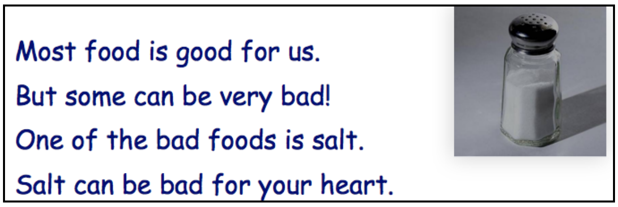


Figure 13: Text and image linkage. Left, proximity and right, verbal (captioning)

One of the tasks was to 'Name one of the bad foods'. This entailed accessing the page entitled 'Good and bad food' from the menu, and then identifying salt as one of the latter. Although in this case the menu entry picture may not have been particularly helpful, it was interesting to see whether the salt cellar next to the sentence about salt enabled quicker access to that text or if participants opted for the answer 'salt' simply on the basis of the picture.

Post-task interviews

In addition to the general problems already highlighted in interviewing people with Learning Disabilities (e.g. mis-representation of interviewee views, and acquiescence bias) Finlay and Lyons (2001) caution against using questions containing modifiers - words or clauses that change the sense of a question. The example 'what would you like to change about yourself?' which respondents might answer without reference to the modifier 'about yourself' (p322)[11].

Question content (in addition to question *phrasing*) difficulties include asking people:

- To make quantitative judgments (such as asking about frequency);
- socially reflexive questions (such as assessing how other people think of them);
- about abstract concepts, or unfamiliar topics.

Another problem is, of course, poor language ability (Perry and Felce, 2002; Lloyd et al, 2003).

Having articulated the problems that interviewing this cohort entail it is important to state that the most constructive approach to undertaking such research is to consider the limitations of the proposed method rather than concentrate on the 'deficits' of the target population (Booth and Booth, 1996) – as befits the social model of disability within which the current research sits.

[11] An example of the present writer's own mistakes in this area was revealed by a tutor at one of the Colleges of Further Education during the introduction to a usability session. He asked participants: "Can I please say a word before you look at the web site ". She advised that members of the class would only react to the last clause of the sentence and therefore look at the web site – the opposite effect to that desired!

In previous work by the researcher, the final part of any usability test has been a post-test feedback interview focusing both on the subjects' general opinions (including those on how the site could be improved); their thoughts on the information retrieval tasks and their explanations of their actions. For Studies One and Two, this element of the study consisted only of the most informal of 'post-task' interviews and, thus, by adapting the method, taking the advice of Booth and Booth, cited above.

Interviews were minimalised for three reasons:

- The potential communication problems of some of the participants, who might misunderstand the researcher;
- Avoidance of the added burden of having to formally engage with a relatively unfamiliar figure;
- A certain redundancy, as participants were encouraged (with the exception of Studies Five and Seven, where their task performances were timed), to chat as they interacted with the system – although this proved more fruitful during the 'free browse' part of the exercise than during the set task element.

The interview element was minimised even more for those participants who had more profound Learning Disabilities. In previous work, with non-disabled people, views were sought on why certain actions were undertaken, site layout and other design features. In the case of Studies One and Two, this was either confined to supporters, after the sessions, or simplified greatly, as outlined below. Second, participants were required to work less independently than would normally be the case, with the help of the supporter being permitted where necessary, despite not forming part of the study itself.

For the other studies comprising this thesis, post-task interviews asked participants if they had any difficulties in using the site (to avoid the polar interrogative and resulting acquiescence bias described above, questions were of the form ''How easy was it to find information?' 'How easy was it to get from page to page?' rather than 'Was it easy …?'). They were also asked for their general thoughts about the exercise. Those who showed an interest in chatting were asked further questions not related specifically to usability or the usability exercise, but regarding their website preferences (as related to Study Four. These included questions on:

- Site design and aesthetics: Prompts were e.g. 'What do you think of the layout?; 'What do you like about it?

- Information content: Prompts here were ‘Show me any part of the site you think you would use’ and ‘Which parts of the site were useful?’

As it turned out, very few participants were interviewed at the end of the session, due to fatigue, time constraints, or a desire to return to the activities from which they had been temporarily removed. In some cases the ‘interview’ (never described as such to the participant because of its formality - the word ‘chat’ was used instead) did not happen because the lack of communication by the individual during the course of the session strongly suggested a similar reticence would have been occurred, and the researcher did not want to place any of the participants in an invidious situation.

Supporters (teachers, peer supporters etc.) working with learners were also interviewed, with the following issues explored in more depth:

- Views on the extent and manner of their interventions and the difficulties they saw in their charges’ use of the websites being evaluated;
- The difficulties/misconceptions they might have had in their own understanding the system (icon meaning, navigational structure etc.);
- General views on the interfaces being studied, in terms of usability.

Measures and analysis

Part One of the study, being exploratory in nature, collected qualitative data. This looked primarily at:

- Overall understanding of task (elicited by actions undertaken - such as use of navigational buttons - questions asked and task success/failure);
- Understanding and use of interface elements, such as:
    - Navigational buttons, images, hyperlink labels;
- Ease and success in negotiate the system including:
    - Scrolling and awareness of non-visible content (below the screen); extent to which menu entries below screen are accessed, where there is a vertical menu column;
    - Effect of text size (in the form of user comments; signs of reading/viewing difficulty, misplaced cursor).

An observational schedule has already been mentioned. This was used not only in the initial stage of eliciting prior knowledge and experience, but guided the observation of free browsing and task completion also.

Quantitative measures were not used at this stage. A problem encountered by only one participant was considered to be interesting data. In the field of web usability, for any interface being studied only between three and ten participants are generally considered necessary (George, 2008). Indeed, Internet usability 'guru' Jacob Nielsen recommends the use of between only three to five 'evaluators' (Nielson, 1994b). He argues that only a small number of people is required to elicit the major issues that arise in, for example, navigation or text size. This is because the aim of usability studies generally is to only elicit issues, problems and areas of interest, in terms of the interaction between the individual and the computer, not to measure their extent or prevalence.

Data analysis consisted of first aggregating notes from each participant's performance, concentrating specifically on specific problems (and successes). As with the pre-test observations, the researcher noted such issues as finding desired content and, where applicable, directing or positioning cursor to activate a link; any problems with scrolling; icon recognition and text reading. However, no strict framework or template was used – any behaviour or action related to participants' interaction with the site was of interest and duly noted.

During the course of Part One an attempt was made to relate the issues noted to website design – the aims of the study being to elicit these and then explore what might be an 'optimum' template for the cohort studied. Thus – it is important to stress – problems in physical mouse control, for example, were not a consideration for this purpose. Results were only accrued from participants who exhibited such difficulties (as, indeed, was the case for all participants) with regard to aspects of their behaviour whose causes and solutions lay in aspects of site rather than hardware design.

For Part Two a larger sample size and method, of recording task-time, enabled a quantitative analysis. Thus, statistical procedures were undertaken for both the usability sessions on the various interface designs and that of a task undertaken on two menu arrangements.

Analyses were based on the comparison of means of task-time, for:

- Two groups: an analysis of individual attributes (i.e. vertical v horizontal menus);
- Three groups: to test differences in effect of the three site attributes (menu position, text size and use of images);
- Four groups: to examine differences in task-time between participants categorized into four literacy levels;

- Eight groups (1): to examine individual tasks and task order effects (to test whether the tasks were equal in difficulty and whether there was any effect resulting from task order that had to be factored into the results)
- Eight groups (2): to see which interfaces are most (and least) effective in terms of time taken to access information; and how they compare between themselves;
- Eight groups (3): to test the relative effect of each interface attribute in isolation and interactively with each other.

With all the comparisons of means described here, a statistically significant result is one where the outcome or result would only occur at or less than once in every 20 occasions, or 5% (Field, 2005). This is expressed as 0.05 (i.e. 1/20).

For each data set, the distribution was tested for normality by using the standard the Kolmogorov–Smirnov test. This was necessary to determine whether or not 'parametric' tests were appropriate. The term derives from 'parameter' or, in this case, 'the characteristic of the population'. These tests assume the population from which the sample is taken is normally distributed (e.g. in a symmetrical 'bell' shape). As might be expected by using time as the dependent variable (one cannot score less than zero, so one of the tails has a lower limit), the data was positively skewed and thus was non-parametric. However, although methods exist to compare means with data that is not normally distributed these 'non-parametric' tests are considered by some to be less powerful or less sensitive (Field, 2005). It was decided, therefore, to attempt to transform the data to normalise it. Tabachnick and Fidell (2007) recommend square rooting or taking the logarithm of the data where there is a positive skew. For present purposes the former was chosen – principally because, there being apparently little difference, the root was more easily visualised and understood. The same normality tests were again carried out, and this was successful in normalising the data except in one case. Fortunately this was data accrued for the first and pilot part of a study examining the effect of menu position, where much qualitative data was also accrued. Nevertheless, for this research (Study Five) the non-parametric Wilcoxon Signed Rank test was undertaken.

Various parametric tests were undertaken. In order for these to be valid, certain assumptions or requirements for the data need to be met, which are described in Appendix 4. The tests undertaken were:

t-tests: There are two types of t-test, the independent samples test, which compares two different groups of people or conditions; and the paired-samples t-test which compares the same group of participants on two different occasions or two 'matched pairs' of participants undertaking the same activity. In both cases, the means of the scores comprising the dependent variable are compared. The former compares the difference in the mean scores of two independent (categorical) groups on a ratio or interval scale (task-time in this case) and the latter compares the same group on two different occasions or under two different conditions. If there is only a 5% or lower chance of the mean score difference (expressed as 0.05) it is considered significant and caused by the experimental condition and not by chance.

Analysis of Variance (ANOVA): These tests compare the mean scores of more than two groups and determines whether there are significant differences on the dependent variable (task-time in this case) across the groups. Post-hoc tests can then elicit where these differences lie. For the current research a univariate between groups ANOVA was undertaken. This compares one independent variable (word position on a menu list in one study, and interface number in another) which has a number of levels (e.g. word positions of left, centre, right; and Interface numbers One, Two, Three etc.). It compares the variability between groups with that within groups, the latter assumed to be the result of chance. An F-ratio is then calculated, which represents the former divided by the latter. The significance level indicates the extent to which the figure would arise through chance alone. As above, if there is only a 5% or lower chance of this it is considered significant and caused by the experimental condition.

There is also a repeated measures ANOVA designed for the situation where each research participant is exposed to two or more different conditions or the same condition on three or more occasions – rather than there being two groups or samples. For Studies Six and Seven, although there was only one sample (the same participants undertook all of the tasks) a repeated measures ANOVA was not considered appropriate. For Study Six this was because each iteration in a word-finding task presented words at random, so that one participant may have had words in the order 'left-placed', 'left-placed', 'right-placed', 'centre-placed'; whereas another could have had a 'centre-placed' word first, then two 'right-placed' etc. Also, for each participant the word position scores were aggregated, so the order was lost and a repeated measures test therefore not appropriate.

A different reason presented itself for not using repeated measures for the comparison of interfaces study (Study Seven). Not all participants undertook all of the tasks, with some taking only six or seven of the eight, and so there are some missing values. In a repeat measures design, when the data is incomplete only measures from participants taking all of the tasks are included (Field, 2005), resulting in unused data and a smaller sample size. As is widely acknowledged, the ANOVA is particularly robust to violations of its assumptions (Field, 2005; Bryman and Cramer, 2011) and so – particularly as each task and each interface were different and randomised - it was felt that using the same group of participants would not invalidate the analysis. As with the menu game, the randomness of the iterations was felt to justify not using a repeat measures analysis.

Multiple regression: This can be used to determine how much of the variance in a dependent variable or outcome measure (in this case, task-time) can be explained by the independent variables (in this case, the web page attributes), and – importantly - the relative contribution of each. In regression analysis a linear (or 'straight line') model is fitted to the accrued data in order to predict the dependent variable (task-time in this case) from the 'predictor' or independent variables. Of course, 'when any line is fitted to a set of data, there will be small differences between the values predicted by the line and the data that were actually observed… These differences are called residuals' (Field, 2005: p144). Multiple regression can be undertaken where the data includes one continuous dependent variable (for the current data, this is represented by task-time) and two or more independent variables (text size, menu position and images).

In addition to these parametric tests, one non-parametric comparison of means was carried out, as described below.

Wilcoxon Signed Rank test: This non-parametric technique is used in a repeated measures situation. The test works by ranking scores for each of the two groups and then comparing them. The significance of the difference between results is calculated from the sample size and the means of the ranks. This test was used in Study Five.

Spearman's Rank Order Correlation: This tested for any effect of task order (i.e. the order in which tasks were carried out) and task-time. The correlation tests the strength and relationship between two variables, and is suitable for use with ordinal and ranked data. For present purposes, both were used – the former constituting task order and rank, the ranked order of time taken.

All analyses were undertaken using the statistical package Statistics Package for Social Scientists (SPSS), versions 20 and 21, the full output tables of which appear in Appendix 4.

Ascertaining preference data

In addition to undertaking usability tests, two studies (Studies Four and Eight) sought specifically to capture user preferences. Although performance data in itself was not sought, set tasks were also used. This was to give a focus for what might have been both unstructured and possibly even disorientating session for people who greatly need order and structure in their activities (e.g. Cline, 2009). The tasks also ensured that various aspects of the sites of interest were experienced by participants. Finally, the use of the same methodology as that employed for ascertaining performance data – albeit supplemented by specific methods designed for the specific study being undertaken and its aim of teasing out preferences from the participants, gave the overall research added coherence and unity.

Site evaluations and preferences were sought in two ways:

- A rating scale;
- Participant observation/ interview.

Each of these is discussed more fully in Study Four, which can be found in Chapter Six.

In sum, this section has built on the previous chapter ‘Preparing the fieldwork’. The former discussed ethical approval, participant recruitment and website development. The current chapter takes the thesis to the next stage by describing the methodology of how the research was actually undertaken, following the lengthy preparation. It has outlined the scope, in terms of participant profile, technology used, focus, methods and data gathering. Each constituent study of the thesis, of course, has a unique focus (be it on the use of audio, retrieving text-based information or eliciting preferences) and so each of the studies described in the following two chapters has its own methods section which describes the individual aspects of the particular studies and how these fit within the general methodological approach.

Chapter six: Fieldwork Part One - eliciting the issues

Introduction

The fieldwork for Part One aimed to:

- Explore and develop the methods initially used (as described above) for examining the usability of websites for people with Learning Disabilities;
- Elicit which attributes of websites may cause problems for people with Learning Disabilities.

In order to do this, three usability studies were carried out using the accessible website Newham Easy Read, described above. For a forth study, examining preferences, other websites were also used. Each of the studies deliberately took a different aspect of website design, and was undertaken with participants of varying degrees of Learning Disability. The studies were as follows:

- *Study One: Examining navigation using 'one action' tasks:* This assessed usability by setting tasks that required minimal (one or two click) activity to undertake. The focus was on navigating from one page to another and back. Participants had very low literacy levels - although to fully participate a basic recognition of individual letters was needed.
- *Study Two: Information retrieval from audio, using 'one action' tasks:* This study repeated Study One, both with regard to the participant profile (although they were slightly more literate) and in having a focus on very simple tasks and navigation. However, in this case, simple information retreival via audio rendition of text was of interest.
- *Study Three: Information retrieval and more sophisticated tasks:* For this study the tasks were slightly more sophisticated in that the information to be accessed was an actual body of text, and thus intellectually more demanding. Participants, of course, had milder Learning Disabilities, and a degree of literacy necessary to read simple sentences.
- *Study Four: Capturing user preferences:* This study looked at how preferences could be effectively captured. Here, again, participants had milder disabilities, as they were required to make value judgements of content (including the text element) and design.

Study One: Examining navigation, using 'one action' tasks

Aims

The principal aims for this study were to test:

- Whether a hyperlinked website structure can be navigated effectively by people with no or very low literacy skills;
- If usability tests related to this kind of interface are possible and effective with such a user community; and
- Which issues and problems related to website use and negotiation present themselves which could feed into stage two.

Setting

The setting was the Functional Skills Unit (similar to a Special Educational Needs unit in a mainstream school) of a Further Education College in Hertfordshire, using the original Newham Easy Read web Portal described in the previous chapter. Two Entry Level classes were involved. The researcher sat in an unobtrusive location at the back of a class, although he gave an introductory and explanatory talk to the students.

Methodology

Sample

Eight people with Learning Disabilities undertook this study, ages ranging from 18 to 23. The population were all at the Pre-Entry 'Milestone Eight' (three participants) or 'Entry One' stage (five) of literacy. As such they could all 'recognise the letters of the alphabet by shape, name [or] ..sound [and] recognise/read a growing repertoire of familiar words, signs or symbols … encounter[ed] in daily life' (DfES, 2009: unpaginated). In addition, the Entry One participants could 'respond appropriately to some familiar social sight words [and]… Recognise common whole words and some personal key words' (NOCN, 2010: p17). Participants, as judged by their tutors, all had good receptive language and were familiar with and had used a computer, even if only with a supporter, without an assistive device. Only three participants were able to undertake the exercise without support, but this was not problematic, as the role of the supporter and how it could be measured and incorporated into the research was an area of interest.

Equipment

Standard laptop computers were used, equipped with standard mice (without a scroll ball).

Method

Four stages were involved in the study, as outlined in the main section on methodology outlined earlier:

- Participant briefing;

- Ascertaining prior knowledge;
- Free browsing of the site;
- Set tasks.

Because of the potential articulation difficulties there were no post-session interviews. As much data as possible was gleaned from observation and free or prompted comments from participants. Also, as it was the system navigation/negotiation that was of interest and not on the understanding of information, participants were not invited in the set tasks to find specific textual information, nor undergo any intervention to show their understanding of the material on the site. Instead, the activity required participants to initially find a specific contents or 'menu' item from a description of its meaning ('Find a picture of something that is big and red which you ride on. Then click on the picture'). On the page accessed by following this instruction, there would be a small 'treasure chest' hidden in one of the images on the page, which was hyperlinked to a page containing a bigger chest with a letter on it (See Figure 14).

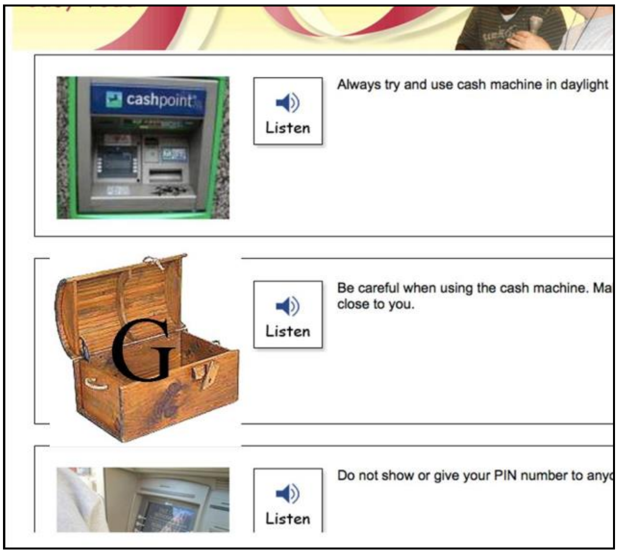


Figure 14: Study One: treasure chest with letter to be found

Having noted the letter, participants (with or without the help of a supporter) accessed the home page again (via an ever-present left-hand menu list) and read the second clue. Four such task sequences were undertaken, with the resulting letters forming the word 'Gold' (as deemed appropriate for the contents of a treasure chest!)

This activity tested the ability to:

- Recognise a 'contents' or 'menu' list;
- Recognise a particular image menu-entry from clues about its description;
- Activate the appropriate link;

- Scan for (pictorial) information;
- Recognise the need to scroll, and do so as appropriate.

Although in this case information as such was not being sought – beyond an image and an embedded letter – the ICT skills required to do the particular task are the same as if they were searching for specific text information, although for the latter an additional literacy and evaluative skill-set would be required. As outlined in the general methodology chapter, an observational schedule was used to record results, consisting of entries related to the skills being examined (such as to recognise a 'contents' or 'menu' list; activate the appropriate link etc.)

Results

Several issues were elicited, principally with regard to usability. However, the implications of the study with regard to the methodology were important, and it is to these that this section begins.

Methodology issues

The role of the supporter: As noted above, the quality of support is an important factor in a special needs context. Given the support needs of the participants and the vital role generally that supporters are required to play in the Learning Disability field, how supporters worked with their charges could have been an interesting area of observation. The focus of the present study, however, was to attempt to examine independent use of the Internet people with Learning Disabilities, and so the role of the supporter was kept to a minimum as far as possible. As outlined in the next section, however, this was not always possible.

Understanding the tasks: As mentioned in the 'Sample' section above, participants who were to actually undertake the specific research activity – the tasks - were carefully chosen in liaison with tutors and by observation of their use of computers undertaken to ascertain prior knowledge. However, once the session began, two participants required guidance to the extent that it was clear they would not have been able to conduct the tasks alone. One appeared to be content to look at the screen, and needed constant coaxing and directing – even though his free use of the computer had been competent and positive. It appeared that the formality of the situation had a detrimental effect on his performance. Of course, he was told he could withdraw at any time, but indicated a wish to continue. The other, by contrast, pointed anywhere on the screen and was happy accessing any page, regardless of the task. The important point here is to ensure that learners wish to participate and enjoy their experience of doing so. Fulfilling the research objectives, of course, is secondary to this. Thus, as mentioned earlier, accommodation should be given to anyone who genuinely wishes to be included, even if they prefer to undertake self-chosen off-task activities. The nature of the project was such that any activity involving interaction with a web interface informed the research.

Use and experience of computers

The overwhelming use of computers demonstrated by this group was that of employing it as a gigantic video-clip library. YouTube was by far the most popular application. Some of the participants were able to type into the search box the names of famous singers, footballers or TV programmes. Two asked the researcher to do this on their behalf ('Stevenage Football Club' and 'X Factor') and the tutor and assistants also helped others with spelling. In one case, the term 'washing machine spinning' had been learned by someone who enjoyed looking at these appliances in action. Pages (such as for the TV series 'East Enders') were accessed rapidly with little time spent on each. This may have been partly out of a desire to demonstrate what they were able to do, and partly as they had a disinclination or an inability to read the text and wished only to concentrate on the photos and audio. Three participants mentioned game playing online. For two this included car games such as 'Truck Mania' and 'Ninja Dogs', which require use of the directional arrow keys, and for the third, the rather more sedate 'Sims', in which one builds a character by clicking hair, eye and other feature options.

Participants had been said by their tutor to be familiar with computers, had used the World Wide Web, and had acquired a degree of literacy necessary to read simple menu labels, if not whole bodies of text. It was clear in this exercise that they were able to manipulate a mouse and activate links as required by the tests. However, only two of the participants actually scrolled down a page during their demonstrations. As detailed below, an apparent lack from scrolling ability or awareness affected how well the tasks were undertaken.

Usability issues

Usability issues concerned:

- Iconography;
- Page-scrolling;
- Left-right mouse clicking confusion;
- Cursor icon;
- Menu entry text-size.

Iconography: The first task required participants to find someone wearing a white hat. In fact, several participants concentrated on just one of the icon descriptors required ('hat', rather than 'white hat') with the adjective being ignored. This lead to two people considering the finding of any 'hat' as being a success – the black one of a depicted policeman, in fact. Indeed, one person commented that the clue itself may be wrong, feeling that it should have asked for a *black* hat.

Complicating matters was that, as is clear from Figure 15, the policeman's hat did, in fact, include a white badge that took up a considerable fraction of the area of the hat. Another reason why the policeman's helmet may have been chosen ahead of the more obvious object was that the white hat appears lower in the contents order and so, ironically, where people actually start a search logically, i.e. from the top of a list, they may be less likely to succeed than where they randomly gaze over the screen.

Figure 15: Study One: contents list from which participants were required to find 'a white hat'

Another issue with regard to iconography and descriptions was elicited from the clue 'Look for a big red object …' The answer was a bus, and so participants had to activate the link in the bus photograph. However, this clue proved more difficult than might have been expected, possibly due to the word 'big'. The reason for this is that a (real) bus may be considered to be 'big' (leaving arguments about relative sizes and reference points out of the argument) whereas the photo – the representation of the bus - was, of course, very small indeed. Following from this, there were many indications that the content photographs were too small generally. Several participants, and supporters also, had to lean forward towards the screen to see clearly, and some asked for assistance. Finally on this point, when the screen was magnified, as is possible with Internet Explorer, Firefox and other browsers, the image pixilated and thus was still relatively difficult to see. A higher resolution was clearly needed.

Page scrolling: One important accessibility problem surfaced – that of scrolling the page (as predicted by Rowland, 2004). As noted above, this was an activity that appeared to be eschewed when participants demonstrated their usual computer activities. During the set tasks, three (of the eight) participants had to be gently reminded that the required content might be situated below the level of the screen, and two of these and two others were unable to maintain their finger depressed on the (left) mouse button for long enough to 'drag' the page down to the bottom where the chest was located. It was also easy to let the cursor drift from the scroll bar and/or not continue a downward movement. However, those who initially found scrolling difficult were able to 'master the art' with some practice. With hindsight, it might have been better to have organised the first task such that no scrolling was required, to give the participants some confidence and some immediate feeling of achievement. However, this might have meant their not expecting to have to undertake this activity for any of the tasks.

It is worth noting on the point about scrolling that the 'mice' used did not have rollers included, which could have assisted usage. However, three people used the keyboard arrows to scroll up and down, which showed familiarity and experience. It may have been, therefore, that supporters and others had taught people to use this method in order to circumvent 'mouse' problems.

Menu orientation: Exacerbating the problem of scrolling, there were indications that the vertical nature of the menu entry list presented difficulties beyond those of not being fully visible on the screen. Three people were observed apparently reading the menu from the bottom upwards – as shown by their use of a finger used to read (and repeated in Study Five, which considered menu position in isolation). Others had to be prompted to find items below the level of the screen, as mentioned above. This finding is very important in terms of the usability of the site, as if one looks from the bottom to the top of a page, it may be less intuitive to scroll down a page, as one has to reverse ones gaze – unlike moving the eye from the top to the bottom, in which case to then access content below that visible on screen is a natural progression. A later study, in Part Two, examined this phenomenon in a quantitative manner.

Also regarding the vertical layout, some participants appeared to be more interested in scanning across the page. Again, this was determined by body language – in this case by head and finger movements. It may be that as the participants were still learning to read and had relatively low literacy levels, it was more difficult to train themselves to read vertically. As detailed in Study Seven, this propensity to read horizontally (strongly supported in the quantitative data), without skimming, had major implications in terms of people's ability to find information and negotiate web pages.

Cursor iconography: Another problem related to iconography was that the cursor transformation from arrow to 'hand' icon, an occurrence activated whenever it hovered over a hyperlink, appeared to suggest to some that an action was required – regardless of whether the link was the desired one. As soon as the cursor thus changed, it triggered a reaction by the participants. Thus, it was natural for some to access the first entry on the menu list. It is difficult to see how this problem could be obviated. Clearly, it is necessary for the hyperlink to be clearly indicated – and the cursor icon does appear a useful way to do this. Greater tuition whilst undertaking tasks at participants' places of work or study, when using computers with supporters, might help.

Menu entry text-size: Finally, regarding accessibility, the icons – particularly the menu entries -were rather small. One participant was visually impaired, and wanted to make the pictures bigger but he could not. The researcher had to resort to describing the pictures for him. In other cases the text itself appeared to be too small. Three of the most articulate participants commented on this, whilst others leaned forward, clearly needing a larger font size. As outlined in the earlier review, much accessibility literature calls for adjustable text size (e.g. Bohman, 2004) or simply 'large writing' (Matausch and Peboeck, 2010).

Left-right mouse-clicking confusion: Another accessibility problem was that of activating the context ('right-click') menu in error. This was, unsurprisingly, the result of not being able to direct the finger to the left side of the mouse – even where people were aiming to do so. Clearly, one solution would be to disable the context menu.

Conclusion

Several issues were highlighted in this study. First, it showed clearly the problems that are associated with images. This was manifest in both interpreting the meaning of images and what they denote, and also recognising differences in the attributes of an image compared to a real-life object. This implies knowledge and understanding on the part of any supporter, to say, for example, 'look for a thing that is taller than you in real life', rather than to ask the learner to 'look for something big'. Obviously, where there is no 'game' element to the activity, it may be better to simply name the object (e.g. 'Now you need to find a bus on this page') as was undertaken in the follow-up study described below.

Following from the above it was clear, as with the writer's previous work (Williams et al, 2007; Williams, 2006; Minnion et al, 2006) and others (e.g. Evans 1993), that supporters play a vital role in the facilitation of access to the technology and the navigation through it. Indeed, this very fact showed how difficult it is to undertake work with this particular constituency of ICT users without allowing for and factoring in the presence and role of a supporter. For this reason, further studies in Part One of the project were undertaken with people having milder Learning Disabilities.

Finally, the problems encountered with regard to scrolling have design implications for web pages, and raise doubts about using images, which make pages longer. Further work also highlighted this issue and suggested that further trials would be fruitful that look at multiple pages, none of which go below the bottom of a screen (as is the case with the website Movingonup). This website itself was used in Study Four of this part of the project.

Study Two: Information retrieval from audio, using 'one action' tasks

Aims

This study followed directly from Study One, which examined issues related to navigating a website by people with very low or no literacy skills. For Study Two, however, instead of participants merely looking for various images, they were guided to specific and meaningful information, accessible via an audio link.

The aims for this study were to test the effectiveness of audio as a text substitute, and also, reinforcing Study One, to examine:

- Whether a hyperlinked website structure can be navigated effectively by people with no or very low literacy skills;
- If usability tests related to this kind of interface are possible and effective with such a user community;

- What issues and problems related to website use and negotiation present themselves, which could feed into Part Two.

As this was a qualitative study whose overriding purpose was to elicit issues related to web use, no attempt was made to quantify the performance of audio over text (for those able to read to the degree necessary to understand the web page under examination) by measuring performance. Rather, the study explored only whether the audio icon was recognised, if the audio was accessed and understood, and whether participants enjoyed the experience.

Setting

The setting was once again two (albeit different) Entry Level classes in the same Further Education College as Study One. As previously, the researcher sat in an unobtrusive location at the back of a class, although he again gave an introductory and explanatory talk to the students. The portal interface described earlier was also used for this study, which contained audio rendition of all the textual content. The fieldwork took place over a number of days.

Methodology

Sample

As this test involved listening to specific information about various aspects of Transition, rather than 'simply' working in a pictorial medium, it was felt more appropriate to involve people having an upper Entry rather than Entry One level of ability. Eight students undertaking 'Entry Two' literacy or Information Technology courses were recruited, via their class tutors at two campuses of a College of Further Education in Hertfordshire. At Entry Two, these participants were able to, for example 'Read on sight high frequency words in common use… Use illustrations and captions to locate information … Read a piece of text and gain meaning from it' (NOCN, 2010: p39). As with the previous study (and indeed, as with all studies undertaken in this thesis) participants had to be familiar with and have used a computer, preferably without an assistive device and in an independent capacity. Ages ranged from 18 to 24.

Equipment

Standard laptop computers were used, equipped with standard mice (without a scroll ball).

Method

As with all of the studies outline Part One, the study began with a short briefing session, followed by participants demonstrating their usual practices and interests on the computer leading into a period of free browsing of the website under consideration, and finished with a series of simple tasks set by the researcher.

Again, it was the system navigation/negotiation that was of interest in the exercise. However, in this case, participants were asked to access information in the form of the audio rendition of text included on the pages accessed. The study examined the following abilities:

- Recognise a 'contents' or 'menu' list and that this provides access to other pages;
- Recognise a particular image menu-entry from clues about its description
- Activate the appropriate link;
- Recognise a (bigger) image embedded in an information page;
- Recognise an 'audio' link icon next to such an image, and be able to activate it;
- Listen to the information;
- Recognise the 'back' button and be able to activate it;
- Recognise the need to scroll, and do so as appropriate.

Following a period of free browsing and a commentary on their computer-using habits, participants were required to find a specific contents or 'menu' item, this time from a question that included the menu label (e.g. 'where would you find information about travel?' where the word 'Travel' was the label, and a London bus the accompanying image. On accessing the page, a series of sentences appeared, forming a sub-menu and route to an information page. The Home page is illustrated, in Figure 16, below:

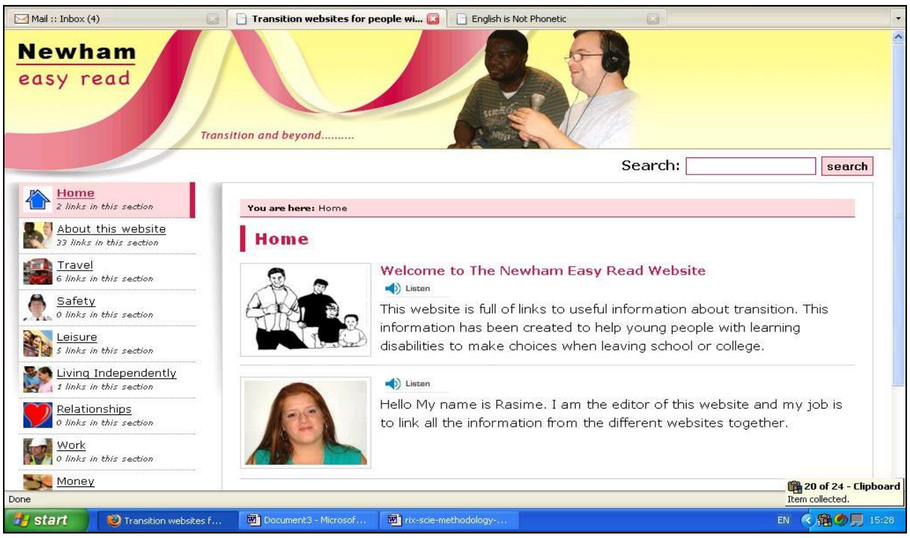


Figure 16: Newham Easy Read homepage

Taking 'Travel' as an example, the page accessed on activating the link can be seen in Figure 17, below:

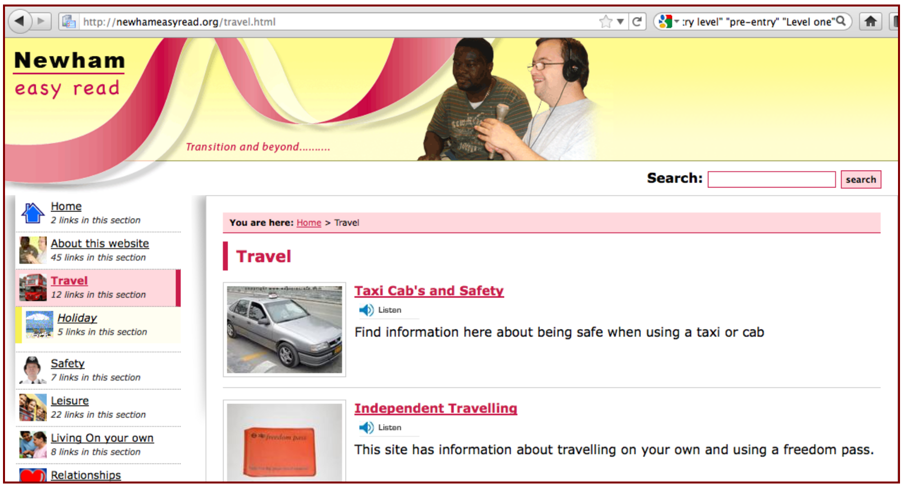


Figure 17: Newham Easy Read travel page

Accessing the 'Independent travelling' page takes one to the page shown in Figure 18, below. This is the information page, from which participants can learn how one person travels independently by listening to the audio rendition of the text.

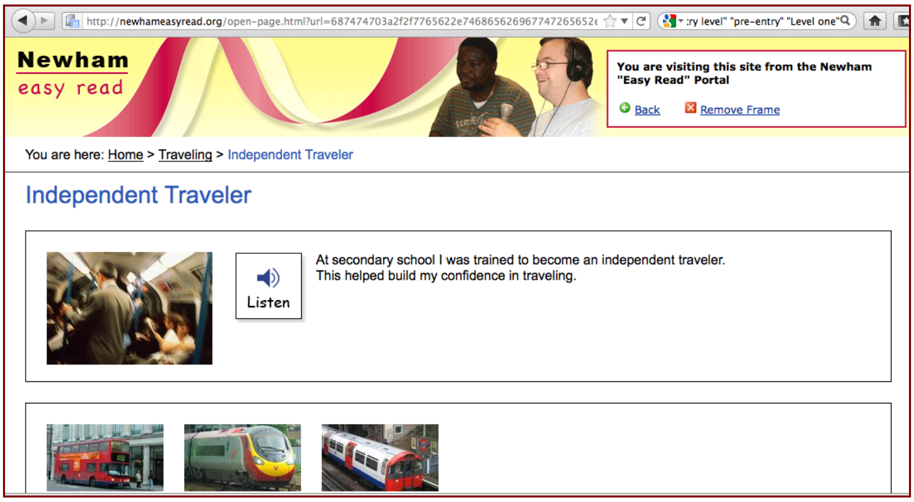


Figure 18: Newham Easy Read: Independent traveller page

Tasks

'Home' page

Task question 1: 'How can you listen to some information on this page?'

Skill required: Recognise an 'audio' link icon.

Task question 2: What information do you think you will find on other pages?

Skill required: Recognise a 'contents' or 'menu' list.

Task question 3: Where do you think you will find information about travel?

Skill required: Recognise a particular image menu-entry (a red bus).

Task question 4: Please see if you can get to that page.

Skill required: Activate the appropriate link.

'Travel' page

Task question: Where can you find information about safety whilst out?

Skill required: To undertake this task independently requires a minimum level of literacy - seeing and understanding the words 'Safety whilst out'. There is an image accompanying this (and all menu entries) but it was felt that it was not possible to encapsulate this concept in this way, unless the other entries on the page were for topics that were not related to travel at all – clearly not the case here. The researcher chose to point to the link, which the participants then opened.

'When out and about' page

Task question 1: How can you hear what the lady says about this?

Skills required: Recognise and activate an audio icon.

Task question 2: Please go back to the previous page?

Skill required: Navigation using the browser back button.

(Return to) 'Home' page

Task question 1: Where will you find information about money?

Skills required: Recognise that there is content below the screen; scroll down to access it; and recognise a particular image menu-entry.

Task question 2: Where can you find information about using a cash machine?

Skill required: Recognise a particular image menu-entry.

Task question 3: See if you can get to that page.

Skill required: Activate the appropriate link.

'Cash machine' page

Task question 1: What does the lady say about this?

Skills required: Recognise and activate an audio icon.

Task question 2: Please go back to the previous page.

Skill required: Navigation using the browser back button.

Depending on the time available and the interest of the participant, more similar tasks were undertaken.

Results were recorded on an observational schedule sheet as outlined in the general methodology and for Study One. This was also the case for the other studies making up the body of research reported here.

Results

Methodological issues

The web pages used were the same as those used in Study One. As certain problems were elicited related to the images used, however, there was more emphasis this time on the actual depiction of a real object. Thus, in the task requiring information related to transport, participants were asked to look for where they might be able to find information on this subject.

One methodological issue did arise, however. As noted in the usability results section below, many of the participants were observed scrolling without problems during the free-browsing period. However, they had to be prompted to do so in the set-task, which raises an interesting issue about the study design. It may be that participants expected the answer to be visible, on a possible assumption that either the researcher himself could see the answer (how else would he know it was there?) or, similarly, that he was inventing questions on the fly and thus had to see the answer in order to formulate each one. One possible way to obviate this problem would be to undertake a demonstration question and answer session, possibly with two examples, one of which would require scrolling. This would make it clearer to the students what was required.

Finally, in this study the support given was by the researcher and, in two of the eight cases, a teaching assistant. Again, this was as minimal as possible, and where participants needed help, this was noted. The (slightly) higher level of the students meant that the degree of support required was less for this study.

Use and experience of computers

Demonstrations to the researcher were remarkably similar to those documented in Study One. Watching TV programmes and clips predominated. One person, for example, was a huge fan of the TV series ‘The Simpsons’, and was adept at navigating between the ‘episodes’, ‘characters’ and ‘recaps’. Away from television, another was fascinated by bus journeys, and found a large selection of clips of people (presumably taken on their mobile phones) taking bus trips. Again, games were popular, including various Pingu activities and games such as Dirt Bike, the latter requiring the use of the keyboard arrow keys (and quick reaction times when playing at a higher level). Unlike in Study One, two people mentioned watching DVDs on their computer (although that is not to say that this was not also undertaken by the previous participants).

This exercise showed considerable ability generally, with five participants keying in their own search terms, and the same number (though not exactly the same participants) demonstrated the capacity and willingness to scroll pages, unlike during Study One.

Usability issues

Usability issues concerned:

- Iconography;
- Page-scrolling;
- Cursor icon;
- Hot-spot size.

Iconography: This was not such an issue in this particular study, because of the changes in methodology described above. However, as with Study One, the pictures were too small, requiring considerable scrutiny to find any given example. Two participants were unable to equate the bus picture with the concept of transport, and two (one the same) did not recognise the audio icon. In these cases the researcher or teaching assistant helped. It was noticeable that both of the participants who were not initially able to link a photograph of a bus with the idea of transport, when they are then asked to 'find the bus' they did so – one with ease and the other one after some reflection. All participants recognised the coins as being money.

Page scrolling: As there were difficulties with scrolling in Study One, this was not introduced here until the third task. Also, the researcher had given a pre-demonstration in the participant briefing of the site and deliberately scrolled to show material below screen level. In the event there were no problems on this occasion. Observation of 'free browsing' indicated a knowledge and ability in this area, and so the expediencies outlined may not have been necessary. However, once again a long time was spent scanning the visible page, and three of the participants had to be prompted to scroll – a finding that was discussed in the section on methodological issues above. Two participants, by contrast, appeared to scroll impulsively - apparently to take in all of the contents of the page as quickly as possible.

Cursor icon: There was no manifestation, on this occasion, of automatic user action prompted by the cursor icon indicating a link (by becoming a hand). This may have been due simply to greater prior experience of using computers by this group. It is also possible that the participants in this study were more able to refrain from the kind of 'impulse actions' displayed by those in the earlier one.

Hot-spot size: 'Hot spot' refers to the area on the screen that opens a link when activated by a mouse-click. For this exercise, both the menu item link (text) and audio links were both used. Figure 19 shows that there was close proximity of these, making it difficult for people to steer the cursor to the required option.

Figure 19: Newham Easy Read Home page (detail) showing the proximity of text and audio links

Using the audio: Apart from the problems of finding the active area to activate the audio, there were no problems in using it. This applied also to the (two) participants who had needed help to understand that the audio was activated by the 'loud speaker' icon. Although there was no formal comprehension or recall test for this study, participants were asked to relate the gist of what was said. Seven participants were able to do this – supporting findings of previous studies using audio, such as that by Zentel et al*,* (2007). The eighth declined, but this may have been due to shyness – as later suggested by her accompanying teaching assistant. It is worth noting, however, that four of the participants read the text aloud – two of them with some difficulty - before they activated the audio.

Navigation: There were no problems with navigating back, except that the 'Home' page was sometimes two 'clicks' away, and participants had to be reminded to action the 'Back' button a second time. It may be that not enough guidance was provided regarding which page was the home page - participants were asked to 'return to the start', which, on reflection, could have been interpreted as 'the start' of the particular topic, such as transport or money etc.

Conclusion

Although this study again highlighted problems with the use of images it also showed that people with very limited literacy skills could navigate to a particular page and access information by audio. For the present study, participants were taken step-by-step through the process and so it is not possible to confirm that they are able to perform as well in an independent manner. However, it may be that with appropriate guidance and gradually increasing familiarity with the system a degree of autonomy might be reached. This would include further use and reinforcement of the menu icons and of the navigation and, of course, further familiarity with the audio icon and the use of audio and, indeed, in this case of the equivalence of the audio and text.

Study Three: information retrieval and more sophisticated tasks

Aims

This study was undertaken with people with milder disabilities than those who undertook Studies One and Two. Its main aim was to test the ease with which participants could navigate the site and retrieve information. As with the other studies, it was also hoped to elicit any methodological issues inherent in designing usability tests for this cohort. It replicated an earlier study undertaken with a younger sample (Williams and Hanson-Baldauf, 2010).

Setting

The tests were carried out in the participants' classroom at the same Further Education College in Hertfordshire as Studies One and Two, and undertaken on the desktop PC used by each participant (i.e. the researcher moved from desk to desk to sit with participants in turn).

Methodology

Sample

Nine students, of between 18 and 22 years, undertook the study. Participants were classified by the college as having 'mild Learning Disabilities', and working at Entry Three or Level One in most subjects, including literacy. As such, all were functionally literate. They were also familiar with computers, and used them at least once a week, seven of them both at home and at college, the other two, at college only.

Equipment

The participants used the same standard PCs and a standard browser, as at college. Nobody required any assistive devices.

Method

The same stages were undertaken as outlined in the main methodology section. This account therefore begins with an outline of the set tasks.

Task one: home page – extracting information from text

For each site, participants were returned to the 'Home' page after their period of free browsing. The first task was to look at this page and describe what information they would be able to find within the site (some of which they might have seen during the free browsing). This activity only required participants to be able to read text.

Task two: home page – understanding links

This was to answer the question: 'where will you find out information on "travel"?' and then activate the appropriate link. There are 'thumbnail' size pictures with the menu entries, (Figure 20), but these may not necessarily indicate the text content of the link. For example, without the text, the 'Living Independently' section could be construed as being about making friends. The ability to read, therefore, appears to be of major importance.

Here, participants were required to:

- Recognise a 'contents' or 'menu' list and that this is a link;
- Recognise a particular entry (either by reading or by inferring possible contents from the picture);
- Activate the appropriate link.

Figure 20 Newham Easy Read: Contents or menu list on home page

Task three: scrolling to find information

For this task participants were asked to select the section entitled 'Using a bus', requiring them to scroll down. The entry was selected as it was (on the computers and configuration used, anyway) below the bottom of their screen. To successfully undertake this task, therefore, they had to:

- Recognise the need to scroll a page;
- Understand how to scroll down a page (using the scroll-bar, a 'PgDn' button or arrow keys);
- Use an appropriate method to scroll down the page.

Task four: extracting audio information from a page

Once the page on 'Using a bus' had been activated, participants were asked to listen to the audio on the page (see Figure 21).

Figure 21 Newham Easy Read: 'Bus' page (section on transport)

This required them to:

- Recognise an audio icon (similar to that shown in Figure 22)
- Activate the audio

Figure 22: Newham Easy Read: audio icon

Task five – navigating back to a previous page

Participants were asked to return to the 'previous' page. To do so, they had to:

- Understand the concept of 'returning to a page';
- Know or recognise either a 'Back' arrow or word, in a browser or embedded in a web page;
- Recognise the previous page (i.e. as the one to which they wish to return).

This task was more difficult than it appeared because of the structure of the portal, which links various websites together and displays pages from them according to topic chosen by the participant. This issue is discussed more fully in the Results section.

Part four: Post-task feedback/interviews: As these participants were a little more articulate than those who undertook the previous studies, informal post-task interviews were undertaken, in order to explore reasons for certain actions, perceptions of what information participants might have expected on opening a link, problems encountered etc. The main methodology section outlines these in more detail.

Results

Use and experience of computers

As with the parallel study involving younger people (reported in Williams and Hanson-Baldauf, 2010) and in Studies One and Two above, the activities shown to the researcher centred principally on using the computer as a surrogate television or games console. In addition, however, these participants also mentioned using the software application Paint, listening to music (i.e. in the form of uploaded or purchased mp3 files, rather than from YouTube videos), using email, and finding things out for their college work. One participant showed how he mixed music using the software package 'Magix' and another enjoyed making posters with 'Publisher'. In short, these participants were adept and using and getting much enjoyment from computers in a variety of ways, and all demonstrated an ability to use the mouse, open hyperlinks, scroll pages and generally navigate their way around and between sites.

Free browsing

When asked to 'have a look' at the site, most participants tended to activate a large number of pages rapidly and apparently without imbibing much information. Perhaps surprisingly, this kind of behaviour is not limited to people with Learning Disabilities. Computer transaction log studies by David Nicholas and colleagues at University College London (see, e.g. Nicholas, Huntington and Watkinson 2003; 2005; Nicholas et al*,* 2006) have shown that usage patterns of search engines demonstrate shallow, 'promiscuous' and dynamic forms of behaviour indicating limited site penetration, with people visiting many sites without returning to them and without spending enough time on them to glean any meaningful information. However, the degree of control of the participants in the present study exercised over the mouse; their knowledge of the location of the cursor, and ability to follow hyperlinks all belied the status of these participants as 'Learning Disabled'.

Usability issues

Reading text and recognising/activating links: All participants were able to recognise the 'contents' list, realise that the entries represented links, and determine a particular entry by its text. However, there appeared to be too many menu entries and – as found previously – the labels were too small for easy reading. This suggested that text size has an importance beyond that of on-screen reading. Mouse activation only proved troublesome for one person, who complained that 'normally' the mouse always functioned when clicked. Finally, as the participants were all able to read the contents entries without problems, the pictures were not necessary. It was interesting that, as with Study Two, three participants read the body text aloud, one appearing to follow each line with his finger. Although he did not place it on the screen he appeared to be aligning his finger and eye whilst he read, and confirmed this with a nod when asked.

Scrolling: Recognising the need to scroll is an essential part of using the web, of course. However, Studies One and Two showed the difficulties that this practice can occasion for people with Learning Disabilities. In this case, however, only one participant was unable to complete this task because they failed to realise scrolling was necessary. In the study with younger people (Williams and Hanson-Baldauf, 2010) it may have been that when told to 'select' something, they naturally expected the link to be in sight. Here they were asked to 'find' a link, in an attempt to avoid that. Also, in another variation from the original study, they were also explicitly told that the item may not be visible on the page. However, this could have been interpreted as meaning it might not have actually been there (i.e. as if the question was more about if there was a link or not).

The other participants were all able to scroll, generally with the scroll bar, although two people used the 'PgDn' button and two others the arrow key. In the original study these were neglected, possibly because, as observed at the time 'they both require the release of the mouse. For this study, only one person made use of the arrow keys (Williams and Hanson-Baldauf, 2010: p47).

Recognising and using audio: The website was designed not just for literate users, but also for those requiring information in audio or, indeed, multimedia form rather than text. As mentioned in Study Two, such users may need particular training in recognising icons such as the audio one used on the Newham website tested (see Figure 22). Unlike with the earlier study, on this occasion none of the participants expected the information in the audio to be different to that given in text. This did happen with the younger cohort, possibly because they were able to read the text and, therefore, found the duplication a bit strange. The participants for the repeated study were also literate, so this potential problem requires a quantitative investigation.

Navigating 'back': All participants appeared to understand the concept of 'returning to a page', when requested to do so, and used the browser 'back' button rather than the site's own internal navigation. The writer has noted the propensity to favour Browser buttons to navigate before (Williams and Nicholas, 2001). In this case it may be a manifestation of the tendency amongst people with Learning Disabilities to be comfortable more with a routine or a standard method of doing something. Clearly, the 'Back' button on a browser looks the same and has the same function regardless of the website being navigated. For this exercise, as with the original study, its use was effective. However, this might not be the case universally, as the browser button does not always return users to the immediately preceding page. If, for example, one accesses an external website from a page within a site, the Back button sometimes returns to the index or 'Home' page of the referring site, and not the preceding page.

Recognising the previous page (i.e. as the one to which they wish to return): No problems were noted for these participants. However, it might be advisable, in the case of material for people with Learning Disabilities (if not for everyone) to include a page number, letter or other identifier at the top of each page.

Methodological issues

This test worked well from a methodological point of view. The pre-task briefing was helpful in putting the project into context, both with regards to the usability aspect but also regarding the nature of the website content. The supporter briefing and the level of the tasks set both helped to reduce the level of supporter engagement, making the results more of a true record of the abilities of the actual participants.

One minor problem was the length of the session. In a minority of cases, people had to be coaxed into undertaking the final task - selecting a topic from the menu and then accessing the information. The day's activities may have been too taxing to concentrate right until the end of the session, especially considering that there were other activities arranged for the group and that they were also in a strange environment where they were in contact with people they hadn't met and were not following their normal routine.

Conclusion

The most important conclusion from this study is that it showed that people with mild Learning Disabilities can be adept with web technology and able to navigate with little support in an environment of interlinked websites. Participants also showed capable search skills in accessing, for example, YouTube clips. Although it was only necessary, in many cases, to enter the name of a particular pop artist or sportsperson to find a page (and, therefore, a minimum level of research skills), there was often then the need to scroll down and select a particular clip, a task which was undertaken with ease by those who scrolled during the set tasks. However, their 'free browsing' navigation was far from focused. Pages were accessed apparently with little thought and discarded rapidly. This was in contrast to the conscientious manner in which they undertook the set tasks – a recurring finding in this study, which is discussed at length in the overall conclusions section.

Study Four: exploring user preferences

Aims

This study sought to test the efficacy of two methods of seeking website preference judgements from individuals with mild Learning Disabilities. It was undertaken in two parts, with results from the first fieldwork session informing a second round. Another aim was to determine the extent to which – if at all - the efforts made to facilitate accessibility made the sites written for people with Learning Disabilities more appealing. The study was designed as a pilot to inform the second phase of the study, when opinions were sought on different web designs.

Setting

This test was carried out at a College of Further Education and a Day Centre for people with Learning Disabilities, in Hertfordshire and London, and involved young people who were undertaking various courses related to 'transition'.

Methodology

Sample

The first fieldwork session involved 12 young (18 – 22 year old) people (eight males) who were or would soon be seeking supported employment, at the College of Further Education in Hertfordshire where the previous studies were carried out, albeit in a different campus. The second round was split between two sites – the same college (albeit with different students) – and a Day Centre in the London Borough of Enfield where participants were either seeking supported work or already working part time. Seven people at the college (between the ages of 18 and 21) and six at the Day Centre (20 and 28) participated in the study. The participants for both sessions were all classed by the college as having 'mild Learning Disabilities' (see the definitions offered in the introductory section), and did not require accessibility devises.

Equipment

For both sessions, standard networked PCs were used, allocated on a one-to-one basis.

Websites examined

For the first session, two websites were chosen to compare with the original Newham Easy Read. These were:

- Movingonup: www.movingonup.info;
- Newham Borough Council: www.newham.gov.uk.

For the second round, Movingonup was retained, plus:

- A beta version of Pete's Easy Read;
- Dobson's Choice: www.dobsonschoice.co.uk/.

These choices were made for several reasons, as outlined below, together with a general description of each site.

For the second round of the research an early version of Pete's Easy Read site and Dobson's Choice were used. The latter was developed by Easy-Read-Online, an organisation which specialises in making information accessible for people with Learning Disabilities, and which includes links to sites on many general topics relating to transition. All of these sites except (surprisingly) Dobson's Choice contained employment-related information, ranging from steps needed to find a job, specific vacancies, and career advice. *Newham* and Pete's Easy Read were described in Chapter Four. The other sites used in this study are described in more detail below.

Movingonup: This website was aimed at exactly the same cohort as Newham Easy Read (people with specifically Learning Disabilities). Second, it also dealt in the same issues, namely, those around transition. Third, it used a very different layout and navigation system to Newham Easy Read, and so made an ideal comparator website. The distinguishing feature of this site was the circular menu style adopted for its 'home' page and the main pages of each of its sections. Such an arrangement removed the need to scroll the page (at least on the all the screens on which it has been seen by the study participants). To an extent, it might also be seen as removing any kind of topic hierarchy, present in a vertical list within which the entry at the top might be wrongly assumed to have greater import than those below it. The menu can be seen in Figure 23.

Figure 23: Movingonup web page, showing circular menu

It is worth mentioning, as participants mentioned this, that the internal pages adopted a more common horizontal menu structure. This can be seen at the top of Figure 23, and also, more clearly, in Figure 24.

Figure 24: Movingonup web page (detail) showing the horizontal menu

A second distinguishing feature of Movingonup is the presence of simple line-drawing icons used as contents markers, rather than photos, as used in the Newham Easy Read site. Some of these can also be seen in Figure 23 and Figure 24.

Each page is light on text. To facilitate this, each topic is divided into several pages, with forward and backward arrows at the foot of each one. There are photographs accompanying each page, and the information on most pages is organised into bullet points.

Newham Borough Council: Newham Borough Council's mainstream website was also chosen mainly because it contrasted with the other two sites in that it provided information more at a mainstream level. This was considered an appropriate resource, despite this fact, as many site for people with Learning Disabilities – such as Movingonup, and Dobson's Choice (a site used in round two of the study) act as Portal sites which lead to mainstream sources. In fact, the latter does not include an information pages itself, but only provides a gateway to others. Thus, many people using sites even specifically targeted at people with low literacy levels would anyway have to negotiate mainstream sites simply by being led there via hyperlinks.

The website offers a wealth of information about employment, including vacancies, how to complete an application form and write a CV, and information about job interviews. There are menu lists on both sides of the page. On the left hand side one is invited to 'Browse by services', which are:

- Benefits and Payments;
- Births, Deaths and Marriages;
- Information for Businesses;
- Regeneration;
- Citizenship and Nationality.

On the other side are more 'interactive' entries on e.g. Pay council tax etc.

At the time of the test (April 2011), though no longer, the structure was also very hierarchical. Once a main content item was chosen, such as 'Jobs and Benefits', a submenu opened to its right, in this case, with five options: Benefits, Careers Advice, Equality & Diversity, Job Centres, Jobs at the council and Training & development. There was a submenu from here, too.

The site, although not written specifically for this constituency, was nevertheless written with accessibility in mind. Each page, for example, has a 'smiley-face' rating facility, and now there is an interactive and accessible menu on the right of every page, with a header 'I want to … Pay it; Report it …' etc. This has actually improved since the time of the test, however, in that previously one had to activate a 'Do it online' link before arriving at a similar menu, and thus had an extra step to negotiate.

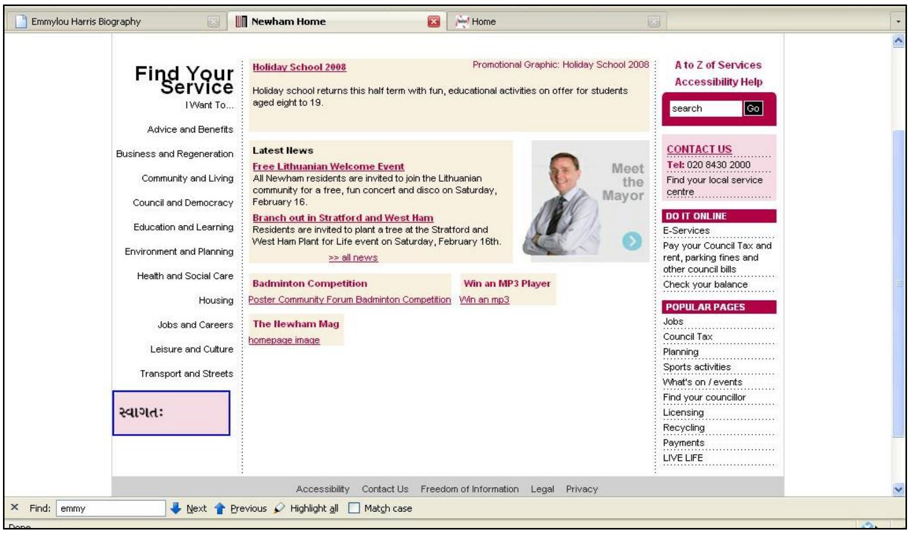


Figure 25: Newham Borough Council home page

Dobson's Choice: This website is purely a portal to other sites, most of which (e.g. Transport For London; Amy Winehouse etc.) are not designed for people with Learning Disabilities. Despite this, it was considered useful for inclusion in the study for two main reasons. These were that, apart from being developed for the target community of users, that it utilised a grid-format menu and employed audio to augment, rather than simply read, the text on its own pages. Both of these features are maintained in the submenu pages. Figure 26 shows both the home and a submenu page for this site. As can be seen, on the home page (left) there are two blank areas to the side of the main menu. These are populated in the submenu pages (on the right) by a submenu title – Entertainment in this case – and links to external sites.

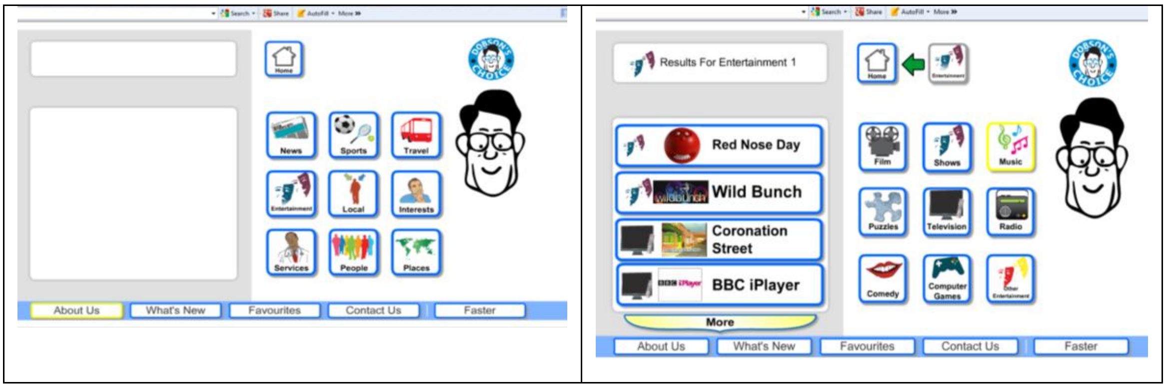


Figure 26: Dobson's Choice website home page and submenu page for Entertainment

Clicking on a menu entry (the small boxes shown in Figure 26) causes the face on the right to explain what the link is, accompanied by the appearance of a speech bubble with the words in writing. To actually activate the link, the area needs to be clicked again.

Method

Participants were given the briefing as described in the main methodology section,. Specific to this study was that at the end of the main introduction to the project they were shown, as a group (i.e. by using a data projector) the different sites under investigation and how they were to undertake the evaluation, including a 'smilometer;' rating system (described below) and form to complete with the help of the researcher, which asked for views on the content ('What the site tells you'), appearance ('What it looks like') and navigation ('How easy it is to get round the site').

For the session, participants remained at their own computer terminals, and were invited to work alone or in pairs. It was decided that all participants would work with the same site at the same time. This offered greater opportunities for discussion and mutual help than might have been the case had individuals worked with different sites. Once they had undergone the activities described below, they moved on to the second and then third site.

Clearly, the issue arises of the influence of site order on opinions. However, this was minimised in the first round of the study by having the site that was markedly different – the 'mainstream' Newham site - placed last. It could be suggested that as the site was arguably more difficult, it should have been the first to have been examined, while minds were still fresh. However, it was felt that doing so would have made the participants wary or worried about looking at the others, and also may have been too tiring. As it was, a fairly long break (30 minutes) was taken during the evaluation.

Having loaded the site, with help from the researcher, tutors and teaching assistants, participants were given the opportunity to browse the sites as they wished, as described in Study Three, and were then asked to look at a series of set tasks, as outlined below.

Set tasks: Three tasks were set for the first round and then two in the second. Each one was as equivalent as the different styles of the sites would allow. The undertaking of these obviously enabled the researcher to evaluate the site for usability, and this was, indeed, undertaken for the purposes of informing the development of an Easy Read site. Set tasks also helped to structure participant site usage in order to offer them a more comprehensive experience of each interface, and thus inform their views on each and their 'smilometer' rating. Note that the relative usability of each site, in terms of task success, was not undertaken. The emphasis was predominantly on the issue of establishing preferences and the development of the Newham Easy Read site into what became Pete's Easy Read.

Tasks are outlined below. They were more varied in topic than that of merely looking for work, because it was the website as a whole being examined and not just any employment section. Also, the participants, although job-seekers, had other interests about which there might be information on the website. In fact, for round two of the study the topic of employment was not considered, ad one of the websites, Dobson's Choice, did not offer any information on this.

Tasks for round one of the study (requested orally) were:

Task 1: Money

Newham Easy Read questions:

Q1: Where do you think you will find out information about money?

- Open that link

Q2: Now where is the section on 'Using a cash machine'?

- Open that link

Q3: What does it say about your PIN number?

This is quite a straightforward exercise, in that the site has links directly to information about money, and then has a link explicitly to 'Using a cash machine'. This is, therefore, a good task with which to start the session. Specifically, it requires participants to:

- Recognise a contents or menu list and be able to scan it;
- Recognise and activate the link 'Money';
- Recognise and activate the link 'Using a cash machine';
- Scroll down the page to find information about PIN numbers.

Movingonup questions:

Q1: Where will you find information about money?

Open that link

Q2: Now where will you find information on money and transport

Open that link

Q3: What does the page tell you about?

Now click on the 'forward arrow to go to the next page

Q4: Where can you get help?

This task, of course, tried to approximate the one on Newham Easy Read, about money, but it is more difficult, as this site goes into more detail and required participants to access more pages. Although, therefore, this was not a 'like-for-like' comparison the aim of the study was to compare sites, and so differences in accessing similar content actually aid that process. For this task participants needed to:

- Recognise a contents or menu list and be able to scan it (as with all the tasks and so not listed again);
- Recognise and activate the link ‘Money and benefits’;
- Recognise and activate the link ‘Money for transport’;
- Understand that the text on the page accessed is just an introduction to further pages;
- Understand the phrase ‘The Community Transport Association can tell you what transport you can use in your area’ (not an easy task) and extract the required information from it.

Newham Borough Council questions:
Q1: Where will you find information about money?

This task was potentially more difficult than those set for the other two sites, and it was felt appropriate to only include only one question. The question required participants to:

- Understand that the entry ‘Benefits and Payments’ dealt with money issues;
- Recognise that ‘Benefits and Payments’ is a link, and activate it.

The resulting page was quite text-dense, and so no other questions were asked on this topic. However, participants were encouraged to comment on the page accessed, in terms of content or design.

Task 2: The cinema
Newham Easy Read questions:
Q1: Where do you think information about cinemas can be found on the site?
Open that link
Find the ‘Cinema Club’
Open that link
Q2: What is the Cinema Club?
Q3: What day of the week does the Cinema Club run?

This task requires participants to:

- Recognise that ‘cinema’ will be found in the Leisure’ section;
- Find ‘Cinema’ from the expanded menu on the left of the screen;
- Read the information provided under the appropriate section;
- Access the sub header ‘Cinema Club’.

Newham Borough Council questions:
Q1: Where do you think information about cinemas can be found on the site?

This required participants to recognise that cinema information would be found in the section on 'Entertainment and leisure' section. Again, the resulting page was quite text-dense, and so no other questions were asked on this topic, although as before, participants were encouraged to comment on the page accessed.

Task 3: Finding work.
Newham Easy Read:
Q1: Where will you find information about jobs?
Open that link
Q2: What are the good things about having a job?
(You will need to open a link to answer)

This task was made deliberately slightly harder than previous ones in that the links used a different vocabulary than that in the question (e.g. question one asks where one can find information about jobs. The word 'jobs' is not a menu item – it is 'work'). The task thus required participants to understand the link between the words 'work' and 'jobs' (one of the few occasions in which genuine language comprehension was tested. This was because the participants were genuinely interested in finding work, because of the vocabulary used on the sites examined and to make the exercise as authentic as possible. In addition, they needed to:

- Access the appropriate link ('work');
- Recognize that the answer to the question (2) will be through another link;
- Read text and extract the appropriate information.

Movingonup:
Q1: Where will you find information about jobs?
Open that link
Q2: Where does it say about getting paid?
(You will need to open a link to answer)
Q3: What is one problem of having a paid job?

In the Movingonup site, the section about jobs is combined with that on post-school education, under the section heading 'Learning and working'. The only sub-sections within that are ‘Supported work’ and ‘Working for money’. Thus, this activity was harder on this site than it on Newham Easy Read. Also, as with the task on the Newham Easy Read site, the word ‘jobs’ was used in the question, whereas ‘work’ was used on the site. Participants also need to know the equivalence of ‘being paid’ and working ‘for money’. Specifically, users needed to:

- Understand, as before, the link between the words ‘work’ and ‘jobs’, and that – in this case - the section ‘Learning and working’ contains information about work/jobs;
- Access the appropriate link (‘Learning and working’);
- Recognise that the answer to the question (2) will be through another link;
- Read text and extract the appropriate information.

Newham Borough Council:
Q1: Where will you find information about jobs?

Participants needed to:
Find the entry ‘Jobs and careers’ and access it.

This site includes a link directly to ‘Jobs and careers’, and so this task may have been slightly easier on this website than that of Movingonup. However, the link was quite near the bottom of the page, although visible without scrolling on the screens used. The same formula was used as previously – that is, no further questions were asked, but participants could comment about the page accessed.

Tasks for round two of the study were not focused on employment. It was felt that this topic had been exhausted and that more data might be obtained in widening the topics. Only two tasks were set per website. It was felt that this would be sufficient because much data had already been collected. What was of major importance for this round was the application of the modified rating scale, although, of course, continuing to test how to best elicit information from simple interviews was also undertaken. Specific tasks were as follows.

Dobson’s Choice:
Q1: Where can you find information about cinemas? What films are on?
This was quite a difficult, as participants had to first recognise that going to the cinema fell under the ‘Entertainment’ section, and then having activated that link, equate the word ‘Films’ with cinema (that being the appropriate section). A list of films currently showing appears on the left of the screen.

Q2: Where can you find information on tennis player Andy Murray? Say one thing about him.

This required participants to activate the 'Sports' menu (which included a tennis racket as one of two small icons in the enclosing box) and then activate the 'Tennis' submenu. A link to Andy Murray's personal website appears as the top link on the left of the tennis page. To say anything about him, therefore, requires access to a third screen.

Pete's Easy Read

Q1: Where can you find information about films on the site? What does it say?

This task was similar to the first question about the Dobson's Choice website. On this site, however, the term 'cinema' is used, and so to make the task as similar as possible, 'film' was used in the question. Participants had to understand that the word 'Leisure' included 'film' and that, once the Leisure section was accessed, 'Cinema' was concerned with 'film'.

Q2: Where will you find information about trains? What does it say?

This task may have been slightly easier in that participants had to activate the 'Travel' link – depicted by a montage picture which included a train; and then find and activate the 'Train' submenu to arrive at the appropriate text.

Movingonup

Q1 Where will you find information about going out? What does it say?

This question required participants to make the mental link between the menu entry 'Free time' and the idea of 'going out' and access the appropriate link from a circular menu. This leads to an introductory page about going out, from which participants can copy or read.

Q2: Where will you find information about money and transport? What does it say?

This question was difficult, in that there is a main menu entry entitled 'Money and benefits'. As this is not called 'Money and transport', there was a slight question as to whether this would be confusing. Participants had to recognise that information about transport could be found in the 'Money and benefits' section and then find and open the appropriate link (actually 'Money for transport') from the circular menu.

Data gathering

Preferences sought related to the content, structure and appearance of the sites. The methods used to capture views and opinions were employed con-currently. They were participant observation / interviews and a 'smiley face' rating system.

The latter was used in two ways, first as a prop for people who might find talking or, at least, beginning a conversation, difficult. In this way a particular rating choice could be used as a focus for initiating a discussion (or at least, a more articulated opinion). Its other use was to measure the 'fit' between ratings and expressed views. This was considered a useful test for any possible work later with people for whom self-expression was more difficult, on the grounds that if the rating and the speech appeared to correlate, that validated the former.

The original scale consisted of a three icons depicting simple faces showing, respectively, a smile, for 'like', a neutral expression 'no opinion / neutral' (described to participants as 'when you don't like or dislike it') and a frown, for 'dislike' (see Table 10). These were similar to rating systems used by others (e.g. Combes et al, 2004) and described by Atwood, (1998) in relation to those on the autistic spectrum. The scale, by using only one positive, one negative and one neutral icon, was designed to minimise possible problems of misunderstanding or bias. As an accompanying measure to the interviews described below, it constituted a concrete, if basic, viewpoint – always assuming, that is, the terms 'like' and 'dislike' were interpreted by participants in the same way as that which is generally accepted in the language. There was no 'order' bias (except perhaps the left to right positioning), as the icons from which the choice was made were shown together. Acquiescence bias was minimised by the researcher leaving the selection to the participant, and only prompting when necessary: 'which picture will you choose?', (and avoiding asking 'this one, or this one…') so the problem of order did not arise.

Participants were asked to provide a 'running commentary' (as described in Study Three) in which they were encouraged to articulate spontaneous opinions about each page accessed during the course of various activities, and then, as they became familiar with the second and then the third site, offer their comparisons between them. Thus, as far as possible they were given free rein to say whatever they felt about each site. In addition, the researcher prompted and asked questions, based on views offered and in response to actions undertaken. At the end of this process, and before the post-session discussion, participants were asked to rate the site using the rating scale discussed earlier.

For both the interviews and the rating scale, participants were asked to consider:

- Site design and aesthetics: Prompts were e.g. 'What do you think of the layout?; 'What do you like about it?' The polar interrogative ('yes/no' question) 'Do you like the look of it?' was avoided, as discussed in the main methodology section;

- Structure and navigation (and the ease with which information could be found): Prompts here were ‘How easy was it to find information?’ ‘How easy was it to get from page to page?’ again, rather than ‘Was it easy …?’;
- Information content, in terms of its accessibility and relevance: Prompts here were ‘Show me any part of the site you think you would use’ and ‘Which parts of the site were useful?’ This was actually a very difficult area of questioning, as the participants were all receiving much guidance – both from their tutors, families and supporters in finding employment – and to investigate possibilities and options autonomously would have been a difficult proposition for many. For this reason, they were asked this question only once, and then only where the researcher or accompanying tutor considered that they would be able to understand and respond appropriately. Of course, it was tempting to ask ‘Was the site useful?’, which perhaps could have been followed up (given an affirmative response) with ‘In what way?’ This option was rejected as both violating the principle of not asking polar interrogatives questions (in attempting to obviate acquiescence bias) and also as possibly putting participants in a somewhat embarrassing position if they are not able to answer the follow-up.

Following on from the earlier studies outlined in this thesis which found indicative evidence that a vertical menu may be more difficult to negotiate than a horizontal one, of particular interest was any difference of opinion with regard to these arrangements. As outlined above, the former is used by Movingonup (which also uses a circular layout) and the latter favoured by both Newham Easy Read and Newham Borough Council sites. A grid menu arrangement was also used, as favoured by Dobson’s Choice and adopted for the home page of Pete’s Easy Read. Participants were therefore asked directly to compare and comment on menu layouts in this respect. Participants were asked to rate the site on the three categories after they had undertaken the browsing and set tasks, on a form handed to them at the start of the session. This is reproduced (scaled down) in Table 10, which also shows the original ‘smiley-face’ icons.

What do you like?	
The look – what do you think of the layout	
Getting around - how easy is it to find information?	
What is in it (the content)	
Anything else?	

Table 10: Study Four: Original evaluation form to capture site preferences
(Note that the top of each right hand cell is where comments are recorded)

This was then used by the researcher in follow-up post-task questions. The results of opting for this method are discussed under the heading 'methodological issues', below. As described in more detail later, results suggested that the 'neutral' icon was not used and may not have been well-understood. A modified version was therefore used, the details of which are outlined below.

Data analysis

Although this was essentially a qualitative study, there were enough participants to attempt the crude quantitative analysis of matching comments to the smiley rating system. Thus, comments made, either 'free' or in answer to interviewer probing, were coded by topic and rating. For example, the comment (about Newham Borough Council) 'It's just a load of writing' was coded under the site design and aesthetics category as it did not relate to the content, but to the appearance of the page. It was (of course) rated as a negative smiley by the participant. Some comments offered when participants were asked to describe, for example, the content, actually addressed one of the other attributed being examined, such as the navigation or aesthetic appeal. These were coded under the heading that most related to the attributes rather than under the attribute about which the comments were requested (i.e. in some cases, when asked about content, answers related to navigation etc.)

Results

'Rated' preferences

Table 11 compares the websites in terms of the 'smiley-face' ratings given to them by the respondents during the first round of the study. The numbers in the cells represent participants.

Website	Aspect	Like	Neutral	Dislike
Newham Easy Read	Site design and aesthetics	10	0	2
	Structure and navigation	7	1	4
	Information content	10	1	0
Movingonup	Site design and aesthetics	11	1	0
	Structure and navigation	11	0	2
	Information content	10	0	2
Newham Borough Council	Site design and aesthetics	0	1	11
	Structure and navigation	1	0	11
	Information content	1	0	11

Table 11: Study Four: preference test: ratings scale results, first round (n=12).

Except for the Newham Borough Council site, there was very high use of positive 'smile'. For the Movingonup site, for example, 11 participants chose the smile for two of the three categories, and 10 for the third, and for Newham Easy Read, 10 chose that category for information content. These ratings were in marked contrast to those for the Newham Borough Council site, which attracted 11 'dislike' ratings across the three attributes being considered. Thus, the ratings highlighted a clear contrast in views about the mainstream and the other sites. Expressed reasons for participants' ratings are given below.

Of interest also was the lack of use of the 'neutral' rating. This raises the issue of its value, both in terms as its worth as a category and as to the interpretation given to it. Moving on, therefore, to the instrument itself, the 'neutral' option was - as noted in the methodology section - described to participants as 'neither like nor dislike' the attribute being considered. It could be argued both that this is not the same as 'no opinion' and that it is easier for people with Learning Disabilities to think in more binary terms of liking or not liking something. In their analysis of 'no opinion' responses Jon Krosnick and colleagues (Krosnick et al, 2002) opine that the exclusion of such a category does not diminish the quality of data accrued.

Another aspect of the instrument is the single positive and negative options. This was, of course, undertaken to make the exercise simple for the participants. However, the lack of use of the neutral option led to heavy use of the positive and negative ratings. For round two of the study, to combat this problem, a four point rating scale was used, with 'like a lot', 'like a little', 'dislike a little' and 'dislike a lot' as options. Where there was hesitation, the researcher simply said 'you don't need to choose any of them if you don't have a view'. For this eventuality, a 'no opinion' would have been recorded, although the situation did not arise. As with round one of the study, however, this was accompanied by the researcher eliciting comments and using the scale as a focal point.

Rating results for this round of the study can be seen in Table 12, below.

Website	Aspect	Like a lot	Like a little	Dislike a little	Dislike a lot
Pete's Easy Read	Site design and aesthetics	10	3	0	0
	Structure and navigation	9	3	1	0
	Information content	6	7	0	0
Dobson's Choice	Site design and aesthetics	10	3	0	0
	Structure and navigation	7	3	3	0
	Information content	8	5	0	0
Movingonup	Site design and aesthetics	9	3	1	0
	Structure and navigation	8	5	1	0
	Information content	9	4	0	0

Table 12: Study Four: preference test: ratings scale results, second round (n=13)

As is shown in the table, the amended ratings scale did produce more discriminatory evaluations. Both the 'like a little' and 'like a lot' options were well used, with at least three of the 13 participants using the former in every case and (therefore) no more than 10 the latter. As each of the sites was specifically produced for people with Learning Disabilities, it is perhaps no surprise that there were few 'dislike a little' and no 'dislike a lot' ratings.

Expressed preferences

It was clear from various comments and question responses that there were similar opinions regarding the Newham Easy Read portal and the Movingonup website in round one and also with all the websites shown in round two. Participants recognised each as being for and about themselves as a constituency, and they emphasised their liking for the use of pictures. Audio was appreciated where offered (Newham Easy Read; Dobson's Choice). In sum, comments provided far richer data than the rating system employed. They are summarised as follows, beginning with the Newham Borough Council website:

Site design and aesthetics: The Newham Borough Council page layout was criticised quite heavily "It's just a load of writing – it's not good if people can't read"; "there are not enough pictures"; "it looks boring". As with Study Three, text size was an issue too, with reports of the text being too small, although the quantity of text seemed to be the main concern.

Structure and navigation: Three aspects were not well received by participants. First, the hierarchical structure of the menu was simply confusing: "I didn't get that"; "when I clicked, all I got was a list"; "I got lost". Second, it was felt that there were too many entries in the list. Clearly, the hierarchical arrangement helped reduce the number of entries, so in a sense this was somewhat of a contradictory criticism. The problem was that the website dealt with so much information on so many topics that it was difficult to have a menu structure that was brief and simple. Finally, the vertical nature of the content entries was criticised – especially the right-columned list. This was mainly because the entries fell below the level of the screen (a problem related to that of the number of entries) and also because participants felt it was harder to read in a vertical manner on the right hand side of the page. ("you can't see all of the things"; "I don't like reading like that [vertically, on the right hand side of the page]"). As one is both trained to read from the left, and also horizontally, it is perhaps no surprise that having to adopt a practice contrary to both would be seen as problematical. This issue, also highlighted in other studies in Part One, was examined in more depth in Part Two.

Information content: This was also badly received by the testers who made comments about this (eight, of the 12 participants). People found it "not clear for information", and having "hard words". Summing up, the existing Council website was not seen as being for themselves: "This information is not useful for me, I wouldn't want to look at that type of stuff", "It might be good for people who work for the Council… nothing useful for me!"

The Movingonup website was used for both rounds of the study, and was much admired. Although no formal measures were taken, participants certainly appeared to be more engaged with this site than the others, and spent more time on it.

Site design and aesthetics: The pictures were particularly valued: "I like the pictures"; "the pics are nice"; "it's easy to see what the topics are". Similarly, the photographs were enjoyed: "you can see who is writing"; "it makes it real", or more simply put "it is nice to see the photos" (an example of which can be seen in Figure 27).

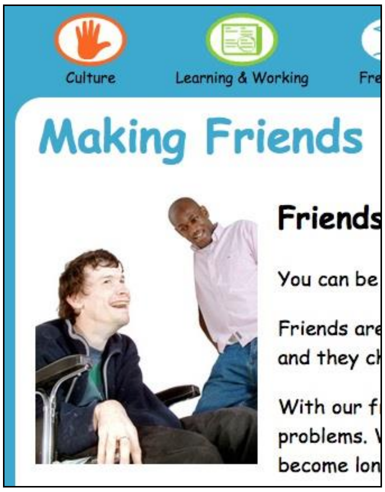


Figure 27: Movingonup website page (detail) showing an example of photos used.

Participants also expressed a liking for the large-text size, which was described as "easy to read" and "better than that [Newham Borough Council] one".

Structure and navigation: The unusual circular menu structure was greatly appreciated: "That wheel is great"; "the circle is cool". In fact, both menu layouts of this site were regarded as superior to those of the other sites – the horizontal arrangement was greatly preferred to the vertical one: "this one is easy to look at", "it looks right", "I like it this way" – comments suggesting that a horizontal style may be more "natural", particularly for people either still in the process of learning to read or who are unable to do so without effort.

The forward and backward arrows mentioned in the site description were used by only four of the 12 participants in the first round of the study, and six of 13 in the second. Thus, despite the positive opinions expressed, the full navigational facilities were not utilised, and therefore much of the information on the site was not accessed, affecting task performance. Thus, not having content below the screen (in other words, employing ‘paging’ for added content rather than ‘scrolling’) does not necessarily imply that it will be accessed with any more ease. In this instance at least, it did not.

Information content: This was well received, too, although – as was the case above – much of the content was hidden until participants were shown how to access it. The most popular topics were ‘Learning and working’ and ‘free time’ (and within the latter, ‘making friends’). The subtopic of making friends was also popular, although here some of the comments tended to be more about the value of having friends rather than the worth of the information on the site.

The Newham Easy Read website was evaluated as follows:

Site design and aesthetics: Participants liked, in particular, the number (and content) of the digital photos included (“the photos are great”; “[the photos] show real things [i.e. using a cash machine etc.]”. No fewer than 10 participants made positive remarks on this aspect of the site, justifying their ‘smiley’ rating. One stated that the photos were valuable because they illustrated every phrase on each page. They were also liked, by two people, as they were taken by and also featured young people with Learning Disabilities themselves. Considering audio in this section (i.e. as part of the site design), it was not well used. In fact, apart from one person who accessed several audio clips, others only did so when they were asked if they had used it, and then very rarely. Two people found the clips hard to understand (they were recorded by the people with Learning Disabilities themselves) although others said it was “good to hear the talking”, one noting that it would be most beneficial for people who were unable to read the text.

Structure and navigation: This was viewed positively too, although there was a general lack of awareness that each page accessed formed part of a satellite site. Predominant use of the browser back button (as opposed to the internal one on the pages of the individual sites) avoided the problem of accessing a new page on pressing ‘back’, which would have happened within the satellite structure. Four participants rated this aspect as ‘dislike’ however. One said the images were too small on the menu entries, and two of the other three felt there were too many pages (the forth was unable to state why he had given this rating, although confirmed it to be correct.

Information content: This was very well received. Again, the attraction was the depiction of people with Learning Disabilities, although, as implied above, content showing everyday activities was particularly liked. Clearly, and perhaps not surprisingly, participants related to concrete everyday occurrences such as pictures of people bowling or learning to cross the road, rather than the more abstract content related to money or benefits featured more in the Movingonup site. Having said that, Newham Easy Read does contain information about money, but it tends to be more grounded in the experiences of potential readers – such as using a cash machine or spending money (although arguably, information such as 'We spend our money on shopping for shirts, dresses, food, trousers, shoes and leisure activities like kicking kangaroo, discos, drama, wall climbing, swimming, cinema and gym' is of limited practical use). Again, the leisure section was the most popular, with bowling being accessed by those who looked at this section – possibly as it is the first menu entry.

Comments for Pete's Easy Read were:

Site design and aesthetics: For round two of the study an early version of the follow-on site to Newham Easy Read was used, which addressed the issues elicited in the first round and in Studies One, Two and Three. Fewer menu items were used; the menu placement was horizontal, there was bigger text, and photos (rather than icons) were used throughout. This was greatly appreciated ("I like it because there are pictures"), with positive comments about the grid structure on the home page ("The menu is very clear") and on the layout generally, which was said by one participant "to look really good". The bigger text was commented upon positively by two participants.

Structure and navigation: Again, this was generally positive ("All you need is to open one page and then another" – i.e. to get from the home page to a submenu page and then to an information page. Another: "You just click and the writing comes up") One person, however, did not notice or recognise the 'back' button and had to ask how to return to the page before.

Information content: Information was kept to around 50 words per topic, but nevertheless, one person said that "there's lots of information and easy to read". The topics themselves were approved ("What we need"). However, although no one rated the information in either of the 'dislike' categories, there were more 'like a little' than 'like a lot' responses. Despite gentle probing and suggestions to compare the content with that on the other two sites, which had both scored higher, it was not possible to determine reasons for these differences.

Dobson's Choice comments were:

Site design and aesthetics: The appearance and design of this site was also very well received – particularly the menu structure and appearance, described as "well organised", "colourful", as well as in more general terms such as "good" and "nice". The only negative point, made by two people, was that there was "too much white" or "too much space" on the screen, the latter comment from a participant who had originally said that the page needed to be more colourful (she was then asked, "In what way?"). The site moved from the menu to the submenu by a dynamic change of menu squares. Surprisingly, no-one mentioned this (and the researcher wished to avoid the "Do you like this aspect?" type of polar question). As mentioned above, the site also contained audio. Unlike with Newham Easy Read, this was activated automatically by mouse over. Two people said they liked it, and others said that they liked the actual picture of the talking head.

Structure and navigation: This was not as well received as the appearance. Mainly this was because when a menu entry is clicked, instead of the page opening a voice was activated saying "This is the [topic] button. If you want to find out about [topic] click on this button". It seems that clicking again on the link during this audio has no effect – one must wait until the end and then activate it. Observations showed this to prove frustrating, although only three people rated the structure and navigation as 'dislike a little', and no-one 'dislike a lot'. Interestingly, two people mentioned the site having many links or topics – both in a positive way. This contrasts with comments made about Newham Easy Read, which was criticised for having too many menu entries – a clear example of the effectiveness of good organisation.

Information content: As mentioned, this website acts only as a portal – the information pages are all from mainstream websites collated by 'Easy Read Online' (the creators of Dobson's Choice). Thus, evaluations of this were based only on sites collected. Everyone was exposed to the film portal page, as one of the tasks was to find it. Those listed included the official websites of 'Harry Potter and the Deathly Hallows'; 'Toy Story 3' and 'Mama Mia', so in a sense evaluations were based on this choice. Those asked for their views whilst on this page therefore tended to discuss the relative merits of the films.

Methodological issues

The issues inherent in this particular study were the use of the 'smiley-face' rating system and the interview schedule and technique. Considering the rating system first, three aspects can be considered:

- the procedure within which it was used;
- the correlation between the ratings and comments;
- the instrument itself.

Regarding the procedure first (ask for ratings at the end of the cognitive walkthrough, and then use ratings, if necessary, as a focus for further discussion) participants will have already offered several opinions about the site before doing the rating assessment. Thus it is not surprising that there was a good correlation between the two (as discussed later). It would have been possible and interesting to have asked for ratings after the free-browsing element of the activity, and for this to have been done without providing the running commentary, and then for the researcher not to have referred to it – just to see if comments and ratings correlated without any external linkage. However, without the structure of the set tasks, their ratings may have been based very superficially, as their actions were – by definition - lacked focus. Any differences between post-task comments and ratings might, therefore, have been the result of the mis-match between their experiences.

The other alternative would have been to have made the observation non-participant so the ratings were given after the complete web session, but before any researcher intervention. The problem here was that post-task interviews would have relied on the participants memorising (and/or replaying) their actions and opinions. It was felt that asking this cohort to provide an unaided commentary would have been too burdensome and would not yield enough data to justify the effort on the part of the participants. Rich data would have been lost by the interviewer not asking for a explanations of actions or asking other probing questions during the session.

Finally regarding the instrument itself, its first manifestation was clearly inadequate. The attempt to make it easy to use made it too blunt to be particularly useful, except as a focal point for further discussion. Indeed, the use of a neutral category did not work at all. The greater variation in responses afforded by the second rating scale was exploited by the participants (not withstanding lack of negative ratings), suggesting that this was both a more sensitive measure and one that added to the data. It appeared to have the added bonus, considering the variation in responses, of being easier to use.

The interview 'schedule' was very loose, with the interviewer asking questions where there were no comments forthcoming or to clarify certain points. The three key areas of interest: content, design and aesthetics and navigation/structure covered every aspect of the sites, and the questioning worked well in that the strict avoidance of polar interrogatives did seem to obviate any tendency towards acquiescence (indeed, it is hard to say yes where the question is not framed to allow that as an answer!). Comments elicited proved that this group of people, at least, were able to evaluate various aspects of sites and offer constructive views about them. It helped that these were made during the course of the exercise, when various features could be pointed to and where the participant or researcher could switch browser tabs to enable easy comparisons.

Conclusion

This study examined how the preferences of website users with Learning Disabilities could be captured. There were question marks over the efficacy of the original rating system employed, from which only a minimum amount of information could be elicited. However, the modified version yielded more data. Combined with careful questioning (e.g. avoiding asking questions likely to provoke answers from participants which they think the researcher wants to hear) it was possible to elicit considerable information from people who find it difficult to articulate their views.

Issues elicited overall in Part One

The series of studies itemised so far in this thesis set out to examine two main topics in the broad of information retrieval from electronic resources by people with Learning Disabilities. These were:

- *Usability issues:* Issues arising in navigating and retrieving information from web-based information resources, with particular emphasis on barriers and difficulties;
- *Methodological issues:* Issues related to methodologies used in examining the usability of the web which provide information to this cohort.

Findings relating to both of these informed the study, and are discussed in turn below.

Usability issues

With regard to the usability of the web - in other words to navigating the system and retrieving information - three key issues emerged which were considered important enough to warrant deeper investigation in Part Two. These were:

- The use of images;

- Text size;
- Menu position.

Before discussing these it is important to note that the studies constituting Part One of this thesis were qualitative in nature, involving relatively small numbers of participants in each case. It is possible, therefore, that other issues would have been elicited with different participants, even where drawn from the same population. Despite this, it was decided to investage further the attributes listed above, both because – regardless of what other aspects of web design it might have been interesting to have examined – the fieldwork legitimised, with empirical evidence, the choice of attributes to investigate. Also, there was a paucity of research literature available on each of the chosen areas of interest, making these areas important ones to study. For completeness, other possible aspects of interest are outlined below a discussion of the three web page attributes chosen, to which this discussion now turns, beginning with that of the use of images.

The use of images

Those with moderate Learning Disabilities showed some problems here, and observation of people with only mild disabilities showed that they appeared to rely on the written label to ascertain the topic of a linked page. Indeed, some of the icons used could be interpreted in a number of ways even by 'mainstream' users. For example, the picture of a handshake could signify a number of things – the closing of a business deal, arriving at a new place or (as was the case on the Newham Easy Read website) 'friends and friendships'. Even where participants were asked to look only for an image, regardless of its meaning, there were problems. A 'black hat' was deemed not to be black, as it contained a light area at the front.

Another issue was that of the space taken up by images. Clearly, their use will necessarily result in longer pages, usually to the extent that content will extend below the level of the screen (or 'below the fold' as it is termed). Such pages, of course, require scrolling. However, as discovered in the studies outlined above, scrolling was a big issue for some participants – the least able appearing to not realise that there was content below the fold, others not being able to scroll effectively, and others not inclined to do so.

From these results it was decided to investigate the issue of images by examining:

- The optimum presentation of images for this cohort. Part One did not explore the use of alternative representations, including different photos or the use of line drawings or icons to see if they conveyed the meaning more effectively;

- Whether there may be a case, under circumstances, for images to not be used. The research in Part One showed both that images were not always helpful, and that their use means that scrolling become necessary. Thus, it might actually be that inappropriate or poorly placed images hinder information retrieval.

Text size

Results here were similar, in one respect, to that for images. This was in the sense that whilst study participants tended to prefer larger text and some guidelines emphasise making it possible for people with Learning Disabilities to enlarge text (e.g. BSI, 2006) to make it more readable, such text may appear to be easier to read, the space taken up by even a small body of text pushes the page length down below the visible screen, necessitating scrolling by the reader. The three studies where scrolling was required to elicit information all showed this to present difficulties for some people. There is also, of course, the potential problem of the readability of the text. In print form, as noted in the literature review above, larger text sizes have been shown to be more readable than smaller sizes (Mills and Weldon, 1987; Rudnicky and Kolers, 1984, Tinker, 1963), although almost all studies have used the print medium, and the differences are often not significant until the size differential becomes quite large. Michael Bernard and colleagues at the Association for Computing Machinery (Bernard et al*,* 2001) noted that no significant research had been undertaken on text size in an online or technology environment.

For Part Two image size was investigated in terms of speed of access to keywords or phrases placed at various locations on the screen (including, of course, below screen level where a page went below the fold). How the questions required for these tasks were formulated is discussed in the Chapter on methodology in the introductory section.

Menu position

Clearly, access to content beyond a 'home' or 'landing' page needs to be as simple and accessible as possible (and not just for people with disabilities) and so the presentation of menu entries is of great importance. The studies undertaken in Part One suggest that, for people with Learning Disabilities, the horizontal option might be preferable to the vertical in a page layout. This is because of two possible reasons: the entire menu is visible on-screen[12], and the direction in which the information presented is compatible with the eye movement of someone reading. In other words, it may be easier for someone with a Learning Disability to read menus from left to right rather than vertically. In Study Four, participants' stated preference was for a horizontal menu, although they were particularly

[12] This is not always the case, as a small minority of pages require horizontal scrolling.

enamoured with the circular menu with which they were presented. Interestingly, prior research (Tullis, 2005; Bernard and Hamblin, 2003) appears to suggest – by contrast - that a vertical menu display aids information retrieval more effectively than, for example, drop-down menus or 'fly-outs'.

Part Two of the study examined menu presentation in terms of the speed of access to menu entries, focusing on if and to what extent the ease of finding these varied according to:

- The orientation - vertical or horizontal;
- The presence or absence of accompanying images;
- Whether there was a need to scroll.

There are, of course, more menu or contents layouts than the two which were compared here. The Movingonup website employs a circular form, and a grid is also possible. In addition, there is also the arrangement of submenus constituting a hierarchy of web pages. Web-based menu design issue has been a central research interest since the earliest appearance of the World Wide Web in 1993. Indeed, the present writer was able to find a reference to 'hypermedia' navigation as far back as 1988 (Frank, 1988). As Yu (2002: p1) explains, research around menu or contents lists relate to 'menu visibility (embedded or explicated), menu organization (indexed or alphabetical), menu presentation issues (e.g., colouring and font size), and location of navigation links. Research shows that the use of embedded text menus (e.g., selectable menu items embedded in text or graphics) produce no significant differences in the incidental learning or retrieval times.' The trade-off between the amount of information to present on one screen or page versus the total number and depth of pages has been also been studied (e.g. Tullis, 2005, Jacko et al, 1995, Jacko and Salvendy, 1996). The only research that appears to have been undertaken with or related to people with Learning Disabilities is that by Rotondi and colleagues (Rotondi et al, 2007), described above, who formulated seven (later reduced to four) website structures as part of a comprehensive examination of website attributes, including labelling and text comprehension.

It was decided not to add more menu designs to the current study for several reasons. First, more than two arrangements would have made the analysis far more complex, particularly when considering factoring in the other attributes. Second, as each task required only one action to complete, it was not felt appropriate to experiment with different hierarchies. Similarly, with a participant group having Learning Disabilities, using 'fly-out' or 'pop-up' or any other dynamic menu arrangement was not felt appropriate. Embedded menu items (e.g. hyperlinking within a text body) was not undertaken, partly because it was the menu list arrangement which was of interest and partly because the normal method of signposting such links is to underline the appropriate text might make reading more difficult (guidelines for presenting information for dyslexic people advise against this method – see BDA: undated, b).

In all of the areas mentioned (e.g. image representation, text size and menu layout) participants were also invited to state preferences, as discussed below, and so it was possible to compare performance with preference data.

Attributes not examined in Part Two

Clearly, it would not be possible to study every aspect of a web page, even in a substantical research project such as that which constitutes this doctoral thesis. As outlined above, the attributes chosen to be examined in-depth in the remainder of this thesis were done so on the basis of the empirical fieldwork and the paucity of research literature in these areas.

Attributes not examined in Part Two include the use of audio, font-type or line spacing, and background colours. Turning to the first of these, the use of audio (e.g. Zentel et al, 2007; Boyle et al*,* 2003) and, indeed, multimedia in general (Wissick, 1996; Shamir and Margalitb, 2011), is an important area of interest in the Learning Disabilities field. It was decided, however, that as the study was concerned with website design and layout, to explore the use of audio within different website designs would make the study lose its focus somewhat. Also, again, a step removed from the aims of the current project, any such study would of necessity be concerned with comprehension issues and not on design considerations. Therefore, instead of including this element in the usability element of Part Two, the use of audio would be confined to that presented here, in Study Two and (with regard to site preferences) Study Four.

Another area that could have been examined in more detail is that of text presentation. In addition to text size, there are many other text attributes that may affect the readability of text on a computer screen. These include font type, white space, the distance between lines of text, paragraph style (e.g. first line indentation etc.), line length and word length (Ali et al, 2013). Clearly, there may be a great difference in difficulty and time taken – even for the most accomplished reader - between reading a Gothic font and an Arial one. However, taking 'standard' fonts, much of the literature suggests that sans serif fonts such as Arial or Verdana are more appropriate for on-screen reading (Peck, 2003; Powell, 2002; Wilson, 2001). However, the study cited above by Tullis et al (1995), found no difference in reading speed between serif and san serif fonts, although Bernard et al., (2001) found that serif fonts were read faster than san serif fonts.

It was decided not to pursue this area of enquiry for two reasons. First, only the issue of text size arose in the fieldwork for Part One of this research. None of the participants mentioned font or spacing or any other text-related attribute. Second, following consideration of the results of Study Two, it was decided to focus only on page layout. Thus, whilst text size would affect this quite substantially (as shown in the results to Study Seven, described later) font style would do so far less. Also, it was felt that for people with low literacy skills, it would be better to restrict the usability sessions to one font, unless this clearly proved problematic. Consultation with tutors and carers, and evidence that a 'sans serif' font might be easier to read, suggested Comic Sans as the default font type. This was kept under review during Part Two, but it was not felt necessary to change.

Another web page attribute that could have been studied is that of text colour. It is well established that people with the Specific Learning Difficulty of dyslexia benefit from different background colours (or overlays) when reading (e.g. Singleton, 2009; McCarthy and Swierenga, 2010). General guidance is to have a dark text on a light, but not white, background (BDA, undated a), and it has been suggested that dyslexics have a lower colour contrast threshold compared to others (Pedley, 2006). No research appears to have been undertaken on this topic for people with learning (e.g. intellectual) disabilities. However, again, the topic was not mentioned by participants, and – again – the colour scheme would not affect the narrower consideration of layout, on which Part Two of the research focused.

Methodological issues

Turning to methodological issues, three main elements arose:

- Formulating the tasks;
- Capturing preference data;
- The role of the supporter.

Formulating the tasks

This issue is, of course, related to the question of support required. The practice of concentrating on 'one-action' tasks appeared to work well in terms of usability. However, previous work by the author (Williams and Nicholas, 2006) showed that there was not necessarily a relationship between ease of use and intellectual effort. An example was given of a game in which players were required to click the mouse when a drawing of an elevator reached floor level on its way up the side of a tall building. The action opened the elevator doors for the occupants to leave. Although this was a 'one-action' task, a considerable intellectual element was involved in, for example, recognising the lift and its function, judging a horizontal and vertical alignment and knowing that one had to click at the correct moment. Thus, formulating 'one-action' tasks in itself was only one element to consider – the understanding of the tasks was also an important component of the exercise.

Apart from Study One, the research to this point required participants to have a certain – if minimal – level of literacy. Text size and menu label recognition, issues both elicited in the fieldwork, can only be explored with such participants. The understanding of images in itself, could, of course, be examined with non-literate participants – as could audio. However, it was felt that such a study would not be able to avoid examining the levels and type of support given, plus the fact that many people with no literacy skills might find the whole concept of 'transition' difficult to grasp. Also, people with greater levels of Learning Disability than those who are able to read, albeit perhaps not fluently, may also find physical difficulties in, for example, using a mouse or the arrows on a keyboard. For these reasons, Part Two of the thesis concentrated specifically on people with a level of literacy (specifically, Entry One to Level One on the Functional Skills ratings) and the ability to manipulate a standard keyboard and mouse.

Capturing preference data

Results of the 'Preference test' study suggested that the second 'smiley-faces' rating system used in Study Four worked reasonably well and could therefore be employed in Part Two of the study. The questioning method – avoiding polar interrogatives - appeared to work well and was further explored. This was supplemented again with requests for participants to compare interfaces.

The role of the supporter

Supporters accompanied some participants and gave help where necessary. However, the study was concerned, as far as possible, with the extent to which the web could be negotiated in an autonomous manner. Of course, in a real situation, the presence of a supporter would be beneficial, if only to discuss and elaborate upon the information given and help with understanding of the content, from which informed transition choices may be made. However, in order to obviate the problem of having to study or evaluate supporter behaviour, and/or untangle it from genuine use by the people with Learning Disabilities, Part Two concentrated on the narrower range of cognitive disabilities focused on in Studies Three and Four, rather than including people who were not literate. Even in the rest of the study, however, supporters still played a vital role both as gatekeepers and arbiters as to the suitability of potential participants. Indeed, the supporters were also instrumental in avoiding any conflict, resentment and anxiety on the part of the participants. Supporters also contextualised and interpreted findings, to give these an extra layer of richness and meaning. Their role in helping on tasks was, however, kept to a minimum.

Summary and conclusion to fieldwork part one

This chapter has described four studies. Study One examined simple navigation with people with a very minimal level of literacy; Study Two looked at the use of audio; Study Three worked with people with a higher level of literacy on more sophisticated tasks (although even here tasks were split into various constituent parts to facilitate task comprehension), and Study Four explored how participant preferences could be elicited. Observation and interview suggested that text size, menu position and the use of images all impacted upon information retrieval and merited further exploration. The author acknowledged that other page attributes may also be important, but argued against including these on both globally and individual grounds. This part of the fieldwork was also concerned very much about developing the methodology described in Chapter Five. It was decided in a consideration of the nature of the tasks that Parts Two and Three of the research would be undertaken with people who had a level of literacy sufficient to read a short body of text (Moser's [1999] 'Entry One and above). This cohort rely less on basic support, and so the difficult issue of how to include the contribution of a supporter in the research findings was resolved. The methods used to capture preferences were explored appeared to be effective and so were taken forward to Part Three of the research, where preferences were elicited of various web pages developed from a combination of the attributes elicited in this chapter.

Before this, the following chapter examines two of the three elicited attributes in isolation. These were menu position and the use of images. Text size was not examined in isolation for reasons outlined in the introduction to Part Two of the fieldwork, to which this thesis now turns.

Chapter Seven: Fieldwork Part Two – investigating the issues elicited, in isolation

Introduction

This chapter examines the issues elicited in Part One in isolation, as follows:

- *Study Five:* The aim of the study was to determine if and to what extent the ease and accuracy of finding entries in a contents or menu list varied according to its orientation and word position within each condition. The 'menu' entries were not hyperlinks but the task simply a form of word-search;
- *Study Six:* This study attempted to determine the most effective depictions of transition-related topics with regard to types of photographic and artistic representation in order to inform website design. The study also examined whether there were any differences globally in understanding representations of concrete and abstract nouns.

Text size, the final website attribute under consideration, was not examined in isolation, as the methods – reading and searching for information - would have been so close to that required for Part Three (the examination of all the attributes in consort) that it was felt unnecessary. Statistical analyses for Part Three were able to determine both the effect of text size on its own and when combined with the other site attributes.

Study Five: Web page menu orientation

Introduction

Following the qualitative findings from the Part One fieldwork, this element of the study sought to examine menu list orientation and its impact on the speed and accuracy of information retrieval.

Aims and objectives

The principal aim of the study was to determine if and to what extent the ease and accuracy of finding entries in a contents or menu list varied according to (a) the orientation - vertical or horizontal (b) word position within each condition e.g. left or right on a horizontal axis, or top or bottom on a vertical one. The study objectives were to:

- Measure the time taken to find 'menu entry' words in various positions on a vertical or horizontal menu bar or table;
- Determine the significance of any differences in time taken between entries on the left or right, or top or bottom of the screen.

Methodology

Sample

The population for all studies in this phase of the research were all within the 'Entry' or 'Level One' stages of their education, as outlined in the main methodology section. For stage one of the study (see the methods section, below), students were recruited from the same College of Further Education in Hertfordshire which had participated in earlier studies. A number of other institutions and organisations participated in stage two. These were a Special Needs School in Middlesex, an adult education class for people with Learning Disabilities, a self-advocacy group and a day centre. The age ranges of the participants were 18 to 47.

Method

This was an experimental study involving the observation and timing of participants as they attempted to find contents or menu entry items from lists with either a vertical or horizontal orientation. The study was undertaken in two stages. For each stage, far more entries were included than might be expected on an actual website - 20 for stage one and 24 for stage two. This is because ease of finding the menu entries was measured by 'task-time' (e.g. time taken to the task of finding a word), and it was felt that the time taken to search for only four or five items, especially considering that these were not to be activated, would not be diverse enough across the different conditions to yield significant results.

It could be argued that it would be unlikely that such a large number of entries (or links) would be present in a 'live' website. However, retail sites such as Amazon have a huge number of links in their homepages (the present writer stopped counting the links once he had reached one hundred, made up of different departments, advertisements, 'best sellers', 'lightning deals', 'what other customers are looking at right now' etc.), and the same can be said of news sites such as that of the BBC. Newham Easy Read itself contained 12 entries and other websites designed for the Learning Disabilities constituency, such as the portal site Dobson's Choice[13] and Look Up[14], also contain a large number of menu entries and/or links embedded in the body text. Research has shown (e.g. Nicholas et al, 2004, 2011b) that people generally access a large number of web pages, and so what might be a minimal problem when accessing one page is exacerbated in negotiating 10 or more of a similar design.

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[13] http://www.dobsonschoice.co.uk/

[14] http://www.lookupinfo.org/ (information on eye care and vision for people with Learning Disabilities)

Stage one, essentially the pilot stage of the study, was undertaken offline, on paper. Stage two was undertaken online, where JavaScript was used to create a dynamic page which presented 'menu' entries at random. For stage one, 20 words were arranged and printed out, to approximate the appearance of a website menu list. The lists were repeated vertically and horizontally, and with and without images, making four conditions in all:

- With-images , Horizontal menu;
- With-images , Vertical menu;
- No-images , Horizontal menu;
- No-images , Vertical menu.

Figure 28 shows the 'vertical with-images' condition.

Figure 28: Study Five: paper-based page used for stage one of the study (detail)

The with/no-images conditions arose from the original aim of the study which was to also examine the effect of images. As outlined in the results section below, however, the similarity in results for the image/no image conditions, and the need to make the images very small to fit a enough entries to make a meaningful comparison of layouts, led to the decision to concentrate, in the second part of study, only on word position rather than the effectiveness of images.

Entries were not themed, either around transition or anything else. The test was simply to 'find the word' as read out by the researcher. The words were chosen on the basis of their inclusion in Entry Level learning materials and books of a reading age of less than eight years for mainstream learners. To give the feel of a website, the banner heading used for the overall research was placed at the top of each page.

Sought words were either situated to the left or right of the page; or near the top or the bottom. This gave eight conditions, as follows (Table 13):

With-images	Horizontal menu	Left -placed word
With-images	Horizontal menu	Right -placed word
With-images	Vertical menu	Top -placed word
With-images	Vertical menu	Bottom -placed word
No-images	Horizontal menu	Left -placed word
No-images	Horizontal menu	Right -placed word
No-images	Vertical menu	Top -placed word
No-images	Vertical menu	Bottom -placed word

Table 13: Study Five: word positions for the offline test (stage one)

Stage two was undertaken using a bespoke web page, written in JavaScript, in which the menu words appeared either along the top of the page, in two rows, as in Figure 29, or down the left side, in two columns. Care was taken to ensure the vertical list did not fall below the bottom of the screen and thus require scrolling.

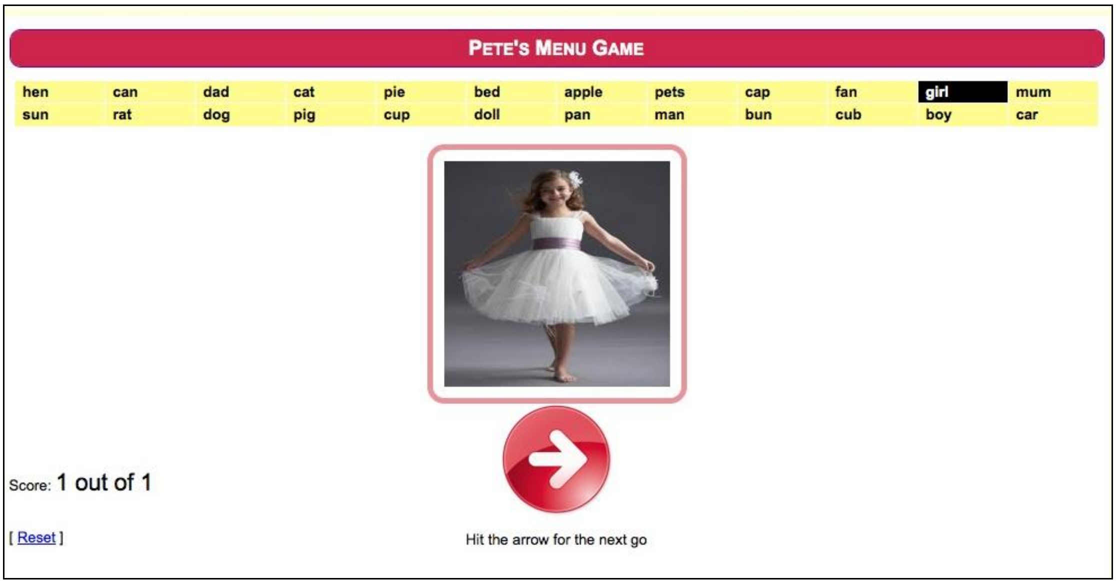


Figure 29: Study Five: word position for the online version (stage two)

For this stage, instead of participants being read the required word, an image appeared in the centre of the screen of an object whose label they were required to find. The words to be found were indicated by a picture in the middle of the screen, to which participants had to react by selecting the word represented and clicking it. JavaScript was used to enable a different selection of words, with a randomly selected image presented at every iteration. This page-refresh was triggered in early trials simply by clicking on the appropriate word (i.e. completing the task). However, it was possible by using JavaScript to capture time-on-task automatically, and early results showed that words near where the cursor was positioned for the previous iteration were found more quickly – thus negating any other effects of word position. For this reason the set-up was changed so that once a word had been selected a large forward arrow appeared under the picture (bottom of Figure 29), which also had to be activated to trigger the next image. Thus, the cursor began in the same position for each word-search. The images being delivered at random by the system, and as each session consisted of 16 iterations, there were always words at each end and in the middle of the list to find, so the effect of word position could be examined fully.

Data gathered included:

- Demographic details of the participants (age and gender);
- Location (participants were recruited from a number of organisations);
- Success/failure;
- Position of chosen and correct word;
- Task-time.

At the end of the session participants were prompted to hit a 'Finish' button. This submitted the data for capture and displayed a 'Thank You' message and a results table.

The online version of both conditions added two other features, graded word lists and a 'game' environment. The word lists were taken from a list posted by author and educationalist Charlotte Gerber (Gerber, undated[15]), with many words taken from the 'Dolch 95 Common Nouns', a list of the most basic and frequently used words in English (Dolch, 1948). Gerber's list helpfully classifies the words into education grades. This meant that the JavaScript could be programmed to present words from progressively more difficult grade levels as the session progressed. The first 20 words were from Kindergarten level (ball, bat, bed etc.); followed by the same number from Grade One (apple, arm, banana) up to Third Grade (arithmetic, badge, basket).

The lists were manipulated in two ways to fit the purpose of the study. First, abstract nouns (e.g. 'advice') and words that were considered difficult to depict (e.g. slave) were filtered out. Second, other words were added, both to make the lists more current and to include those likely to be familiar to participants. These were all related to technology and, purely because technological labels (e.g. USB, PC, Wi-fi etc.) tend to be so, happened to be

[15] The list can be found on innumerable Internet sites (e.g. http://www.momswhothink.com/reading/list-of-nouns.html) and was not necessarily compiled by Charlotte Gerber. Its source proved impossible to trace.

abbreviated: CD, DVD, TV and DS (the latter being a portable game console produced by the Japanese company Nintendo).

The game environment was used to encourage participation and to make the activity more of a fun activity. It was achieved by incorporating a counter, which provided a 'score' of correct answers and permitted friends to play what was described to them as a word-search game. Although this element of competition might appear controversial, in terms of pitting pupils against each other, prior observation showed that computer games, used as educational aids by class tutors, were very popular and played without any rancour or argument. Of course, the activity was also sanctioned by the tutors involved.

Procedure

First, for both stages, a briefing session was undertaken as described in the main methodology section. Additionally, for this study, participants were told in a group session that previous work by the researcher had led to apparent differences in ease of use between the horizontal and the vertical menus. He was careful not to explicitly state that vertically placed menu lists appeared to be harder to use than the horizontal ones, to minimise possible bias, whereby the participants take longer because they are 'supposed to' or to please the researcher.

For stage one of the research, participants were then shown the four sheets on which the various menu combinations were displayed and told what the test entailed. For the test itself, they sat (individually) at a free desk with the researcher and were shown one of the sheets of paper representing each of the attributes listed above, and asked to find a word that was situated at or near the top or bottom, or left or right of the paper. The order of design was random (using a random number generator[16]), but the word positions were not. The latter was to ensure that words had to be found from both sides or from top and bottom of the lists and that there were an equal number of these. Participants were timed as they looked for each word, with the time starting as soon as the required word was given, and stopping when the letter was indicated physically - participants being asked to put their finger on the word. The clock was paused where they engaged the researcher in conversation or otherwise exhibited off–task behaviour. Although task-time was the main measure of success, incomplete tasks were also noted. Originally there was an informal, unstated, time limit of 30 seconds to find each word. If this was exceeded the researcher offered to show its location. However, in some cases, participants were engrossed enough

[16] www.random.org/

to be left to continue searching - engagement being assessed by eye or finger movement across or down the page.

Stage two was undertaken at various locations, as mentioned above. In all but one case (the special school in Middlesex) the researcher attended the sessions, although as results were automatically collected by the system there was no need for his presence. For this reason, at most locations the exercise was undertaken as a group exercise, with the researcher and carers or tutors on hand and circulating the room to deal with any questions. As far as possible, half of the participants started with the horizontal condition (the system default) and the other half with the vertical condition. This was to balance any familiarity effect. Once participants had completed one session they started again on the other condition. Of course, they were given the option of not continuing and also told they could stop at any time, even once started.

Data analysis

For the paper-based activity comprising stage one of the study, of much interest was the process and the comments and feedback from the participants. However, in addition to this a basic statistical test was also undertaken, despite the small sample size, (31) and non-normality of the dependant variable, task-time. The latter was determined by the Kolmogorov–Smirnov test of normality[17]. Also, as the same participants completed each condition (horizontal and vertical) the samples are not independent, breaking one of the assumptions of the test. However, it was considered acceptable to proceed with the analysis for three reasons:

- Participants attempted each condition in a random order, so any familiarity effects would have been cancelled out;
- The timings were not as accurate as desired, as participants often made off-task comments to the researcher and, in a small minority of cases, found words but failed to communicate this (it was only on prompting that this was established);
- This was simply a pilot study in preparation for an online version, and so results were indicative only.

For Stage two, the data were again tested for normality. Results suggested that the distribution was again significantly different from normality ($p<0.01$). However, transforming the data into the square roots this time rendered the distribution normal, and so parametric tests (t-test and Analysis of Variance) were carried out. It is worth

[17] The distribution was still non-paramentric (not normal) even when task-times were transformed into square roots, one of the standard methods for normalising data.

adding that as the variable was time (in seconds), there were no negative numbers to square root, so the problem of roots becoming positive (Field, 2005) did not arise.

Results

Stage One

Results were:

- On the horizontal condition, words to the right (including the last three words in the list, reading from left to right) in the row took longer to find than those on the (last three positions of the) left, as would be expected in a reading exercise (8.3s to 7.0s). The difference was calculated as significant in the Wilcoxon Signed Rank ($p<0.05$). It must be emphasised again, however, that the small sample, violation of the 'independence' rule for the statistical analysis, and less than accurate timings mean that the results of these significance tests should be taken as indicative only. For this reason, full SPSS output tables are not considered necessary for this particular analysis;
- It took longer to find words arranged vertically than horizontally (9.5s to 7.6s). Again, the Wilcoxon Signed Rank test found this to be significant ($p<0.01$);
- In the vertical condition (again, the three words comprising the extremes were used), however, although the mean time to find words at the bottom of the page was greater than at the top (9.0s to 10.1 sec), this was not statistically significant ($p<0.05$);
- Finally, there was virtually no difference in time taken to find words whether they were accompanied by an image or not (8.3s to 8.8s). Due to this similarity in findings and the need to make images extremely small to run the tests as a horizontal versus vertical arrangement it was decided to continue to study only word position for the full online version of the test.

In addition to measuring performance, observational data were accrued in the process of undertaking the study. This qualitative and informal data gathering was almost as valuable as the quantitative findings, as it revealed a great deal about the processes inherent in undertaking the procedure studied in the tests. Most importantly, many of those who undertook the test used their fingers to guide their eye, and so their searching behaviour was very clear. For example, as noted above, the measured task-times showed that it took longer to find the menu entries from the vertical condition, and longer in that condition where the word was at the bottom of the page. However, the finger movements of some participants showed them looking at the text from the end of the list up the page to the beginning and thus finding words at the bottom first (hence the difference in mean times as statistically non-significant). This is interesting in two respects. First it suggests even more difficulty finding words online when they are below screen level (unlike in this case), as the eye is moving up and not down, and so the reader may be less likely to scroll. Second, having to move the eye from the top of a page immediately to the bottom if one did still scroll, having looked from the bottom of the page to the top, is one more step removed (in addition to having to read vertically) from a 'normal' left to right, top to bottom reading procedure.

Enriching these results, some interesting scenarios occurred of general interest to the study and to the wider issue of undertaking research with this particular cohort. As noted in previous work by the author (e.g. Williams, 2006) research participants having Learning Disabilities often behave in unexpected ways, and this was true during this particular study. Stage one, in particular, produced many incidents. First, one participant did not answer either of the first two questions, but then read each of the entries, slowly and methodically, thus clearly demonstrating that he could read but either did not understand the instruction (e.g. to point to one given word) or had no wish to proceed as requested. A small minority (five) pointed to entries that interested them or caught their attention rather than those requested, although three of these were able to attend to the task when reminded. In these cases, timing stopped when the incorrect word was chosen, but started again once the required one was repeated by the researcher.

Finally, in early trials, again in stage one, some participants moved the paper so that it was in an optimum position for them to examine. In one extreme case, the vertical menu sheets (printed in 'portrait' orientation) were rotated almost 90 to become 'landscape', or horizontal. It became clear, therefore, that the paper had to be fixed somehow. This recognition came with the realisation that, being laid on a table, the paper did not reflect screen reading – the latter being in a vertical position in front of the reader. Thus, for the remaining iterations of the test, the sheets were attached to a PC screen.

Stage two

For this online stage, words were designated as being Left, Middle or Right and Top, Centre or Bottom (Table 14 and Table 15) with those not in the middle/centre or near the extremes being labelled as 'Null' and not included in the results.

Left	Left	Left	Null	Middle	Middle	Middle	Middle	Null	Right	Right	Right
Left	Left	Left	Null	Middle	Middle	Middle	Middle	Null	Right	Right	Right

Table 14: Study Five: Horizontal designation of word positions

Top	Top
Top	Top
Top	Top
Null	Null
Centre	Centre
Centre	Centre
Centre	Centre
Centre	Centre
Null	Null
Bottom	Bottom
Bottom	Bottom
Bottom	Bottom

Table 15: Study Five: Vertical designation of word positions (stage two)

Differences in times taken were explored both globally and by using a mixed pairs method. For this exercise, although the distribution of mean times was skewed, the data was normalized by using the square root of these values. Thus, parametric tests were possible in this case.

Results for the basic horizontal versus vertical conditions were undertaken using a paired sample t-test, which compared the mean times taken to find the words of each participant who undertook both conditions (n = 76, from 97 who took part altogether). (Table 28, in Appendix 4, where all statistical tables can be found), unlike the offline (paper) test, shows there was little difference in the times taken between these conditions. p=0.43, well above the 0.05 threshold. An independent t-test was also undertaken in order to include all the data, which again produced a non-significant result (p=0.91, see Table 29). Finally, for completeness, participants undertaking the horizontal condition first were compared in an independent t-test to those undertaking the vertical condition first (Table 30) and vice versa - i.e. second attempts were examined (Table 31). There were non-significant results in each case (p=0.99 and 0.63 respectively). This finding echoed that of Helena Ojanpaa and colleagues (Ojanpaa et al, 2002) who undertook possibly the only comparable study to the current one, and also found the search-time difference between the two conditions to be non-significant.

As with the offline test, also of interest was whether there was any significant difference between times taken to find words on the left or right of a horizontal menu, and top or bottom of a vertical one. This was to see if the task was approached in the same way as a reading exercise might be – with left to right and top to bottom viewing; or whether the nature of the exercise made participants view the page in a different way – from the centre outward (as the images representing each word were centrally situated) or randomly, or even (as in some cases with the hardcopy test) from bottom to top. A univariate ANOVA was undertaken to examine test for differences in means.

Results from all iterations (Table 32) suggested that, as with the offline test, there was a significant difference between times taken to find words ($p=0.01$) with regard to their position.

Of interest was any differences in performance in terms of speed of access to words in different placings by higher and lower performers (Table 33). In fact, the same result was manifest between those who scored at least 75% of iterations correctly, and those who scored below this threshold (only 7 out of 97 participants failed to achieve this target, although between them they undertook 112 iterations). Mean times to find words increases as the position shifts from left, to the middle and across to the right. Similarly, and more markedly, the mean times to find words increased from the top, down to the middle and to the bottom.

Taking global results again, times taken to find words comparing left and right were significantly different ($p=0.03$), as were words placed at the top and the bottom of the vertical list ($p=0.02$) (Table 34), which also shows that significant values for comparisons between the two conditions, namely horizontal left v vertical bottom and vertical top v horizontal right, with the first named being the quickest in each case, $p=0.01$ and 0.04 respectively). Higher scoring participants (those achieving 75% on at least one condition), however, did not take a significantly longer time between finding words on the left or right, although they did between top and bottom ($p<0.01$, Table 35). There were again, significant differences between horizontally and vertically-placed words, notably between both the horizontal left and middle-placed words and those at the bottom of the vertically-placed ones ($p=0.03$ and 0.02 respectively).

These results strongly suggest that although the words were randomly positioned, and participants therefore had an equal chance of finding them regardless of where they chose to look first, they tended to undertake the test as if it were a reading exercise. It is particularly noteworthy that words in the centre (horizontally) and the middle (vertically) of the page are not the quickest found, because the picture prompting the word search appeared in the centre of the screen, so it might be supposed that words immediately above it or to the side (e.g. at the middle or centre of the lists) would be discovered first. The fact that they were not, and fitted in the exact positions they would have been found in a reading exercise, strengthens the evidence that the participants, perhaps subconsciously, tracked from left to right and top to bottom.

Conclusion

The principal findings for this study are that first, where there are many menu items and any accompanying images are, therefore, compressed into a small space (to prevent either several rows of menu or an unacceptably lengthy page) the images do not act as an aid to quick retrieval. Second, whether consciously or not, participants behaved as if the task were a reading test, by moving their gaze from left to right and top to bottom. In the sense of being methodical, this might appear to be a desirable outcome. However, this very fact, in turn, provides evidence – considerably supplemented in the next part of this thesis - that people with Learning Disabilities do not tend to take in more than a small area of the screen, imbibing content sequentially from the top left of a page.

An important consequence of this is that approaching a screen in the same linear manner as a hardcopy page, hypertext – the foundation of the World Wide Web - may not work as well for these individuals. Interestingly, higher scoring participants showed considerably less of this tendency towards linearity, by not taking a significantly longer time either between finding words on the left or right, nor between top and bottom – suggesting this may be a problem specifically with people with lower levels of literacy. Performance and literacy level is explored more fully in Study Seven.

Study Six: A word is worth 1,000 pictures: depicting web page menu entries using images

Introduction

Following from the above study and Part One, the use of images was explored in more detail. This piece of research extended that described above by placing it in the context of transition – the subject of the web pages designed – and by exploring the effectiveness of various pictorial representations in conveying different topics.

Aims

The overall aim of the study was to determine which were the most effective depictions of transition-related topics with regard to types of photographic and artistic representation in order to inform website design. The study also examined whether there were any differences in understanding representations of concrete and abstract nouns.

Methodology

Setting

The qualitative phase of the fieldwork was carried out at two (of three) campuses of the Further Education College in Hertfordshire used in earlier studies. The sessions were carried out in the familiar setting of the participants' classroom. In each case, the groups were attending the same course and participated either during one of their classes or, in one case, during their lunch break (for which the researcher was more than grateful!) Other institutions and organisations participated in stage two. These were the same as those described in Study Five.

Sample

The population for phase one of the study were all within the three 'Entry' or 'Level One' stages of their education, as described in the main methodology section. There were stages to the study. An initial qualitative exploration of how people with Learning Disabilities categorise and interpret images, followed by a more quantitative phase where images are presented on screen and participants select appropriate categories for them. For the former, an initial sample of six learners undertook the exercise. A second round took place with a sample of five. Following the results elicited from these groups, some of the depictions were changed and then tested on a third sample of six. Thirty nine individuals completed the online activity, described below. The age range of the participants was 18 to 44.

Method

From prior work by both the present author (e.g. Williams, 2008; Minnion et al*,* 2008); other literature on information needs and transition, outlined in the literature review in Chapter Three (Townsley, 2004; Tarleton, 2004; Ward et al*,* 2003; Morris, 2001) and resources available (e.g. Mencap[18]; Friendly Resources[19]; Movingonup[20]), several categories of information topics were drawn up. Initially these were:

- Education;
- Health;
- Leisure;
- Independent Living;
- Money;
- Relationships;

[18] www.mencap.org.uk
[19] www.friendlyresources.org.uk/
[20] www.movingonup.info

- Safety;
- Support;
- Transport;
- Work.

All but two of the terms are abstract nouns - 'intangible objects [such as]… thoughts, ideas or imaginings' (Seely, 2009: p2). Unlike concrete nouns they cannot be experienced by our five traditional senses. The only non-abstract nouns in the list are:

- Money (although this is a tricky one. It can be thought of as 'concrete' in that it refers to coins or notes, although strictly speaking it is an abstract - and, incidentally, uncountable – concept) (Lyons, 1995).
- Transport (a collective, but which can be considered concrete almost by default in that it is not an idea or feeling).

Considering the aim of exploring the understanding of such terms, it was decided to omit Transport and Money from the list for the study, as it was considered relatively easy to select images that clearly represented these topics. In fact, even amongst the abstract nouns listed it was felt through professional discussion and experience that some were more easily encapsulated by an image than others. Independent Living (named for this exercise as Living On Your Own to avoid the difficult loner word 'independent') and Support were considered particularly difficult to express, whilst Leisure not so much so, as concrete examples such as bowling can be depicted.

Three representations of each topic were found or created as follows, using Education as an example topic:

- Depiction 1: As direct a photographic representation as possible (a photo of a teacher with her class)
- Depiction 2: A less direct photograph (a photo of a set of books)
- Depiction 3: A simple line drawing (in this case, of a school certificate).

The photos were found using Internet search engines (Bing and Google) and taken from appropriate websites such as Newham Easy Read and Movingonup. In each case, only photos were used which represented the required word/concept, both as search result 'hits' and in the context of the enclosing page.

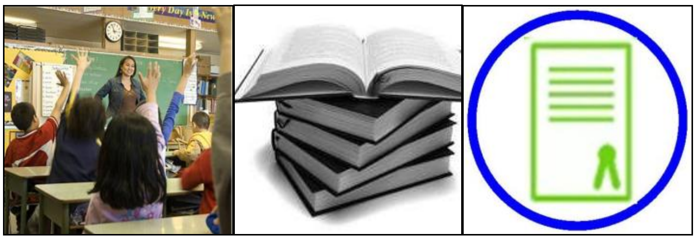


Figure 30: Study Six: three representations of education

Six of the eight drawings came from the Movingonup website, as this dealt in the same lexical and informational area as the site produced for the current project. The other two (Living On Your Own and Safety) came from other sites found via Internet searches.

The research was undertaken in two stages. Stage one consisted of a qualitative study of how a small number of people with Learning Disabilities sorted the cards into the transition-related categories listed above. This was undertaken in order to test the appropriateness of the initial images chosen by the researcher. Following the findings from a pilot round of this, cards were modified and re-presented to the same and other participants in an attempt to arrive at a set of images that better represented the categories to be used on the website.

Stage two consisted of an online exercise, again undertaken using a web page written in JavaScript. As the intention was to examine which categories participants placed each word, and not the efficacy of the menu position, the menu words in this study appeared only along the top of the page and were static (in other words, their position did not change with each iteration). A randomly selected image was presented to participants for every iteration, with a new image appearing when the forward arrow described earlier was activated.

At the end of the session participants were again prompted to hit a 'Finish' button. This submitted the data for capture. Unlike Study Five, however, there was no second session as word position was not being studied in this case. Data gathered apart from a participant number and first name were the image selected, mapped onto the original image designation. For convenience 'success or fail' comprised a third column. Gender was also captured from a log-in, but the sample size (39) did not prove large enough to use these data.

Procedure

To begin, a participant briefing was undertaken as outlined in the main methodology section, ending with an explanation of the specific study and explaining – on a data projector as with all the studies - the problems people in the research up to this point had shown in interpreting images. Then, for the qualitative sessions, the researcher sat in an unobtrusive place in the participants' classroom where volunteers were ushered in one by one. The images had been printed on photographic paper, 5cm x 5cm in size (deliberately small to approximate the size of image likely to be encountered on a website) and the set of 24 of these were spread out on the table and a sheet with the eight categories or topics written on one side in a grid, with space on the other side for the images to be placed in the correct category, as shown in Figure 31.

Figure 31: Study Six: sorting sheet with four pictures placed (one of which is in the 'wrong' category)

For the first and second round, the researcher worked with participants on an individual basis. In order to help those finding the label reading difficult, each category was read aloud several times to them as the sorting progressed. Help was also given in the physical placement of the pictures. Participants were asked to talk about their choices as they were making them, although no pressure was applied. In fact, no comments were forthcoming except in response to gentle questioning. Despite this apparent reluctance to talk, when participants did so they made some very valuable observations, as outlined in the results section below. For the third and final round of the qualitative stage, participants worked in a small group to sort the cards and then discuss choices with the researcher.

For the automated computer-mediated session, several participants undertook the session (in other words, played the game) in pairs and concurrently, with the researcher moving from pair to pair and terminal to terminal to both oversee proceedings and seek comments and observations from participants. As there was little discussion for this phase, it was possible, within time constraints, to increase the number and range of depictions.

Data analysis

Each picture was placed in a category by the researcher and professionals working in the field. This categorisation was compared to those chosen by participants, in order to study the overall variation from the pre-classifications, and the extent to which each class of representation varied from this.

Results

Interview (qualitative) phase

The first of the three sessions yielded findings that not only suggested various changes to the images used, but also gave an insight into the thinking behind the choices made. One principal finding was that the icon/drawn representations were clearly more difficult than the photos. Fifteen of the 19 instances where the initial participants did not put the images into any category were icons/drawings, with the (Movingonup) icon of a helping hand by a signpost remaining uncategorised by four of the six participants. The full set of icons appears in Figure 32.

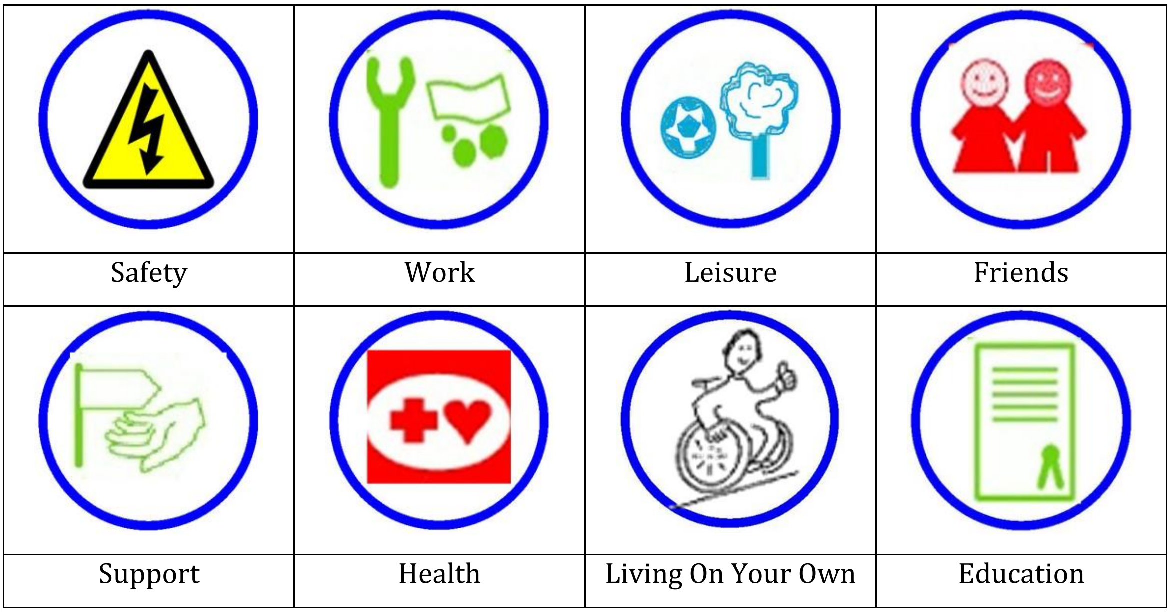


Figure 32: Study Six: pictorial representations ('icons' in the text) of the transition topics

Several examples of this emerged, including:

- Failure to find any category for the Leisure icon (two participants). Perhaps either the football or the tree on their own may have yielded more positive results;
- Failure to categorise the Education icon (three) Only two correctly did so, with one other placing it under Work (it could, of course, easily have been an employment-based award);
- Categorising the Work icon under Safety because, in one case, the note and coins were mistaken for falling stones and in the other because you could trip over the spanner. One person only correctly categorised it;
- Failure by all participants to correctly categorise the Support icon (a signpost with a hand, presumably showing the way). Four did not select any category, one suggested it signified Living On Your Own as the representation meant, for them, finding your own direction, and the other Health, but she could not articulate her thinking behind this choice.

Two of the designs did work, however. That showing quite clearly two people together was recognised by all participants as being in the Friends and Relationships category, and the red cross and heart classified under Health. Nevertheless, it would be fair to say that the icons generally presented difficulties in interpretation – a finding that might well apply to people who do not have Learning Disabilities.

Regarding the photos (rather than the line drawings), three main issues arose. These were:

- Categorising as Work people depicted whose jobs signified other categories;
- Providing alternative interpretations of the photos containing animals;
- Making well thought-out alternative categorisations.

Categorising as Work people depicted whose jobs signified other categories: A good example of this was the nurse. This photo (part of Figure 33) was chosen by the researcher to represent Health, but two people put this under Work.

Figure 33: Study Six: nurse, policeman and pedestrian safety officer photos

Similarly, two people classed a policeman under Work and one under Support– both reasonable answers – and only three people under Safety (the 'correct' choice). A school crossing patroller (more colloquially known as 'lollipop lady', and described as such by two participants) was also placed in Work by two people. Although these are logical categories they nevertheless suggest an interesting general phenomenon: the images were selected by the researcher as representative of particular abstract concepts – Health and Safety in these cases. However, they were regarded by the participants more in terms of their concrete representations of people in their specific employment roles – a policemen, nurse etc. and placed into the category of Work. This is not surprising considering the difficulties people with Learning Disabilities have with abstract concepts (e.g. Booth and Booth, 1994; Finlay and Lyons, 2001).

Providing alternative interpretations of the photos containing animals: two photos featured animals (see Figure 34). The first was that of a cat and dog apparently enjoying each other's company. This was the 'less obvious' Friendship photo. Three people chose instead to put this under Living On Your Own, on the grounds that one is more likely to have pets when in this situation. Another chose Leisure, considering playing with one's pets to be a very common leisure activity, again, emphasising the relationship between dog and human.

Figure 34: Study Six: photos featuring dogs (depicting Friendship and Support respectively)

A second photo shows a man in a wheelchair with a dog beside him and someone pushing the chair. This signified Support, although it could just as easily represent Friendship or possibly Safety, considering the dog or the helper as a guide. Again, there was an assumption by one participant that the animal equated with solitary living.

Making well thought-out alternative categorisations: The test showed several other examples where participants placed images in categories other than those for which they were chosen by the researcher. However, these could hardly be called mistakes, but demonstrated just how many photos could be placed quite logically in alternative categories. Examples were:

- Books (Work instead of Education);
- Coach trip (Education instead of Leisure);
- Electricity warning sign (Health instead of Safety);
- An apartment complex (Leisure – as in 'holiday home' - instead of Living On Your Own)
- A man cooking in a flat (Safety instead of Living On Your Own)

Of course, it may be considered somehow a 'false' or artificial exercise to require people to categorise these diagrams. After all, each one would be accompanied by a text label on the website which gives it meaning. For example, having the picture of a spanner, notes and coins juxtaposed with the label Work may make people realise what the picture means. However, there are two arguments against this. First, if the text is necessary to explain the picture, then the latter is surely redundant. Second, the idea of employing pictorial representations is to aid comprehension and, indeed, ultimately, to obviate the need to read at all.

Following these results, the images were changed for several of the categories, as discussed below, and the icons supplemented by those produced by the accessibility organisation Widgit, in order to compare the efficacy of different non-photo representations. The organisation produces a bank of 11,000 symbols 'for people who, for whatever reason, find the printed word hard to access'. These 'can be used to represent over 40,000 words and phrases' (Widgit, undated: unpaginated). The 'Widgit' symbols used for this study are shown in Figure 35, below.

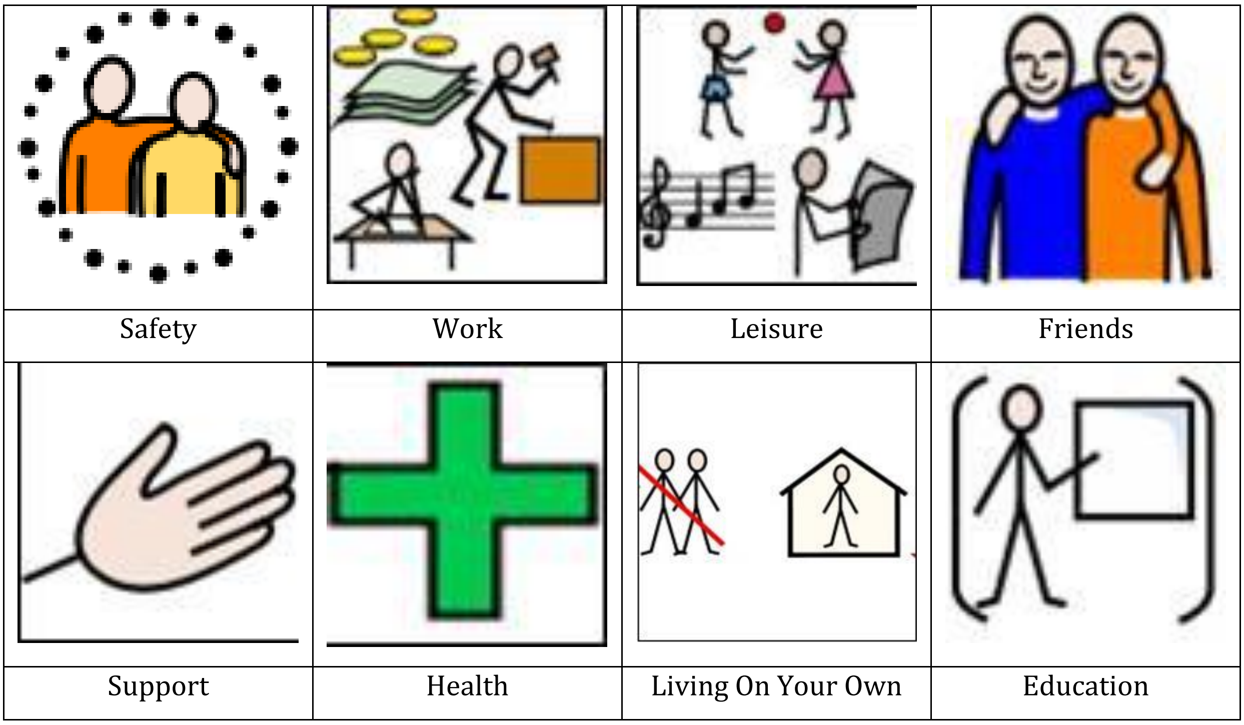


Figure 35: Study Six: Widgit symbols used for Study Six

Regarding the Widgits, the main issues were the interpretation of those representing Leisure and Safety. The former group depicting music, reading and ball-playing was interpreted by the group as a whole as belonging in the Education category. The Friends and Safety Widgits were so similar that this caused great confusion and, perhaps not surprisingly, some criticism. Both were classed as Friends, although to differentiate them two people felt that one of the depictions (ironically, that for Friends) could arguably be placed in the Support category. The Widgit for that – a hand – was also not universally seen as such, with individuals suggesting it could mean Work, Safety (being interpreted as a 'Stop – Danger' sign) or Education (showing someone something). Only one person mis-categorised Education, thinking the whiteboard was a TV and categorising it as Leisure. Despite these various problems, it was decided to keep the Widgits in the study for the quantitative stage.

As well as the addition of Widgits, other changes were made where the original depictions caused problems. These were the Health, Safety and Leisure categories, with the changes being as follows.

Health: The question here was how to encapsulate health without using either a health professional (so as not to suggest it relates to work); a sport (possible overlap with

Leisure) or a healthy food. In the first round, an apple, held in a cupped hand, was used, but in the full website Food was a category, so depicting Health with a foodstuff would not be sensible. It was finally decided to replace the nurse with someone in a yoga pose, which although could be classed as Leisure, may suggest Health more strongly. The apple was changed for a photo of a woman apparently with a headache (Figure 36) in fact suffering from morning sickness. The idea here was that 'healthy' depictions could easily be mistaken for other topics, whilst someone who was clearly *not* healthy might better convey the concept of health, a tactic of the absence or opposite of the concept conferring meaning that was also adopted later with regard to Safety.

Figure 36: Study Six: depiction of 'health': lady with a headache

Despite these changes, depicting Health continued to prove difficult. The 'sick lady' was considered by two of the five participants to be suffering from depression and so was categorised under Living On Your Own, on the grounds that doing so could induce loneliness. Another one classed her under the label Support, because 'she looked as if she needs some'. The choice of yoga as an indication of a healthy lifestyle was similarly unsuccessful, with only one participant seeing it this way. Two people failed to find any location for the picture, and two others equating it – logically - with Leisure. This was therefore dropped for the quantitative phase of the research. However, it was decided to retain the photo with the headache depiction and the nurse, to see whether the problems elicited could be quantified. A doctor actually treating a patient, by examining him with a stethoscope, was also added for this phase to see if a more active representation made a difference to people's categorisations.

Safety: Regarding this topic, the policeman was replaced by a someone fastening a car seat belt, and the traffic safety officer with a man clinging to the roof of a building, his ladder having fallen (Figure 37). This repeated the tactic of using an absence of the concept to give it meaning. Of course, there was the risk that either of these images could have been classed under the category Health. Indeed, it could be argued that Health and Safety could be placed together, although it was felt that topics such as crossing the road safely and what to do at a doctor's surgery (for example) were sufficiently different to warrant their own categories.

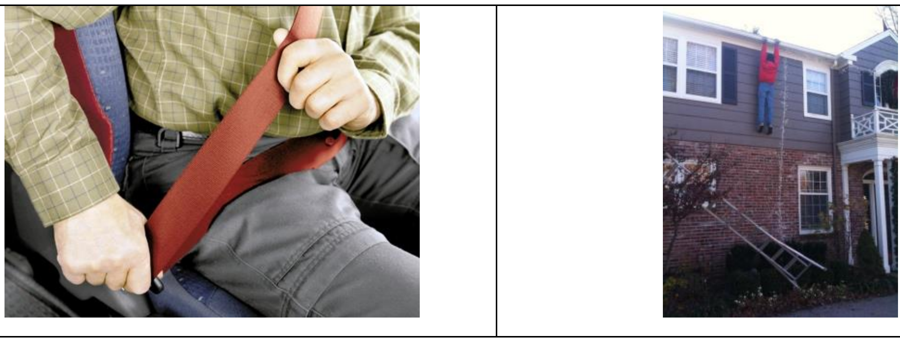


Figure 37: Study Six: safety photographs

Leisure: The only problem here was the image of a group of young people looking out of a bus or train carriage (it is not clear what), included as it was used for the original Newham Easy Read site. Two participants put this in the Education category, one describing it as a school trip and the other saying he recognised it as an American yellow school bus. This echoes the findings regarding the Widgit symbol for Leisure, also placed in the Education category. Two others could not classify the photo at all, leaving only two who placed it in the category for which it was intended.

The difficulty in discriminating between Leisure and Education prompted a change in label for the quantitative phase – with the former being re-named 'Going Out' . In keeping with this, a photo of an amateur tennis player in action was added. The Widgit for Leisure was to have been removed, but despite apparently removing the image from the directory, it was still presented to online participants by the system, and had to be removed from the results.

Other changes in the photos worked well. There is a certain overlap, of course, between Safety and Health, but neither the man falling from the ladder nor the car seat belt picture were classified outside these two labels – with only the seat belt being put in both - three in Safety, as chosen by the researcher, and two in Health. Of course, had Travel been a category, as in the actual website, the seat belt picture could have been classed under that category.

Quantitative (online) phase

This exercise both quantified the qualitative findings and attempted to explore the efficacy of the different representation types. Regarding the latter, none of these was successful on more than just over 60% of occasions on which the representation was presented (Table

16). Clearly, it could be argued that the choice of images was at fault and that with 'better' representations the success rate would have been improved. However, the photos were selected after a lengthy qualitative piloting process and that the icons and Widgits were designed specifically for this cohort of target users. Thus, it seems fair to say that even with very carefully chosen images, that without the support of a label, it was very difficult to categorise individual representations. Perhaps surprisingly Widgits, said to be in use in '80% of special schools and 50% of mainstream schools'(My Learning UK, undated) and developed over 30 years (Widgit, undated), performed the least well, with only around half of the times one of its symbols was presented to participants being correctly categorised.

Representation	**Mean 'success' rate (%)**	**Number of images presented**
Photos	60.7	532*
Icons	57.2	202
Widgits	50.3**	179
*The greater number of photos presented is because there were at least two representations for each topic, in order to explore which might be the most effective. **Not including the 'Going Out' Widgit (for reasons described below). Including this, the mean success rate is 50.0% (204 images presented)		

Table 16: Study Six: online test: 'success' rate, by representation type

Readance and Moore (1981) found in their meta-analysis of pictorial representation that line drawings (the equivalent of Widgits in the current study) appear to facilitate reading comprehension more than do photographs, although Moll (1986) found a preference for photos. The current findings suggest that photographs would be more appropriate with regard to menu labelling, however, as there was more incidence of 'correct' identification than with the other forms.

Looking at results by topic (and including all representations), Table 17 shows that , Friends and Work were the categories where participants chose a greater percentage of the same categories for the images as the researcher and team (82.0% and 69.1% respectively). These are possibly easier concepts to understand and to depict than those of Living On Your Own and Support, the two topics where there was the greatest divergence, with only 42.7% and 43.8% respectively of selections being the same as the pre-determined categories. Health was the third nearest category, where virtually two thirds of selections equalled the original categorisation.

Topic	Mean success' rate (%)	Number of representations
Friends	82.0	106
Work	69.1	110
Health	66.4	125
Going Out	61.8*	76
Education	55.2	76
Safety	50.3	165
Support	43.8	137
Living On Your Own	42.7	117
*Not including the 'Going Out' Widgit (see below). Including this, the mean success rate is 54.5% (101 representations)		

Table 17: Study Six: online test: 'success rate' by topic

Table 18 shows results by topic and representation type. In other words, it compares the percentage of successful categorisations for each topic by each of the representation types. One can see from the table that only in one case were the photo representations the least effective. This was for Health, where the icon was the most effective and Widgit second. This may be because of the use of the universally recognisable green cross (Widgit) and red cross (icon), the latter accompanied by a heart symbol (see Figure 35 and Figure 32). The only category in which the icon was most effective was that of Friends, a male and female holding hands. However, for this category both the photos and the icon proved suitable – the only issue being the placing of Friends images into the Support section, as outlined in more detail below.

Topic	Success rate, by representation (%) (with rankings from most to least effective in brackets)		
	Photo	**Widgit**	**Icon**
Living On Your Own	48.8 (2)	54.2 (1)	16.0 (3)
Support	46.7 (1)	43.5 (2)	31.8 (3)
Safety	58.9 (2)	0 (3)	71.4 (1)
Going Out	64.3 (1)	20 (3)	58.3 (2)
Education	63.6 (1)	42.3 (3)	60.7 (2)
Health	59.2 (3)	76.9 (2)	78.2 (1)
Work	78.9 (1)	70 (2)	46.2 (3)
Friends	82.4 (2)	73.9 (3)	92 (1)

Table 18: Study Six: online test: results in percentages by topic and representation type

Many findings of interest emerged when examining in detail results from each category, as follows:

Education: Fifty five point two per cent of depictions in this category coincided with those pre-designated. The least successful was the Widgit. Although these generally did not perform well in this test, for the Education category the design was a person standing by a black/whiteboard. Even in the age of computers and technology generally, this might be expected to have been recognisable, as Smartboards were used in the participating locations. The main categories in which the Widgit was placed by those not regarding it as depicting Education were Work (6, or 23.1%) and Going Out (4, or 15.3%). One categorisation was made in each of the topics: Health, Living On Your Own, Safety and Support.

The second least successful depiction was the icon. This showed an educational certificate. Seventeen of 28 (60.7%) participants shown this identified it as such. It is worth noting that learners at participating institutions were, in fact, familiar with such certificates. At least two locations use external qualifications (ASDAN - Award Scheme Development and Accreditation Network) and the others offer internal certificates in place of or in addition to these. It may that the problem here was that the icon was not very clear. Three observed participants said that they could not see what it was. Of the 11 (39.3%) participants who did not chose other categories, seven put it into Work. In fact, of 34 'errors' in total in the Education category, no fewer than 18 (52.9%) were classified as Work.

With regard to representations 'incorrectly' classified *into* the Education category nearly a half (19 out of 40, or 47.5%) should have been in the Going Out one instead, 12 of which resulted from the mis-reading of the Widgit chosen to represent this idea. As mentioned above, this was to have been removed. It is worth adding here that the actual Widgit for Going Out shows a person literally walking out of a door (Figure 38), which may not necessarily give the idea of going out for leisure (although it could be argued that the text label also does not make this clear). That for Leisure, on the other hand, although showing a ball game, also included depictions of music and reading – both of which (indeed, all three of which) would be common in an educational setting.

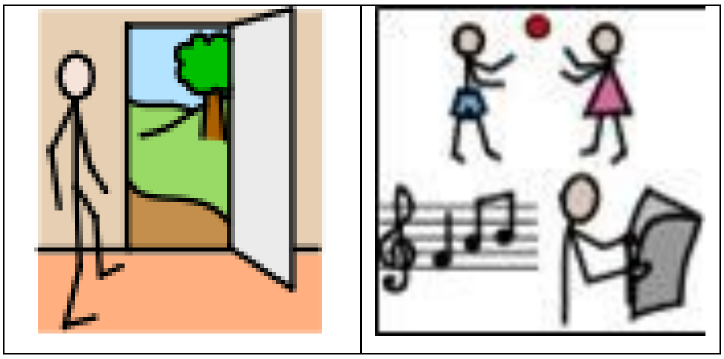


Figure 38 Study Six: Widgit icons for Going Out (left - not used in the study) and Leisure

Friends: This was the category that proved to be the easiest. In fact one of the two photos depicting this category, that of three people posing for a camera with one of them having his arms around the others, was classified differently by two participants, one as Education (one can imagine a college outing) and the other as Living On Your Own (harder to interpret, but possibly signifying going out for a good time after spending the day alone).

Figure 39: Study Six: friends photograph

Even the Widgit – which proved difficult to interpret in most subjects – worked well, with 73% (17 out of 23) participants putting it into the 'correct' category. Of the total of 19 people who chose other categories, eight selected Support, six of which were in response to the image of three people laughing and embracing – which could easily be considered a depiction of (certainly mutual) support. Of the 48 iterations mis-classified into friends, 34 were Widgits, and 26 of those were of that depicting Safety. This is a picture of someone with his arm around another, and is, in fact, extremely similar to the one that does represent friends. The topic of Work was much over-represented.

Living On Your Own: By far the most effective representation of this category (chosen by 14 out of 20, or 70% of presentations) was the photograph of a small kitchen of the type that may be found in a one-room flat (Figure 40). Surprisingly, another photograph, of a young person cooking alone, was seen on only 13 out of 27 (48%) of its presentations as representing this topic.

Figure 40: Study Six: living On Your Own, photograph

Of 67 errors in total, 18 (27%) of these were classified as Safety and 15 (22%) Health and 13 (19%) for Support. The preponderance of Safety classifications is partly accounted for

(6 of the 18, or 33%) by the use of a man cooking in one photo, and a small kitchen in another (with hindsight, the similarity of these images was a mistake), the former of which was highlighted by focus group respondents as being related to Safety because of the dangers inherent in cooking. The Living On Your Own icon chosen, a drawing of someone travelling without help in a wheelchair and giving a 'thumbs up' salute, was also classified by four participants as belonging to Safety.

The number of Living On Your Own depictions 'erroneously' classified under Support is interesting. It might not have been so marked had the word 'independent' been used after all, as this word suggests a lack of support needs. Indeed, all of the depictions chosen showed either a person managing something on their own or – in the case of the Widgit – at least being shown removed from others. Those who chose Support did so for the 'thumbs up' icon (6 out of 15 or 41%) and the photo of someone in a wheelchair moving with no help (5, or 33%). 'Erroneously' placed into the Living On Your Own category were the support-tagged photo of a person having help with cooking, and the wheelchair user with the guide dog (as opposed to the icon of the unaided wheelchair user). The icon, photo and Widgit representing Work were also put into the Living On Your Own category, as discussed below. Less predictable was that the Safety-classified man hanging from a ladder was, too – possibly on the basis that he was independent in that he did not have the Support he needed to extricate himself from his predicament.

Finally, Health was another category favoured by respondents who did not class as Living On Your Own the same way as the researcher and partners. Fifteen of the 67 'incorrect' classifications (22%) fell into this category, nearly half of them (7, or 10%) relating to the wheelchair ('thumbs up') icon. Again, it is not hard to see the logic.

Safety: Unusually, the icon (the electric danger sign, as shown in Figure 32) was the most effective representation here. As with Health, this may have been because the symbol was well-known and commonly seen. Just over 50% of respondents chose the same classification here as the researcher. Results partially reflected those of the qualitative phase. The policeman was put under the category Work rather than Safety in 35% (9 out of 26) cases in which it was presented. The man shown hanging from the guttering having let his ladder slip away from him was only put into the Safety category on 59% (17 of 29) occasions on which it was presented. Living On Your Own (4, or 14%) and Work (3, or 10%) were the principle alternatives – the former possibly because the man is shown without help or Support (literally!) and the latter for the more obvious reason that he may be doing a job. Interestingly, although only 50% (13 out of 25) classified the school crossing patroller ('lollipop lady') under other categories, only one classed this picture as depicting work, unlike members of the focus group.

The problem with the Widgit symbol for Safety, highlighted in the qualitative phase of the research, was prevalent even more here. No-one (out of the 30 participants to whom it was presented) placed it in the correct category. Twenty five (83%) considered it to be Friends, and 3 (10%) Support. Single individuals categorised it as Education, Going Out and Health.

Health: As mentioned in the section on the qualitative phase of the research, it was decided to retain the photos of the nurse and the lady with a headache. In addition to quantifying the earlier results, one area of interest regarding this category was any possible discrepancy between categorisations of the nurse, appearing alone, and of the doctor, treating a patient - added for this phase. The nurse was classed as being in the Work category on 32% (7 out of 22) occasions in which her image appeared. However, the depiction of the doctor examining a patient was only categorised as Work on 15% (4 out of 26) of occasions. Thus, the act of examining a patient was more effective in conveying the idea of Health more than a doctor or nurse in isolation. Interestingly, Health was the only topic where both the icon and Widgit representations were more effective in terms of participants putting the images into the same category as that for which they were intended.

Interestingly, the finding from the qualitative phase that the 'headache' could be considered to represent Living On Your Own was repeated, with four of the 12 mis-categorisations of this photo (Figure 36) being so-classed with three selecting Support - presumably on the basis that someone suffering requires support!

Mis-representations into the Health category were varied. An inter-change between it and the various representations for Safety was understandable, and accounted for 16.7% (7 out of 42) of mis-categorisations. The icon for Living On Your Own – a drawing of a man on a wheelchair, propelling it without assistance, also accounted for the same percentage of 'incorrect' entries into the Health category.

Going Out: The most effective representation in this category was the photograph, which showed a group of people at a bowling alley, placed in the 'correct' category by 18 of 22 participants (82%). Two people categorised this as Support and one as Friends (the forth did not register a category, being 'timed-out' by the system after one minute's deliberation).

Figure 41: Study Six: going out photo representation

Unsurprisingly, generally representations that should have been placed in the Going Out category were mainly placed in Friends or Education – the latter accounting for 38.8% (19 out of 49) and the former 22% (11 out of 49) of the 'errors'. As mentioned earlier, the Widgit used for this category (that designated by the company as representing Leisure) was to have been removed as it was considered too confusing. Twelve of the 25 occasions in which this Widgit was presented (48%) it was categorised as being in Education. In fact, by removing it from the results, these were still the most popular categories in which participants mis-placed Going Out representations, with 8 out of 29 (27.6%) placed in Education and 7 out of 29 (24%) placed in Friends. Five (17%) of the mis-categorisations went into the Living On Your Own category.

There were 37 instances (of 204 in total, or 18%) of categorising images into the Going Out category. They were fairly evenly spread across categories and illustrate clearly the difficulties inherent in encapsulating concepts into images. For example, 7 (19%) of the mis-categorisations should have been in the Safety category. However, these were one of the photos for Safety – that of a man fastening his seat belt in a car and a school crossing patroller. Both of these representations could easily have been for Going Out. Similarly, the icon for Living On Your Own was a person in a wheelchair (Figure 32), chosen four participants as representing Going Out – quite logically. The photo of the doctor examining someone, the two friends Widgit and the wheelchair user with the guide-dog (Support) were also all categorised as Going Out.

Support: The most effective representation (17 out of 23 or 73.9%) here was a photo of a girl at a desk, being helped to stir a cooking pot. This far exceeded any other photo or iconic depiction.

Figure 42: Study Six: support, photograph

The majority of mis-categorisations that should have been placed in the Support category 30% (17 out of 57) were placed into Living On Your Own, reciprocating the mis-placement of representations that should have been placed into Support but were placed there instead. Also, 24.7% (19 out of 77) were put instead into the Going Out category, as noted above.

Work: This was the second most successful category in terms of percentage of times a 'correct' allocation was made (69.1%). Both the photographic representations – one the manual labour of gardening, and the other the more intellectual pursuit of using a computer were correctly categorised on more than 75% of occasions (21 out of 26, or 80.8% for the former, and 24 out of 31 or 77.4% for the latter).

Figure 43: Study Six: two photographic representations of Work

By contrast, as in the qualitative work, the icon fared poorly, being put in alternative categories on more than half of occasions (14 out of 26 or 53.8%). As mentioned above, there were many instances of representations being mis-categorised into Work that represented more abstract concepts such as Health or Support. However, the reverse was also true. Seventeen point six per cent (6 out of 34) of instances where people failed to correctly place a Work representation, it was placed instead into Support, including the icon and Widgit for Work and the photo of a man at the computer. As noted above, representations of Work were also placed into the Living On Your Own category. As all of the participants were in one way or another studying aspects of independent living, and as the ability to acquire and keep some form of gainful employment is, clearly, most important in being independent it is no surprise that one equated with the other.

Conclusion

Many websites, both those specifically designed to be accessible by people with Learning Disabilities and other, more 'mainstream' sites, use images liberally to illustrate content. Indeed, as discussed in the main thesis literature review above, this practice is universally recommended by organisations and individuals concerned with accessible information provision (e.g. W3C, 2011; Rowland, 2004; Pearson and Kopi, 2003). The present study was undertaken following findings in Part One, which highlighted the difficulties of understanding images. It has shown that, whilst intuitively sensible, the use of pictorial representation may not actually aid understanding of content, because of the difficulties inherent in attempting to encapsulate concepts within a single pictorial representation. Similarities between concepts typified by groupings such as Safety, Health and Support, and Leisure, Education and Friends – all typical transition-related topics - make the task even more difficult.

Findings suggest, not surprisingly, that more concrete topics such as Friends, Work and Going Out are easier to represent pictorially than concepts such as Support, Safety or Living On Your Own (see Table 17). The topic of Health, at first difficult to encapsulate, proved in the end to be easily represented by the well-known, standard symbols of a heart and a green cross, which was not only very familiar to the participants, but possibly as familiar as the more common *red* cross might have been. One could argue that other icons, symbols or photographs could become familiar with further exposure on the website, or their meaning formally taught in cases where tutors or carers wanted to promote a particular resource. However, the goal of accessibility is surely to enable people to find information without substantial prior training – this study has shown that facilitating this situation requires more than simply populating a website with images thought to be relevant by the information provider.

For many people, of course, text labels accompanying images, whether menu items or captions etc., are sufficient guide although, as argued earlier, do make the image somewhat redundant in these cases. A strong case could be made from these results for audio rendition of labels. Study Two showed that with guidance people with Learning Disabilities were able to access and understand audio-presented information. It may be that the combination of picture and audio label are more effective than that of picture or text label. As the full research is concerned particularly with site layout, the next phase – of creating a series of accessible websites - looked at whether and how, within the context of an information resource rather than in isolation, images aid information retrieval. This study informed the choices of images for these, as outlined in the next chapter.

Summary and conclusion to fieldwork part two

To summarise, the fieldwork documented in this chapter has described two studies, each of which examined one of the attributes identified in Part One of the study, Study Five looking at menu position and Study Six at the use of images. The former highlighted how participants tended to search for menu entries methodically and as they were reading a body of text – looking left to right and from top to bottom, despite their gaze initially focused on an image in the centre of the screen. As described in the next chapter, this behaviour was manifest in participants' search for information from a body of text, which led to images placed below some of this content failing to provide effective signposting to enable direct access to content. Study Six looked at the understanding of images. It showed that difficulties in representing concepts also inhibited their effectiveness, and suggested reinforcement, where possible, by supporters or carers (i.e. by repeated use) or the use of audio captions.

The following chapter compares all three of the attributes identified in Part One, testing which combinations of these best facilitate speed of information retrieval, and suggesting, from a statistical analysis, which of the attributes have the greatest impact in this regard.

Chapter eight: Fieldwork Part three – investigating the issues elicited, in consort

Introduction

This chapter builds from the previous research forming Part One and Part Two by describing usability and preference tests on eight web page interfaces that combine each of the three attributes highlighted earlier as worthy of further research. Whereas in Part Two these were studied in isolation, for this final element they are examined in consort in order to test the relative impact of each and the effect they may have on each other, thus addressing the overall aims of the research – to determine which Web page interface factors facilitate success in set information retrieval tasks by people with Learning Disabilities.

Study Seven: Testing the usability by comparing various accessible interfaces

Aim

This study sought to determine which combination of the Web page interface factors elicited in Part One (text size, page layout and use / absence / appropriateness of images etc.) facilitate success in set information retrieval tasks by people with mild Learning Disabilities.

Settings

As a fairly large number of participants was required, the study was carried out in several different locations – these consisting of all those listed in the main methodology section. Each of the locations had computers for use by the participants and tutors or carers who used them in their teaching or care for their charges. There was thus a very positive attitude towards the study, and in order to aid recruitment staff were quick to highlight what they felt was its importance in helping to improve information access and the value of the contribution each participant would make. Arguably, this put additional pressure on people to agree to take part and so the researcher made sure they were aware of their right not to do so and that no unfavourable treatment would result from such a decision – as noted in the section on 'Participant briefing' in the main methodology section.

Methodology

Sample

In total, 104 people began the sessions, although only those who were able to undertake at least six of the eight prospective tasks (as outlined below) were included in the results, leaving a total sample size of 88. The tasks were very simple and relatively quick, and so anyone not obtaining the answer after about 90 seconds – depending on their degree of engagement – was given help. In such cases, the task-time was not recorded. Where this happened more than twice with a particular participant the full set of tasks was not given. Instead, participants were invited to further demonstrate how they used a computer and what sites they like to access etc., not – as far as they were aware – as a substitute activity, but as an integral part of the research. This practice was undertaken to avoid participants feeling stigmatised by their apparent failure.

Participants were either categorised by their tutors as having levels 'Entry One', 'Entry Two', Entry Three' or 'Level One' of literacy. The approximate literacy levels of nearly 75% of participants (65 out of the 88) whose performances are included in the study were provided by tutors and carers, based on the classification used in Further Education Colleges and detailed earlier in this thesis. These are shown in Table 19:

Level	Participants
Entry One	9
Entry Two	26
Entry Three	20
Level One	10
Missing	23

Table 19: Studies seven and eight: Participant literacy levels

Fifty five participants from this sample also undertook Study Eight, described below. The age range of participants was 18 to 61, although the majority were between 18 and 30 (mean age 28.4).

Equipment

Participants used the computers with which they were familiar. In most cases this was a desktop PC, but in a minority of cases the researcher's laptop was employed, where participants expressed this preference or where it was more convenient for the group for the session to take place in a corner away from the main classroom or activity area. In these cases, a choice of using a mouse or touchpad was offered. It is worth mentioning that despite the different screen size between a laptop and a desktop, where a menu item or text content had to be found that was below the level of the screen, this was the case with both computers.

Web interfaces used

Pete's Easy Read website was used for this study, as outlined in Part One. JavaScript enabled each web page to be set-up and displayed to exhibit various arrangements of the attributes elicited earlier that were shown to merit further investigation. These were:

- Location / organization of menus
- Use of images
- Text size

Location / organization of menus

The website was created to enable the following attributes:

- Vertical; left side
- Horizontal

Each of these are shown in Figure 44:

Figure 44: Pete's Easy Read: vertical and horizontal web page conditions

Use of images

Clearly, the nature and representativeness of images (Moll, 1986; Choi and Bakken, 2010) is of great importance. This was addressed in Part Two. For present purposes, however, the issue was whether photographic representations in general aid information retrieval. Photographs were chosen over icons or drawings as these were shown to be most effective in capturing specific topics or concepts, in that more research participants placed the photos into the same categories as they were intended (by the researcher) to represent.

Thus, for the website, two alternative versions were used:

- Alongside text;
- Not used.

These two conditions are shown in Figure 45:

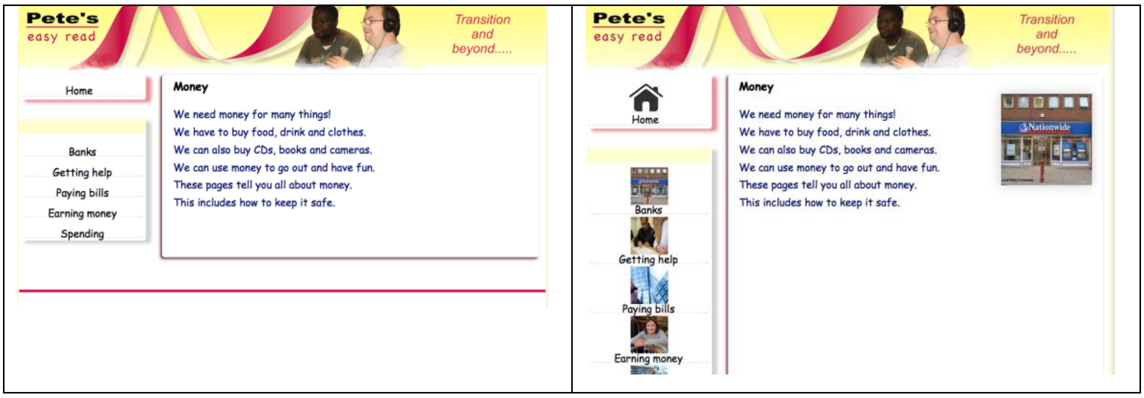


Figure 45: Pete's Easy Read: with and without images web page condition

Study Six examined people's understanding of images in depth, and results informed which were chosen for the experimental website. Images for some of the categories were less difficult to picture, such as Food or Money, and were selected by the researcher and tested in pilot sessions with participants. Others were selected on the basis of Study Six findings. To illustrate Leisure, for example, a picture of people at a bowling alley was used, this being the representation which had been the most identified as relating to this topic. Similarly, the picture chosen to represent Friends and Work were those that most readily chosen by participants.

With regard to Health, despite the fact that (in this unusual case) iconic representations were more effective than photos, it was decided that for consistency, a photograph would be used here also. Thus, that which proved to be the most effective of its type – a doctor treating a patient - was used for the web page. All of the choices can be seen in Figure 46, below.

Figure 46: Pete's Easy Read: home page (detail), showing menu depictions

Text size

In addition to the indications from the studies reported in Part One, text size has been shown by others to be an important variable in usability studies (Myung, 2003; Ling and van Schaik, 2006). Although this can be changed by the user within a browser configuration, observation (unreported, but in research outlined in Williams et al, 2004 and Williams et al, 2002) strongly suggests that most users do not avail themselves of this facility, relying instead on the default size. Indeed, in all of the observations of free use of the Internet in Studies One to Four reported in the present thesis, no-one adjusted the browser settings, and only one had been pre-configured to display large-text. It is, therefore, important to at least attempt to produce an 'optimal' text size as a default, notwithstanding the issue of different representations according to browser and other configurations. The websites used 'large' and 'small' sizes, as shown in Figure 47, below.

Figure 47: Pete's Easy Read: large and small-text size web page condition

By using three attributes, each with two levels, the resulting eight interfaces were required (Table 20).

Interface 1	Menu-horizontal	images-not used	Text-small
Interface 2	Menu-horizontal	images-not used	Text-large
Interface 3	Menu-horizontal	images-with text	Text-small
Interface 4	Menu-horizontal	images-with text	Text-large
Interface 5	Menu-vertical	images-not used	Text-small
Interface 6	Menu-vertical	images-not used	Text-large
Interface 7	Menu-vertical	images-with text	Text-small
Interface 8	Menu-vertical	images-with text	Text-large

Table 20: Pete's Easy Read: web interface alternatives

Method

This study consisted of a series of simple information retrieval tasks, requiring the:

- Recognition and activation of a hyperlink (from a text label, with or without an accompanying image);
- Recognition of the need to scroll a page to gain access to all contents;
- Understand how to scroll down a page (using the scroll-bar, a 'PgDn' button or arrow keys);
- Use an appropriate method to scroll down the page;
- Reading of simple text;

- Identification of a string of text containing the answer to a simple question.

Three task stages were involved in the sessions, as outlined below.

Task one: Identifying the subject from a main grid menu on the 'home' page (see Figure 46, above), requiring the recognition and activation of a hyperlink.

Task two: Answering a question from the introductory paragraph of a particular subject (Figure 48, below, shows the 'Subject home page' for Health in which this page sits). The skills required here were the reading of simple text; identification of a string of text containing the answer sought and (for some interfaces and questions) recognising the need to scroll the page, and to do so. The actual questions asked can be found in Appendix **2**.

Figure 48: Pete's Easy Read: subject 'home' page for Health (detail) (with-images, small-text and vertical menu conditions)

Task three: Identifying the within-subject topic from the subject menu (Figure 48, above, shows the subject menu for Health), requiring recognition and activation of a hyperlink (on occasion positioned below the level of the page and thus requiring scrolling).

Task four: Answering a question from the text of the topic accessed. Figure 49, below, shows the information page for the topic of 'Going to hospital' which had to be consulted to answer one of the questions. The skills required are the same as those for task two (reading of simple text, identification of the answer from within the text and scrolling).

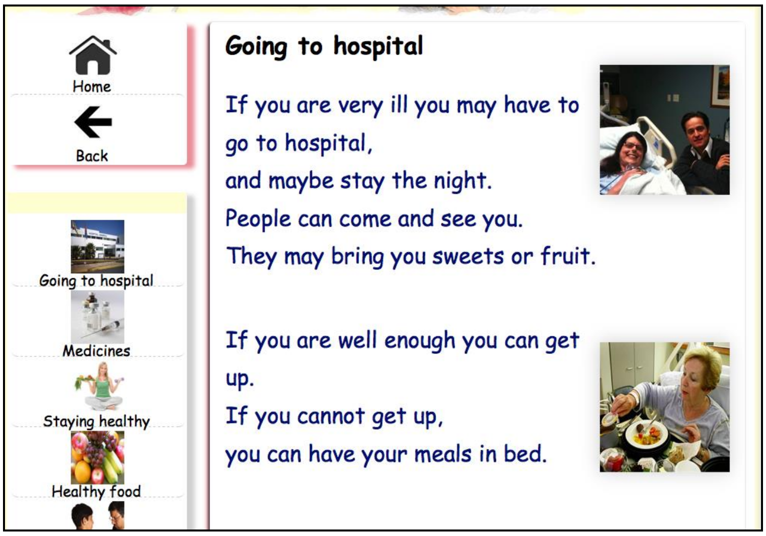


Figure 49: Pete's Easy Read: information page (detail): 'Going to hospital'

Part One discussed the formulation of task questions. To recap briefly, only direct questions were used, whose answers contained the same words as those in the question (albeit, owing to the exigencies of English grammar, in a different order[21]). An example of one such question is: 'Where can you have your meals?', the answer being 'in bed' or, more directly from the text 'you can have your meals in bed'. This is because the study sought only to examine the effects of website design on information retrieval – time taken in interpreting questions or inferring answers would have detracted from this aim.

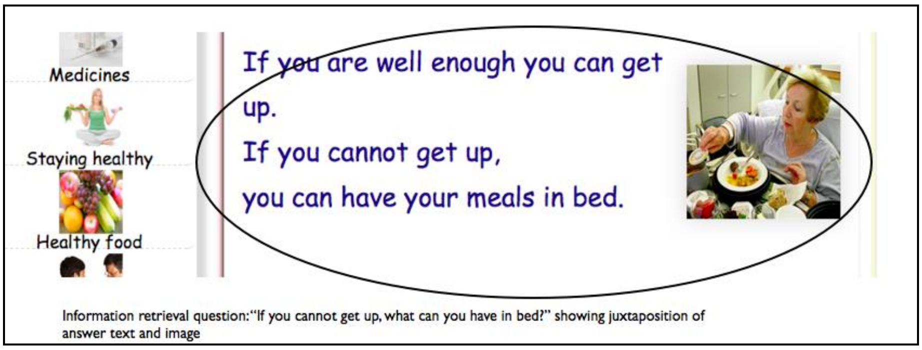


Figure 50: Pete's Easy Read: information page (detail) showing the special proximity of text and image

Another issue was that of the use of images and whether they aid information retrieval. The main methodology section earlier in this thesis mentioned the linkage between text and images (e.g. verbally in the case of menu entries, by captioning; and spacial proximity in the case of images in the body text). Figure 50, above, shows the proximity of text and image related to the question 'Where can you have your meals?' The images were chosen

[21] In a question the auxiliary verb, or the appropriate conjugation of the main verb 'to be', is placed before the subject rather than after it, as in indicative sentences, unless the subject itself forms the answer (as in 'who broke the window?')

both to illustrate and make the text easier to follow, but also to test whether the images helped in answering questions. Another example (not shown) is the sentence, in the information page about trains 'You have to buy a ticket'. This is next to a picture of a train ticket. Of interest here was the extent to which the images both prompted answers and acted as a guide as to where the text supporting the answer might be found.

Following each task-set, participants were required to return to the 'Home' page. However, the link here was unchanging, in both appearance and position, and as there were no condition effects to be measured this activity was not timed. To complete the session as many participants as possible, given time and other constraints, were also asked to offer preference judgments on the sites, as described in Study Eight, below.

Procedure

The same procedure as outlined in the main methodology section was undertaken, with certain study-specific modifications. First, there was an additional explanation in the participant briefing regarding why various interfaces were being examined. Second, no 'free-browsing' was undertaken. This was to avoid over-familiarity with one or two of the interfaces being examined that would have contaminated the results.

Data gathering and analysis

Two main data gathering methods were used: task-time and observation, as outlined in the introduction, and two types of analysis used to compare interface designs:

- A statistical analysis based on measures of task-time;
- A qualitative analysis comprising researcher observations and interactions with participants and post-hoc informal interviews with participants and carer / tutors etc. The latter was to ask for their own views on and explanations for the findings, in order to contextualize the statistics and give some value and meaning to them.

The following analyses were undertaken:

- T-tests;
- Univariate Analysis of Variance (ANOVA);
- Multiple Regression analysis;
- Correlation.

Results

Testing for validity

It was important to test whether there was a significant difference in task difficulty and in task-time with regard to task order (e.g. whether the later tasks would be undertaken more quickly as participants became more familiar, or more slowly as fatigue or set in or interest faded). Clearly, if there was a significant difference in performance as a result of either of these factors, they would need to be taken into account in the main statistical analyses related to the interface designs.

Set task equality: Care was taken to ensure each task was equal as possible – each being written at the same reading level, using words that appeared in the text containing the answer and obtaining feedback from professionals regarding both the language level and equality of question semantically before running the tests. To test whether these measures had, indeed, produced tasks of equal difficulty, a univariate ANOVA was undertaken to compare the mean times of each. Where a t-test can compare the means of two independent variables, an ANOVA generalises t-tests to more than two groups. In this case, we have eight variables in the form of different tasks and also eight places in terms of the order in which tasks were undertaken (e.g. first, second etc.) Table 36 shows that p = 0.123, being well short of the threshold required to be classed as significant.

Task order effect: An ANOVA was also undertaken to test whether task order was a factor in task-time, with the intuitive expectancy that familiarity would reduce task-times for later iterations. Perhaps surprisingly, there was no significant difference in task-times where task order was the independent variable (p=0.25, Table 37).

This result – though welcome – was slightly unexpected. For this reason, task order was correlated with the mean ranked task-time (Table 38). As the sample was only eight (each task) it would be inappropriate to read too much into the results, an observation echoed by the significance figure of p=0.21. Nevertheless, Spearman's correlation co-efficient, R= -0.50 showed a slight trend towards taking slightly less time as the familiarity with the exercise may have played a small part - although like the ANOVA, the analysis showed no *significant* difference between the means of task-times. Indeed, although the first task (of eight) was undertaken in the 6^{th} fastest time – so relatively slow - and the eighth was second fastest, the fastest time was to undertake the forth task and the slowest was the third, indicating an overall poor correlation between task order and task-time, despite the high R value.

The results from both these tests of validity are interesting in two important ways. They confer more validity upon the study, and they are indicative of the way people with Learning Disabilities approached the tasks. On the first point, it is clearly more valid to have each of the tasks being of equal difficulty. This means that variation of task-time can be attributed to the factors of interest to the study – interface layout considerations – and not to individual task differences. Similarly, considering task order, the less a 'familiarity effect' permeates the findings the better. Results here showed that whilst there might have been a slight effect, this was not significant.

In terms of how the results are indicative of the way tasks were approached, they agree with researcher observations made during the course of the sessions. Most respondents appeared to undertake each task in the same way –concentrating particularly on the text read from top to bottom, as one would if reading extensively (e.g. a longer passage, for pleasure). A significant 'familiarity' effect, with the information accessed more rapidly as each task was presented, would have suggested, by contrast, that the reading and imbibing of the information had become more sophisticated by scanning the text. This involves speed-reading, usually skipping trivial words, in search of specific key words or phrases. This might have been undertaken by more mainstream readers once the question/answer style and the language and nature of the text became familiar.

Another tactic, having become familiar with the task etc. could have been to skim the text (or, better, the content of the whole page). This is more of a superficial read to get the gist of a passage, and might have led the eye to the images, where they were included, again, accelerating the retrieval process.

Individual site attributes and performance

Each attribute (or variable) of the website was looked at in isolation, using a t-test. This test compares the means of two groups on a continuous variable, to see if there is a significant difference between them. In this case the groups are the individual interface characteristics (menu position; text size etc.) and the continuous (dependent variable), task-time.

As outlined in the Data analysis section of the main methodology chapter, above, there are two types of t-test: paired sample and independent. For present purposes the paired t-test was used. Although this might seem the obvious choice, as there was only one sample, a case could be made for using the independent test, as both the task and the interface were different for each iteration, making each iteration independent (usually in a paired t-test the same measure is used, usually before and after a particular intervention). For this reason, the results of an independent t-test are also given, for comparative purposes, where results differ.

In each case there were two cases for each attribute. These were:

- Presence or absence of images;
- Horizontal or vertical menu;
- Large or small text size.

Each of these occurred in four of the eight designs. For example, the images occurred where there was also small and large-text and vertical and horizontal menus. As participants were presented with the interfaces at random, however, and completed at least six tasks, one per interface, any influence occasioned by one or more of the other attributes would be balanced out or negated by task-times taken on the others. In fact, the great majority of participants (49) undertook all eight tasks, with 20 undertaking seven, and 19 six.

Before examining results, some overall findings accrued from observations are outlined, as they help explain how user behaviour in general affected performance with regard to specific interface characteristics. The most important of these, in terms of impact, is the way many of the participants elected to read rather than merely skim the text. In many cases this practice was clear - a minority read aloud (as with the earlier studies reported here, some followed the text with the cursor) and a smaller group read with their finger on screen guiding them. This group, clearly, read linearly, but did not try to skim the text or to look for non-verbal clues (in this case the images) to help. Others also appeared to be reading, simply from their eye and head movements, although in these cases the indications were less certain, of course. Some prior literature has also noted this tendency (Theofanos, et al*,* 2004; Summers and Summers, 2005) with Summers and Summars articulating the problem particularly succinctly:

> 'Reading itself takes a great deal of concentration and effort [for lower-literacy users]. They can't grasp the structure of the page at a glance by reading headings and subheadings. Some … compensated by reading every word on the page so that they didn't "miss" the answer' (Summers and Summers, 2005: p6)

Time differences overall in finding answers when the required text was at the bottom of the screen compared to when it was at the top suggest that in the current study this practice was widespread. An independent t-test to compare task-time means under both conditions (e.g. top and bottom) found a significance level of > 0.01 between the two – a very significant result, considering that the text length was only around 50 words (Table 39).

It can be said from this that the participants acquired information by what the writer feels is akin to the 'serial access' term used in computing. This is where to data are read from the storage medium in the order in which they were recorded until the required item is reached (Daintith and Wright, 2010). With regard to the present research, many participants read word-for-word until they found the information sought. This is similar to an example of mathematical multiplication tables, where the product of six sevens might only be accessible by going through the sequence "two sevens are 14; three sevens are 21 …" etc. until the required equation and answer is reached.

Whilst the phenomenon of serial access may sound like a synonym for 'linear access', a phrase that is common in web design and usability (see e.g. Horton, 2005), it is important to note the terms do not mean the same thing. This thesis presents evidence that, when seeking specific information, people with Learning Disabilities not only access content linearly (i.e. in a sequential fashion from left to right and top to bottom), but that they imbibe all the information as they proceed. This is not the same as the art of skimming – the speed reading of content facilitated by omitting trivial words – whist searching for a key fact or other item of content. The term 'serial access' can thus be considered as an extreme form of 'linear access'.

This finding is in contrast to previously observed web behaviour, (Nicholas et al*,* 2004; Wilkinson and Payne, 2006), and also to 'free-browsing' behaviour observed during the various studies comprising this thesis. Behaviour under these circumstances shows high levels of skimming, scanning, browsing etc. For mainstream internet users, the practice appears to be prevalent over a wide span of web activity, including that of specific information seeking (Nicholas et al*,* 2011). For the present participants, however, although indulging in apparent skimming and much rapid jumping from page to page during 'free browsing' (Studies One to Three) this ceased when the activity changed to negotiating specific tasks. Clearly, these represented a qualitatively different activity than that of free browsing - one that may have been far more intellectually challenging. These phenomena are discussed in more detail in the overall conclusions, with the more unstructured, rapid moving from page to page and object to object labelled 'random access', in keeping with the computing analogy.

Turning to the use of images, it is important to restate that, as outlined in the sections on constructing the website and the methodology, the selection chosen were done so after working with people with Learning Disabilities themselves (Study Six) and with the help of professionals in the field. Thus, they were as representative as possible. However, there appeared to be no significant difference between mean retrieval times for pages displaying images or not (p=0.34, Table 40). Thus, images appeared to offer little or no help in accessing information – at least not in terms of speed of access. If this is considered a surprising result, the study by Poncelas and Murphy (2007) described earlier, examined the role of images in the understanding of text, and came to the conclusion that 'the addition of symbols to simple texts does not necessarily improve people's understanding of it' (p466).

Second, observational findings suggested one major reason for this, which not only had consequences for information retrieval but also for the study design. This was that participants appeared to be focused almost exclusively on the text-based content of the pages in order to undertake the tasks, ignoring what they may have considered to be extraneous detail - as Large et al, (1998 and Fidel et al, (1999) found when giving set tasks to mainstream children, who ignored multimedia content in order to secure a verbal answer to a question.

When shown this result, one of the tutors at a participating Further Education College made the point that, "when you see text, you have a natural inclination to read it". She described how, when watching subtitled films with her hearing-impaired husband, she could not stop herself reading the text rather than looking at the moving image. She added that this phenomenon might be particularly prevalent amongst people with low levels of literacy who might need to concentrate so hard on the text that they fail even to notice other elements – as also noted by Summer and Summer (2005).

In hindsight, an argument could be made for dispensing with text almost altogether, so that, in the page on bowling, 'You have to wear shoes they give you!' might become 'wear these!' next to an image of bowling shoes. On the other hand, although this might draw attention to the shoes a little better, the shorter sentence omits to state where to get the shoes, and might be discouraging to some people who would not know they are provided. These issues are discussed more in the overall conclusions.

Finally, and possibly counter-intuitively, one might have expected access to information to actually take longer when examining pages with images, partly because only these pages required scrolling, and partly because the images mean the text take up more lines.

With regard to menu position, the paired sample t-test (Table 41), showed that negotiating the vertical menu took significantly longer than the horizontal ($p<0.01$). This contrasts with Study Five, which looked at menu position in isolation and found that its alignment was not significant in terms of task-time (although the position of entries within the menu list *was* significant). This discrepancy is possibly explained by the propensity to read the text body, rather than concentrate only on the menu entries, regardless of the task. It also differs from other (albeit not equivalent) studies such as that described earlier, by Ojanpaa (et al*,* 2002), although is in line with that of Laarni (et al*,* 2004) who studied reading rather than word-search.

To explain the results, it is worth noting again the steps needed to solve each task. When participants were on the subject 'home' page (arrived at via the main menu), and had answered the element of the task that required them to search text they were then required to look for and open a menu link to a more detailed information page. Some participants, despite being asked to look at the menu (and when not doing so, shown its location) tended, instead, to read through the text again. Even gentle probing by the researcher failed in these cases to determine whether this was because of a poor understanding of the task or a belief that the link was embedded in the text. Indeed, there were cases where it was not obvious whether the menu or the text was being consulted and where a question asking this did not produce a response. Hence the difficulty in quantifying this behaviour. This behaviour appeared to affect performance on the vertical menu pages more than on the horizontal – seemingly because when one reads, one does so from the top of the page, which is where the horizontal menu was placed. The interference of 'noise' on the page – text and, in some cases, images, appears to explain why in the 'menu game' described in Study Five the vertical menu was accessed as quickly as the horizontal one, whereas in this case, as part of a complete web page, it took significantly longer.

Following from this, the propensity to absorb information in a serial manner – methodically from top left to bottom right – means that where there is distracting material present, the vertical menu entries are accessed more slowly than the horizontal ones. This behaviour is discussed in more detail below, as it has important implications for the way images were approached, and also even for performance with different text sizes. Suffice to say here that it is possible, given the difference in mean times taken on task for the two conditions – that the lower entries of the vertical menu were only accessed after horizontal sweeps of the entire page. Clearly, more research is needed to explore this further, possibly using eye-tracking software.

Finally, the obvious problem was that in a certain condition, with-images, where the required content was lower down the menu list, there was a need to scroll which both added time to the task and also made the task more difficult for a minority of participants who grappled with the idea of text below screen level.

The horizontal menu, however, was not problem-free either. Difficulties were observed if scrolling was required even with this menu, because it also was not always visible. It would have been had it been constructed in a frame. However, being only one constituent part of a page meant that when the bottom of the page is read the entire menu disappears off the top of the screen, as can be seen in Figure 51. This contrasts unfavourably with the vertical menu, of which at least some of its content was always visible (although, of course, depending on the length of the entry list and page, this too could vanish with more scrolling).

Figure 51: Study Seven: Horizontal menu, visible when page is presented (left), but disappearing when page is scrolled (right)

There was a slight difference in task-time between the two text sizes presented (Table 42). For the global results presented in this section, this was not significant, although it could be said that the very lack of significance between text sizes challenges traditional guidelines (e.g. Bohman, 2004; Hassell, 2005) which state that a larger text size should be used. As discussed later, participants with lower levels of literacy actually took significantly longer to negotiate the large-text condition than the small-text. It should be noted that the participants had no visual impairments.

Combined site attributes and performance

Each interface was compared with each other using a univariate ANOVA (Table 43). Results showed that there was only one instance (of 28 possible pairings) where participants' task-times were significantly different ($p<0.05$), and one other which showed a difference that may have proved significant had the word-count been larger and the task therefore taken a wider range of times to complete. The significantly different interfaces were Interface one and eight (i.e. between the 'horizontal menu, no-images and small-text' condition and the 'vertical, with-images and large-text' one) and the 'nearly significant ($p<0.06$) pairing was Interface one and six (vertical, no-images and large-text).

The contrast between these interfaces is no surprise - interface one contained the information in the smallest area of the screen, whilst the same material displayed in interface eight takes up the greatest amount of space, and in some cases finding the information required participants to scroll. In both cases participants retrieved information quicker from interface one. The relative equality of access times for the other interfaces suggests that individually the three attributes studied either did not have a significant effect or that their effects cancelled each other out.

In addition to the ANOVA, multiple regression was also used to compare interfaces. As outlined in the general methodology section, this can be used to determine how much of the variance in a dependent variable or outcome measure (in this case, task-time) can be explained by the independent variables (in this case, the web page attributes), and – importantly - the relative contribution of each.

One aspect of multiple regression is that it calculates the extent to which the examined attributes are correlated with each other. Results of this analysis are shown in Table 44. None of the attributes tested are correlated (although both image presence/absence and text size are correlated with the dependent variable task-time). Thus it appears from the lack of independent variable correlation, that changing one attribute does not impact significantly on any change in the others. The statistical significance of the model as a whole is confirmed in the ANOVA that forms part of the multiple regression. Table 45 shows that the ratio of the average variability in the data that the model can explain to the average variability it cannot was very significant ($p=0.01$).

A standardized coefficient, known as beta, is produced as part of a multiple regression. This is used to determine the extent to which the independent variables (interface attributes in this case) uniquely predict or, in other words, contribute to the dependent variable - task-time. The higher the value, regardless of sign, the more contribution the variable makes – with the values being converted to a level of significance. Table 46 shows that the most significant coefficient is that of menu position, followed by text size, with both at the $p<0.01$ level. These results reflect the t-tests which examined the conditions in isolation. In each case, that requiring more space (large-text; vertical menu) took longer to navigate. Interestingly, all results confirmed the t-test results described earlier, that the use of images made little difference to task-time, but that text size and menu position were contributory factors.

Performance related to participant literacy levels

As mentioned above, participants ranged in level from Entry One to Level One of the Skills for Life categories used by Further Education colleges. As there were so few participants at the two extremes for the purposes of the analyses, two groups were created, consisting of Entry One and Entry Two students comprising the 'Lower' group, and Entry Three and Level One comprising the 'Upper' group. This gave participant numbers of 35 and 30 respectively. The results should be considered with some caution, for three reasons. First, even by combining levels, the sample size is still fairly low – although for the independent samples and multiple regression the analysis was undertaken at the 'iteration' level, so that the number of cases was well over 100 for each variable. Second, the ability levels are only approximate. They were estimated by carers or tutors in the non- Further Education locations, and said to be 'fairly rough' in any case even by tutors within the system, who spoke of the difficulties of measuring ability levels of this cohort. Finally, the measure of task-time was somewhat inaccurate, as explained earlier.

With these caveats, a basic analysis follows, beginning with a series of paired sample t-test analyses. Table 47 shows the Paired Samples Correlations for each of the conditions, by each group – in other words, it compares the performance, in terms of the extent to which they correlated, of the lower level group on the vertical versus the horizontal condition; on small-text versus large-text and images versus no-images. It is interesting that there was no significant correlation between the two sets of scores, either for the lower or higher literacy cohorts. In other words, people's performances with the small-text and large-text were not significantly correlated; nor were their performances with regard to the two menu conditions or presence/absence of images.

The Paired Sample t-test output for significance shows the significance of the mean difference between scores on each of the conditions (Table 48). Interestingly, and unexpectedly, there was no significant difference in mean scores between menu conditions for the lower-literacy level participants, although there was with the higher level ones. This suggests – possibly – that it was the higher level literacy group who were reading the body text whilst they were also seeking a menu entry from the vertical list. The lower literacy group may have concentrated on just the menu as the amount of body text may have been too daunting, especially as they were not required to read it whilst seeking a menu item.

The multiple regression analysis undertaken with all participants and described above was repeated for the lower and higher literacy level groups. This examined globally all the iterations undertaken by each group (Table 49). Again, there was no correlation between any variable. As described in Appendix 4, the SPSS output of the analysis includes a column labelled 'Standardized Coefficients Beta'. This shows the unique contribution of each variable when the overlapping effects of all the other variables are removed, which is converted into a level of significance. The results were contrasting (Table 50). For the higher group none of the conditions on its own produced a significant difference in mean task-times . For the lower level group one significant condition emerged - text size (p=0.03).

The lower and higher level cohorts were also compared using an independent t-test, for each level of each condition. Table 51 and Table 52 show the results for menu position. There was a significant difference between performances regarding the horizontal (p=0.03), but not the vertical menu. As might be expected, the higher level group performed the tasks quicker in each case. The difference in horizontal menu results was an echo of the results from Study Five, which showed that higher performing participants did not take significantly longer in accessing menu entries on the right than the left.

There were significant differences in performance of the groups both in accessing information from pages with and without images (Table 53 and Table 54). Perhaps not surprisingly, the difference (and therefore significance) was greater when comparing the 'no-image' condition, and again it was the higher level group who undertook the tasks quicker. The significance level (p) for the latter was 0.03 and for the former 0.05.

Finally, there was a considerable difference in the comparison of performances with regard to text size. There was little difference in performance for the small-text condition, but by contrast, a significant difference (p=0.01) for the large-text condition. Again (and not surprisingly) the higher group performed fastest. People with very limited literacy (but good eyesight!) took significantly longer (p=0.05) undertaking tasks under the large-text condition than they took to negotiate small-text (Table 48). Observations suggest this was the result of two factors, both related to the large-text condition, the increased number of lines generated, and the resulting increased length of the page.

Regarding the first of these, the large-text condition led to only a small number of words per line. This was particularly true in the vertical menu condition, as the width of the area of the page occupied by the body text was reduced. The 'with-images' condition further reduced line length as the image occupied space otherwise used by text. This did not greatly affect the small-text condition as the short sentences generally meant that one sentence fitted on one line even where the space was reduced. Thus, the number of lines to read did not change significantly between conditions. However, the number of lines of text was far greater in the large-text condition, particularly in interfaces where restrictions on the space allocated to the text body were imposed by images and menu layout. Thus, readers had to focus more on moving from one line to the next a greater number of times (those who read aloud tended to pause between lines). This, and the small number of words per line, may have made it more difficult to read efficiently and also to understand the text. Also, of course, the page lengthened to the extent that it went below screen level and increasing task-time.

There are implications in these results for the design of mobile devices, where the space is more limited than a PC or laptop screen – and some research into usability issues with regard to people with Learning Disabilities has been underway for several years (see e.g. Dawe, 2007). The trade-off between text size and words-per-line is one that may affect e-reader, mobile phone and other technologies, and is discussed in more detail in the section on future research later in this thesis.

To summarise this section, the major findings were that text size appears to play a considerable part in the time taken to access information for the lower literacy level participants. Surprisingly, the small-text condition was negotiated quicker, as with the global results and for apparently the same reasons as previously discussed. It may also be that as the large-text size took up extra lines and was quite spread apart, those of lower literacy ability could not keep track of the line they were on. Of course, in a normal page of writing this might be said more for the small-text condition. However, in the website design a maximum of 10 short words were used on any one line.

The differences in task-time between lower and higher literacy level participants, and the significant differences elicited with regard to pages with and without images, strongly suggest that those with a higher level of literacy are beginning to be able to skim for information and move from the serial to more efficient linear access and, possibly, thence to a degree of 'direct' access . An example of the latter would be immediately noting a relevant image at any particular place on a page. Of course, this could be termed 'random' access in computing terms, but for present purposes the latter refers to the more unstructured behaviour of accessing pages at random – particularly at speed and seemingly without imbibing information.

This finding supports Study Five, which looked at menu (and word) position in isolation. Although it was not possible to capture the literacy levels of participants, for reasons given earlier, a comparison was made between low and high scorers. The latter appearing to be moving towards random access by not taking significantly longer to find words placed at either end of a horizontal or vertical list, whilst those performing the task slower appeared to adopt the serial access behaviour.

Finally, considered globally, the results show significant variations in performances even within quite a narrow range of literacy levels and measuring task-time, where tasks took a minimal amount of time to perform. The findings thus highlight the dangers, implied in web accessibility guidelines (although understandably) that people with Learning Disabilities form a homogenous group. Both professional practice and published literature indicate the range and individuality of the ability levels of those deemed to have 'Learning Disabilities'. When speaking of attempting to measure literacy levels, tutors participating in the present study used phrases such as "unpredictable performances", "roller-coaster abilities" and "spiky profiles". In fact, the latter is a common term to indicate somewhat inconsistent abilities in people with Learning Disabilities (Frederickson and Reason, 1995; Armstrong and Heathcote, 2003).

Although this research was undertaken within the social model which – as noted in Chapter One – concerns how society can *enable* people, outlining the range exhibited by people manifesting specific medical conditions, albeit without attempting any medical definition or explanation, nevertheless informs the study, in that large variations in performance may occur even between people having the same medical condition. For example, there is 'a wide variation in ability in people with Down syndrome just as there is in the rest of the population.' (Rutter, 2002: unpaginated). Similarly, although most people with Prader-Willi Syndrome have mild intellectual disabilities, about 22% have IQs of <50 (Whittington and Holland, 2004), and as such, are on the border of having profound disabilities. Amounts and rates of learning vary greatly in students with Angelman Syndrome (Williams et al, 2009). Finally, there are also broad differences between male and female intellectual disability have also been discovered, particularly for those with Fragile-X syndrome (Sabaratnam and Thakker, 2011).

Conclusion

This study sought to compare different interface designs, produced following qualitative work in Part One, which elicited the issues needing addressing. The method of using a statistical analysis of task-time across comparable websites appears does not appear to have been reported in the literature. However, tests to validate the findings, by comparing tasks and task order to see if either of these factors affected the findings, show that neither significantly did so. Thus variation of task-time can be attributed to difference in the layout, as was the study aim.

Given this endorsement, the main findings in terms of interface design were that the most important attribute was the menu position, with the horizontal menu being more effective in facilitating information retrieval. Text size was a major factor for lower literacy participants with, surprisingly, the small-text condition appearing to best facilitate information retrieval, at least in terms of speed of access. The finding that images are apparently almost inconsequential in information retrieval does not necessarily suggest that pictorial representation plays no part in the process. Rather, it may suggest that the way the information was presented did not exploit the possible benefits of this medium. This idea is explored more in the overall conclusions to the research.

An issue that went beyond both an exploration of individual site attributes or interface designs was the contrast between the 'random access' behaviour of rapid consumption and skimming of content, much different page accessing and general superficial behaviour when not seeking specific information; to the practice of 'serial access' to content when undertaking the set tasks. This phenomenon is discussed in more detail in the general conclusions below, including with regard to the implications for site design.

Study Eight: Comparing user preferences of the interfaces comprising Pete's Easy Read

Aim

The aims of this study were to:

- Explore further the value of a four point rating scale as an instrument to express preferences for people with Learning Disabilities;

- Match this with open comments about the pages shown;
- Determine whether expressed preferences matched performances in terms of time taken to access information.

Methodology

Participants and setting

This study was undertaken at the same time, with the same participants and (therefore) at the same locations as Study Seven, above. As the tests were undertaken after the participants had undertaken the set tasks comprising the earlier study, they were already familiar with each interface, and although shown each one again at the point of stating their preferences, could base their judgments on their prior experiences. Not everyone who undertook the tasks went on to express their preferences, due to a shortage of time, fatigue or waning interest. This left a total of 55, although not all of these are included in the results. This is because the method and data accrued was changed after the first 12 individuals had undertaken the exercise, as explained in the methods section, and so their results were not included in the findings.

Method

The study consisted of seeking participant website preferences. As with the earlier pilot study exploring preference judgements, preferences were elicited from a four point scale and by interview. Originally, participants were asked to rate and comment on each of the eight interfaces in turn, based on any of the attributes ('It doesn't matter why you like one or dislike each site'). This was because the results were originally going to be analysed using the same statistical techniques used for the performance measures, which would have elicited the most important attribute and assigned a relative weight to each. However, many of the interfaces were similar (indeed, they all had the same border colours and style, same sized photos and same font), which made it difficult to discriminate between each one. Having eight such interfaces to examine one after another was both tiring and – frankly – repetitive.

The test was thus amended to address these issues. The task for the revised round was to compare three pairs of interfaces. Each paring consisted of websites that were the same except for one of the three attributes to be examined. Thus, the first pair both had images and small-text, but differed in the menu arrangement. The second pair differed only in text size, having a vertical menu and no images. Finally, a third pair had the same menu (vertical), same text (small) but one included images and the other did not. To obviate the problem of participants rating the pages on content rather than layout and design, the same page (making friends) was used for each interface. In addition, and unlike previously, participants were advised to look at the differing attribute in particular before making their judgements.

Results

Rating results were as follows:

Condition	Like a lot	Like a little	Dislike a little	Dislike a lot
		Menu position		
Horizontal	19	20	3	1
Vertical	15	20	8	0
		Text size		
Large	20	20	3	0
Small	2	15	16	10
		Presence or absence of images		
Images	26	16	1	0
No-images	0	14	16	13

Table 21: Study Eight: preference test for Pete's Easy Read: rating choices (n=43)

Considering the results overall, there was clearly a willingness to use all of the ratings offered by the scale, which indicated both its value and appropriateness and its superiority over the original scale. Only three people out of the 43 who used this scale gave the same rating of all six conditions, and only four restricted their ratings to two categories - in each case only 'like a lot' or 'like a little' were used. As outlined with regard to individual attribute ratings, several people rated both conditions of each aspect (e.g. large and small-text) equally, but this is to be expected. There is no reason why anyone should necessarily have a different view about text size or menu position etc.

Moving on to the individual attributes, Table 21, above, shows that with regard to menu position there was a small preference for the horizontal condition. This was not as great as expressed in the earlier preference test comparing other sites. In that case the horizontal menu of Movingonup and the grid of Dobson's Choice were much favoured over the vertical arrangement of Newham Easy Read. The lack of discrimination between these two this time (21 participants gave the same rating to both) can be explained by the fact that the negative comments made about the latter were addressed in the design of Pete's Easy Read, such that the problems noted were no longer applicable. Thus, there were far fewer menu entries and – except in the with-images / large-text condition - the menu did not extend below screen level.

Text size was more clear cut, with 20 ratings of 'like a lot' for the large-text condition, and only two for small-text; and 20 'like a lot' ratings for large-text against 15 for small-text. In ten cases, the same rating was given for both conditions – in each case 'like a little'. Conversely, there were a total of 36 'dislike a lot' or 'dislike a little' ratings for the small-text, against only three for the large-text (all of which were 'dislike a little').

Ratings for the image conditions were also very clear cut. No participants rated the no-images condition as 'like a lot' (against 26 who did so for the with image version). However, there were 14 ratings for 'like a little'. Seven of these gave the same rating for the with-images one. Only one participant did not rate the with image condition positively, for reasons outlined below.

Individual comments were not as forthcoming or as rich as for the previous test, because there was less variation on which to comment. The horizontal menu was preferred by a small margin over the vertical one, with comments indicating it was "a bit easier" and "It goes across" (to which comment the researcher asked whether this meant it was easier,[22] obtaining an affirmative reply). Similarly, the large-text condition was described as being "easier to read", "better" and "nice", and, as such, reinforcing the guidelines outlined earlier, such as those by Matausch and Peboeck (2010) and Rowland (2004). The small-text condition was simply "too small", although one person who rated it as 'like a lot' said it was actually easier to read, as it was "all in the same place". Interestingly, being able to see more text in one saccade or eye movement and, complementary to that, not having the text extend too low on the page, were reasons given by professionals, when they were shown results suggesting that the small-text condition interfaces performed better in terms of quicker access to information.

The images attribute stimulated the most comments. They made the page look "nice", "gives it colour", "helps you to understand", and "makes the writing easier". The one participant who had a negative view said that he did not like the particular picture shown. He was not asked whether he would like the pictures illustrating another page, for fear of provoking a positive response merely to please the researcher (i.e. the 'acquiescence bias' mentioned earlier). Instead, he was told "Not everybody likes pictures being on the page", in the hope that he would qualify his remark – which he did not do. Finally, two of those who rated both image conditions the same made remarks to the effect that, as one of them declared, "it doesn't matter whether there are pictures – I can read".

[22] And in doing so being unable to prevent himself from asking the 'polar interrogative' he tried so hard to avoid!

There is only partial agreement between attribute preferences and attribute task-time performances. The clearest was in relation to menu position, where the preference for a horizontal positioning reflected findings that information was accessed quicker from sites with that arrangement. Results regarding text size were opposed, with participants stating a preference for a large-text size even though information from the small sized text was accessed quicker. The positive comments and ratings for the use of images is not surprising, despite that fact that they appeared to play little or no part in information retrieval.

Conclusion

This study provides further evidence that a four point rating scale can be a valid instrument for eliciting preferences from people with Learning Disabilities, in that all the ratings were used and that the ratings given worked well as a focus for eliciting more qualitative and richer evaluations verbally. Second, the mis-match between preferences and performance was interesting and informative. The general preference for large-text is contrary to the performance finding that information was retrieved from the small-text size quickest. Of course, one could argue that retrieval time is subservient to preferences and that therefore a web page should be designed purely around the latter. However, there are reasons for taking into account performance too. As outlined in the introduction to this thesis, One characteristic of Learning Disabilities is that of a short attention span (LDAA, 2010; Lerner and Johns 2009) and therefore people are likely to desist if finding information takes longer to find than their attention span will tolerate. By contrast, however, pages produced that contain few, if any images or colour on the grounds that these attributes have only a minimal role in speed of retrieval may appear so uninteresting that they will have no attraction for any user. Thus, both the performance efficacy and its attractiveness for users need to be considered, with one informing the other.

Summary and conclusion to fieldwork part three

This chapter has outlined the two studies in this thesis in which a comparison has been made between performances (Study Seven) and preferences (Study Eight) related to the series of web pages created from the attributes elicited from the qualitative work described in Part One. The key themes to emerge were the extent to which each attribute contributed to task-time (and, in particular, the apparent failure of images to aid retrieval times by signposting content); the distinction between participant behaviour when undertaking set tasks and free-browsing; and the differences between interface designs that aided performance and those actually preferred by participants. Each of these issues and their implications for web page design is discussed in the following and concluding chapter.

Chapter Nine: Overall conclusions

Introduction

Several issues have been highlighted in this thesis that either have not appeared in prior literature or have not applied to this cohort. These relate to menu position, the use of images, and text size – the basic building blocks of online (and to some extent, hardcopy) information presentation. It is surprising, therefore, how little research has been undertaken on the impact of these attributes upon the usability of a resource for people with Learning Disabilities. There is also a paucity of literature in the area of seeking preference choices with regard to either websites or information technology in general. Rare examples are that of Karreman et al*,* (2007) and Sutcliffe et al*,* (2003), as outlined in the literature review. This section first attempts some overall conclusions from findings from the various studies comprising this thesis; then looks at methodological issues arising, and finally suggests further research that could take the area of study forward.

Usability conclusions

Taking the results globally, four main conclusions from the usability studies can be reached:

- People with Learning Disabilities behave in a manner when formally seeking information which suggests they search in a limited, serial manner;
- Their free use of the Internet, however, shows the same, or even an exaggerated form of behaviour exhibited by mainstream users – random and 'promiscuous' (Nicholas et al*,* 2004);
- Without supporting text or audio, the use of images as an aid to information retrieval has only limited value;
- People's preferences and performances do not necessarily match.

These are discussed in turn, below.

Serial access to content

The finding that, perhaps, has potentially the most impact on design is that when seeking specific information people with Learning Disabilities may be limited by having only 'serial access' to content. This means that all of the information is taken in sequentially, until the required content is reached. As noted in the results to Study Seven, serial access is not the same as linear access, although it may be considered as an exaggerated form of it.

The phenomenon of 'serial access' is evidenced in the research reported here in a number of ways. The menu game (Study Five) showed that words on the left were found more quickly than those placed in the middle, even though the latter position made the words much closer to the picture and potentially within the same field of vision as the picture. Pete's Easy Read website information retrieval comparisons (Study Seven), produced results that showed both that images were ignored until reached 'serially' via accompanying text being methodically negotiated; and that information took longer to be accessed from vertical menus, possibly because of distracting text at their side drawing away the attention of the participants. Also, the small-text content was consumed quicker than the large-text, as the latter took up more lines – another indication of serial access in action. Unlike with the menu game, where there was no horizontal distracter, here the added lines necessitated by the large-text condition took more time to negotiate, as when accessing information serially, it requires more eye movements to retrieve information from a body of text where more lines are used. Finally regarding Study Seven, the finding that participants did not gain from any task familiarity also suggests that even for the sixth, seventh or eighth task, 'serial access' behaviour was the norm. This is because the relative equality of mean task-times strongly suggest that participants were not moving to a linear or random access behaviour pattern and, as such, 'consuming' the images more readily or skimming irrelevant content. The more qualitative findings from earlier studies (particularly One and Three) also showed this behaviour in terms of the audio recitation of content and observed finger movements by participants.

Of interest here is that linear, if not serial, access has been used to describe access to online content in terms of learning or cognitive style. Here, individuals are described as being on a continuum of 'field dependency' from 'field dependent' or FD to 'field independent', or FI (Witkin et al, 1977). The FD individuals tend to be greatly influenced by the dominant visual field (in the current context, this would be text, as participants were asked for verbal information) whereas the FI individuals tend to be less influenced by the information from the visual fields and consider all the information more globally (Ling and Salvendy, 2009) . Of interest to the present study is that FD individuals appear to prefer a linear route through hypermedia (Lui and Read, 1994). This research suggests that for people with Learning Disabilities, the linear route is slower than for other individuals because of the serial access phenomenon.

There are important implications for this behaviour. First, the perceived need and effort to process all of the information up to and including that required clearly places an extra cognitive burden on those whose behaviour follows this pattern and, as has been shown in the results to the study, makes access to content below screen level or at the bottom of a page more time consuming. Second, relying on serial access may make it more difficult to use one of the well-trumpeted attractions of the web - its non-linearity, manifested in the form of hypertext and, more recently, hypermedia. Hypertext is a technique for organising documents (usually web pages) to facilitate the non-sequential retrieval of information – the access being via links between documents facilitated by hypertext transfer protocol (http) – the rules a computer follows to enable one to jump from one page to another. 'hypermedia' refers to this linking, when more formats than text are involved (Nielsen, 1990).

It has been suggested that non-linear access within hypermedia can enhance learning in comparison to the linear access to more traditional media (Chen and Ford, 1998). However, Andrew Dillon and colleagues at the University of Texas (Dillon et al*,* 1993: p.169) point out that hypertext is 'a .. system which demands the user finds his/her path in a complex information space'. For some people – not necessarily those with Learning Disabilities – navigation can be a daunting task, causing a disorientation that adds to cognitive load, that is, it requires extra working memory resources called extraneous cognitive load (Sweller, et al*,* 1998). Given this, it is perhaps not surprising that DeStefano and LeFevre (2007) found readers with low working memory and low prior knowledge were usually disadvantaged in hypertext. The analysis in the present study that lower literacy level participants were more likely to seek for specific information serially than higher literacy level participants, and took longer to access it, supports the suggestion that the non-linear organisation of the Web may be difficult to negotiate for this cohort.

Random access to content

'Random access' behaviour – the accessing of content in an unstructured, non-sequential way – was observed consistently when participants were given the opportunity to explore sites without the burden of seeking specific information. This is, of course, behaviour that is in direct contrast to that practiced when undertaking the set tasks. However, David Nicholas and colleagues (including the present writer), latterly at University College London, have undertaken much work based on the computer transaction log analysis of user behaviour (Nicholas et al*,* 2003; 2004) and describe 'today's information consumer' as 'a "flicker" or a "bouncer"' (Nicholas et al*,* 2003: p25) . The authors explain that:

‘As children use the remote to channel hop, so their parents information hop or bounce their way across the digital information terrain, and especially the Web. Our studies show that 40% of [web] users never really get beyond the initial menu pages … This results from a number of factors [including] …having very short attention spans [and] … being hostage to a retrieval system (the search engine) that is constantly coming up with empty, irrelevant or uninteresting postings … We are “promiscuous” consumers’ (p23).

Such behaviour was certainly manifested by the present research participants. As the majority of use centred around YouTube or other video hosting sites, this rapid accessing of different resources was facilitated by the interface. Figure 52 shows an actual web page accessed by one individual during researcher observation of free use of the Internet, showing suggested alternative clips listed with thumbnail screenshots to the right of the main video screen.

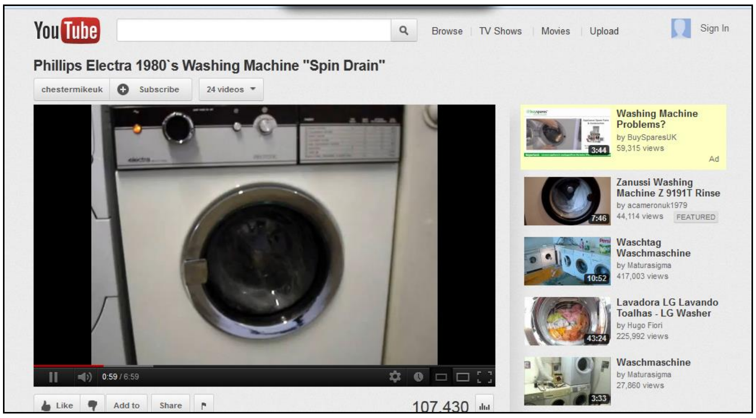


Figure 52: Web page (detail) showing a washing machine in action, with other similar clips listed on the right

In this case the participant watched less than one minute of the clip featured, and went on to sample several others, for similarly short periods of time. With other people seeking photos of the latest ‘boy bands’ and sports people the same rapid access, consumption and exit pattern was noted. It is worth noting, from these observations, that participants – particularly those with milder Learning Disabilities - showed that, in addition to apparently random access behaviour, they were capable of ‘direct access’ too, by finding YouTube clips, games or photos of their favourite music artists or sports personalities with ease. In one sense, the study showed the power of Google (always the preferred search engine) as clips or other media were found easily by using only the most basic of search terms. The somewhat random nature of the behaviour of many participants was in then continuing to seek other pages without apparently consuming any content.

Clearly, taking a somewhat holistic view of web behaviour, these activities constitute ‘entertainment’ more than formal ‘information retrieval’. However, when asked to look at the information pages of Newham Easy Read, Movingonup and other explicitly ‘information-centred’ sites, there was no modification of this kind of rapid activity, suggesting that such resources are best utilised as focal points around which people with Learning Disabilities and their parents or carers can discuss issues, where the latter can act as the ‘guide on the side’ (King, 1993), taking care not to dominate.

Use of images

Considering the use of images, there was little evidence that accompanying a body of text with an image was helpful in accessing information. Study Six showed how complex it is to represent abstract, and even to an extent, concrete nouns. The study showed it was particularly difficult to encapsulate concepts such as ‘support’, ‘Living on your own’ or ‘safety’. Other transition-related concepts relating to topics identified as being information needs in the literature, such as ‘Rights’, ‘Careers’ or ‘Benefits’ (Townsley, 2004) may have been as difficult to portray, had they been included in the websites constructed for this thesis. Study Seven showed that the use of images as signposts to content does not enable faster access.

As noted in the introductory section, there is little guidance on the use of images in the literature, which tends to assume that illustrating text, or substituting text for images is automatically beneficial without regard to the nature of the image or its page position. This research has shown that where pages include both text and image, people who have low levels of literacy will tend to concentrate so much on the former that they barely notice the latter, even when it apparently complements the written content.

Although in Study Seven, performance on pages with images was no better than when they were absent, it might still be that some people feel reassured when they are struggling to read a word to find that they must be correct because the accompanying photo supports their reading. Also, with repeated use, even an obscure image can be learned and related to its intended representation. This is discussed more under the section on areas for further research, below.

A final conclusion from this aspect of the research is that if images are to be used (and people did favour them considerably) then – as suggested in Study Six - a photograph appears to be more effective in conveying a particular category of information than an icon or other graphical representation.

Preferences versus performance

The final major finding (from Study Eight) was that user preferences and performance (in terms of speed of information access) do not necessarily match. In this study, participants overwhelmingly preferred the version of Pete's Easy Read which used large-text, when the performance was the reverse of this; and were equally in favour of images on the page, although they proved to be of very limited help in accessing information. Only the slight preference for a horizontal menu approximated performance results. The discrepancy between preferences and performance is discussed more fully in the section examining methodological issues.

Methodological evaluation

This section evaluates the methodology adopted in terms of how well it elicited data and also how appropriate it was to use with this particular cohort. It takes the major elements of the methodology and evaluates them in turn. These were:

- The information content;
- The use of 'one-action' tasks;
- The informational nature of the tasks;
- Observation of unstructured web use;
- Ascertaining preferences;
- Quantitative data analysed.

The information content

Setting the usability study into the meaningful context of transition information needs was calculated to increase understanding and relevance with regard to assessing the efficacy of the specific web resource. However, this seems only to have happened to a limited extent. When invited to browse Newham or Pete's Easy Read or other sites (the latter when considering preferences) participants accessed a great number of pages but appeared to imbibe very little meaningful information from them. It may be that the kind of information hosted on the site is that which would normally be discussed with an adult rather than independently. Of course, many decisions, about work, study and even leisure, need to be made by this particular constituency in consultation with an adult. However, this does not devalue the exercise, but merely recognises that even if information is made accessible, it will often be accessed and assimilated collaboratively with carers and parents, upon whom it is incumbent to give the person with Learning Disabilities real choices and a real voice.

Employing a 'set-task' method

Two main aspects of the set task method are of interest. These are the 'usability' and the 'informational' aspects of the tasks.

The 'usability' aspect of the tasks

To make the tasks as easy as possible from a usability point of view, they were broken down into sub-tasks each requiring only one action. As found in a previous study (Williams and Nicholas, 2006) and outlined above, making a task 'one-action' does not necessarily make it intellectually simple. For present purposes, the researcher was careful to formulate tasks that were simple both from usability (or manual) and intellectual perspectives. Although the full task did require a number of sub-tasks to be completed, indications were given at every step as to the following required action. An example is:

- Can you find the section on Health? (task: find a menu entry)
- What is one way to stay healthy? (read the text or look at the photo)
- Now go to the page about hospitals (find a link)
- Where can you eat your meals in hospital? (read the text or look at the photo)

The development and use of this type of task did make it possible for participants to undertake the tasks without the help of a supporter. This may not have been the case if the task had been to answer the question 'Where can you eat your meals in hospital?' directly from the site 'home' page, without any guidance.

The disadvantage of using this method is that it does not measure how easy it is for a user to autonomously navigate a hierarchy or understand site structure, as usability tests with other cohorts of users typically involve and from which usability is normally measured (e.g. George, 2008). In a sense, the exercise represented a trade-off between providing activities that could be undertaken autonomously and approximating a 'real' situation where resource users would have to make more complex judgments and follow a menu or site hierarchy involving several steps. An example might be where participants are asked what they might need to wear at a bowling alley – requiring them to first recognise that bowling falls under the category of leisure and then to look for the subject menu entry on bowling. This undirected search behaviour may have been too taxing for many of the participants. However, considering the number and importance of the issues elicited from the directed searching actually undertaken, the use of sub-tasks instead of what might be termed 'full' ones did not appear to be prejudicial to the research. The method had the added benefit of facilitating inclusivity, as a large number of people could participate who would have struggled with an alternative arrangement.

The informational aspect of the tasks

In one way, the use of set tasks in the form of seeking a specific informational fact was somewhat removed from the likely method by which the participants might normally use a website of this nature. As discussed earlier, where participants were offered 'free rein' to explore pages, of greater importance than individual facts was to access as many pages as possible. However, the tasks were formulated such as to require participants to seek a specific fact – albeit one that they might seek in a real life context . Examples are facts about what is entailed in a visit to the cinema or what equipment is needed to take up cycling etc. Thus, the search for specific information would not be unrealistic. Also, whilst these topics might be looked at and be focus of discussion with a parent or carer, the accessing of the information autonomously, as far as possible, would facilitate a degree of empowerment. The propensity of participants to read thoroughly all the text on the page, however - possibly due to the burden of addressing specific questions - suggested that this method of testing information retrieval may not have been appropriate.

Following this, it may have been better instead to have shown the participants the web pages and simply asked what they could say about the subject from anywhere or any element on the page. However, adopting this method might have been more difficult to quantify the responses. Timing participants as they elicited content, or counting the number of facts accrued would also have been problematic. In both cases it would have been difficult to compare interfaces, as the responses to the content might have been different (e.g. a picture may have proved interesting on one page, but a different picture on another page not so). Also, it is quite possible, given the 'serial access' finding that they would simply have read the text, as they did for the specific tasks given.

Finally on this point, to obtain an accurate indication of the benefit of images it would clearly aid the enquiry to introduce a measure of participant comprehension into the task and to be more flexible in allowing for a greater lack of task success. In other words, to enrich the data from a measure simply of speed of access to that of exploring in greater depth the more fundamental question of the extent to which images aid understanding. This is described more in the section on future research. Suffice at this point to re-iterate the scope of the present study which was limited to an examination of interface factors and their effect on speed of information retrieval and not on the comprehension of content which, of course, would have been as worthy (if not more so) but would have been more of a pedagogically based enquiry some distance from the parameters of the current research.

Observation and interview

Eliciting information by interview proved difficult, although important in fostering and maintaining the research as inclusive and participant-based. In this regard Walmsley and Johnson (2003) note how, historically, research with (or more accurately, 'about') this cohort had little or nothing to say about the perspective of the subjects of the research themselves. As mentioned in the section describing the general methodology, where the timing of tasks was not involved, information was elicited from most participants during the course of the session rather than at the end. Although there was some success in interviews to ascertain individual preferences, as described below, it proved very difficult to elicit usability problems by this method. Comments at times were typically brief to the point of consisting of one word ('easy' or 'hard'). Similarly, individuals found it difficult to express, for example, what they expected to see before opening a link. Also, only a very small minority offered the requested 'running commentary' on their actions. The absence of this was probably due to the demands of the task and participants' concentration on it. This was also affected by a desire, in Study Seven, where tasks were timed, not to prompt participants by asking questions, a practice which might have generated more data in the situations like these, but which would have lost the analysis that elicited 'serial access' and the apparent ineffectiveness of images.

Far greater research data was obtained by observing, both participants' natural use of computers and their set-task performances. The observation of the former, which helped ascertain prior knowledge, skills and experiences proved a reasonable counter-balance to the formality and rigidity of the set tasks and an alternative to asking what information was found on any given page. Thus, in terms of the research reported in this thesis, it added an extra richness which put the more formal set tasks into the context of wider Internet use. It also highlighted the contrast in Internet behaviour between attempting to find specific information and general online activity – which would not have been elicited if the research had only comprised the set tasks.

Observation of the set tasks themselves elicited a number of issues, such as the difficulties some of those with more profound disabilities have in manipulating the mouse or scrolling (or, indeed, realising that one needed to scroll); and general problems faced by various individuals throughout the study, such as in understanding images and menu labels and working with a vertical menu.

One final benefit of observation, to a greater extent even than the use of one-action tasks, was that participation was facilitated. As mentioned in the methodology section, those who wished to be involved but who did not have the required literacy level to undertake the tasks were welcome to talk to the researcher about their computer activities and show off their technological prowess for him to observe and admire. In total 16 people contributed to the study in this way.

Ascertaining preferences

Preferences were established in three stages. Stage one (Study Four) found that the rating system was flawed, both in offering only one negative and one positive option and in including a neutral category. The amended scale, used in Study Eight, offered much evidence that a four point rating scale, with two positive and two negative levels, worked for the cohort studied with a reasonable array of options used (e.g. not just those at the extremities ('like a lot'; 'dislike a lot'). The ratings also helped participants verbalise their views, and the breakdown of the websites into the three categories of appearance, navigation and content, also appeared to help. Finally, the avoidance of asking polar questions was successful. Indeed, in one sense it could not fail to be so, because if interviewees are starved of the opportunity to agree with their interrogator, they cannot fall into the 'acquiescence bias' trap. On the other hand, it might well be that with people with a greater degree of Learning Disability might not be able to answer questions such as those asking for opinions. Here is where the technique of offering binary choices might came in to its own.

A comment on the mis-match between preferences and performance is necessary. This may have been due to the different perceptions the researcher – or anyone seeking specific information – might have to an information resource as compared to a person with a Learning Disability. For the former, speed of access might be valuable, whereas for the latter, other considerations might be more important, such as appearance or 'fun' elements such as the talking head enjoyed by those who evaluated the Dobson's Choice website. On the other hand, for information providers and web developers to not consider access to information and simply construct a resource on the basis of its general appeal would be a dereliction of duty in terms of facilitating inclusion and self-advocacy.

Of course, one could argue that retrieval time as a measure of ease of access is subservient to preferences and that therefore a web page should be designed purely around the latter. However, there are reasons for taking into account performance too. As outlined in the introduction to this thesis, One characteristic of Learning Disabilities is that of a short attention span (LDAA, 2010; Lerner and Johns 2009) and therefore people are likely to desist if finding information takes longer to find than their attention span will tolerate. By contrast, however, pages produced that contain few, if any images or colour on the grounds that these attributes have only a minimal role in speed of retrieval may appear so uninteresting that they will have no attraction for any user. Thus, both the performance efficacy and its attractiveness for users need to be considered, with one informing the other.

Perhaps the best approach is that advocated by Anders (1999 - quoted in Costa, 2008: p265), who observed that 'there are three things to remember about website design: content is king, content is king, content is king. But in order to ensure its primacy, we must present the content in a way that is attractive, orderly, and, if possible, original'.

Quantitative data analysis

Parts Two and Three (Studies Five to Eight) were quantitative in nature, the accruing data being of timed tasks and preference ratings. The methodology section justified the use of task-time as a measure, arguing that the nature of the task, participants' short attention spans, precedent, and ethical considerations (eschewing 'task success/failure') all gave the approach legitimacy. It also made the results quantifiable (and therefore comparable) in a way that interpretation of qualitative results would not have done.

One consequence of working with people with Learning Disabilities, however, is that a great deal of flexibility is required. This was noted earlier regarding the non-relevant questions asked of the researcher by participants in their pre-session briefings. This flexibility extended to the accuracy of timed activities. For Study Five, accuracy was enhanced by being automated by the system (although even here there might have been cases where words were found but not 'clicked' because of a distraction or inattention). For Study Seven, which relied considerably on a measure of task-time (albeit, being supplemented by qualitative observational data) a certain flexibility was required in terms of how the measure was undertaken. Times were only approximate, because the watch had to be stopped to allow for many off-task activities. These included:

- Off-task comments to the researcher or other individual present;
- Task-relevant comments, where these appeared to hinder the process of undertaking the task;
- Apparent inactivity (it was difficult to judge in some cases whether a participant was undertaking the task or had become mentally distracted);
- Opening an incorrect link or otherwise making an error.

There were also occasions where a participant succeeded in the task, but neglected to verbally inform or gesture as such to the researcher.

Thus, the timings were not as accurate as might be desired, and so results need to be treated with a degree of caution. This is particularly so also when considering that the tasks themselves were not time consuming enough to generate a wide range of completion times. This was, of course, to allow for the particular situation of the participant group, for whom longer and thus more complex tasks may have been too taxing. On the other hand, 88 participants were able to undertake at least six of the eight tasks set (the threshold for inclusion in the data analysis) and altogether there were 645 usable task-times to analyse. Thus, even with the inaccuracies reported, it could be strongly argued that the large sample size and the rigorous method by which the tasks were timed, (notwithstanding some inevitable inaccuracies) legitimise the findings. In fact, in one sense, the method worked better than expected in that it elicited the phenomenon of 'serial access', which has major implications for website design and the presentation of information. Also, the quantitative results were reinforced by qualitative data in which the results accrued quantitatively were contextualised and explained by observation (e.g. of participants reading aloud or 'mouthing' page text; using a finer as a guide, or simply ignoring the non-text content). This data triangulation helped very much to legitimise findings accrued from task-time analsis .

A final point relates to the expectation that the analysis would elicit the most effective interface and the attribute most influential within it. In this regard, there was less success, for two reasons. First, the attributes studied contributed only minimally to task-time, according to the results from the multiple regression. However, as has been noted, this result may be due to the very simple nature of the set tasks and the relatively quick time taken to complete them (a mean of 45.5 seconds). A more complicated task would have discriminated between interfaces better. However, that is one of the constraints within which working with people with Learning Disabilities entails. Second, changing one attribute of the website did not appear does not impact significantly on the effectiveness of the others.

Recommendations for website design

One major aim of the study was to determine which Web page interface attributes facilitate success in information retrieval by people with Learning Disabilities. Considering this, and the fact that vulnerable people were participants, it was considered especially incumbent upon the researcher to formulate recommendations that may be of real practical benefit to and for project participants and, indeed, the population from which the sample was drawn. As mentioned in the introduction to this thesis, in addition to the failure to explore and meet the information needs of people with Learning Disabilities, the issue of how to best present information online has been a similarly neglected area of interest to library and information professionals.

In this case, results suggest certain 'best practices' with regard to web page design. Following from the observations above, any such recommendations need to address two major considerations. These are reconciling preferences versus performances, and obviating problems inherent in 'serial access' behaviour. Of course, the caveat needs to be made that, as mentioned above, people with Learning Disabilities, like everyone else, have varied and individual needs and abilities. These recommendations, therefore, should be seen as rough guides only, to be tailored and adapted for any specific known user group.

The considerations of performances and preferences can be addressed together, by looking at the interplay between text and images. The use of photos and other pictorial representations, unsurprisingly, were very popular – despite the ineffectiveness in terms of information retrieval times, observationally shown to be due to participants not examining pages globally. Even with only around 50 words to negotiate, participants had to concentrate so much on the text – consuming it 'serially' – that they did not engage with the other elements of the page. This clearly suggests that cutting text even from this modest word-count may be advisable. An attempt to do this can be seen in Table 22, which shows two versions of a page on the leisure activity of bowling. The original text is on the left, with an edited version on the right.

Bowling is really fun! You need at least two people to play. Before you go bowling you need to know. … where the bowling rink is … how to get there … and how much it costs. You have to wear shoes they give you! Remember to give them back at the end!	Bowling is fun! Two or more people to play You need to know. … Where it is How to get there Cost Wear shoes they give you Give them back after!

Table 22: Full (left) and edited (right) versions of the page on bowling

The shorter version has been cut such that it still includes virtually all the information content of the original. The text could be reduced even further, in fact, although some of the information would be lost. However, using supporting images, and bringing the text and images more adjacent may both aid understanding and speed of retrieval, and also address participant preferences, which were unsurprisingly strongly favourable towards the use of images. Indeed, to populate a web page only with plain text, however accessibly written, would not be a very attractive option.

Figure 53 shows the detail from a page resulting from reducing text to a minimum, as discussed and juxtaposing the images with the exact line of text to which it refers. Although the lack of text-based information may appear to preclude completely autonomous information understanding, the resource would be used as the focus for discussion between the person with Learning Disabilities and a carer or parent (rather than autonomously). In fact, the missing information content could be added during the course of such interaction – possibly in the same form of question and answer that helped produce the material initially.

Figure 53: Further edited version of the page on bowling showing the juxtaposition of words and images (detail)

Reducing the text content as shown would also resolve the discrepancy between preferred text size (large) and most efficient in terms of information retrieval (small). With fewer than around 20 words per page, the length is unlikely to creep below screen level and the slightly longer time it may take to read large text – as indicated in the results – would be minimized with such a reduced amount of content to negotiate. Similarly obviated would be the problem of serial access as less (text) information would need to be imbibed.

It is worth making one more observation regarding text size. Browsers can be configured to display the text size (and often colour and/or background colour) of one's choice, and many organisations, particularly in the disabilities field also include this facility on their site (Mencap[23], The British Institute of Learning Disabilities[24]). However, a discussion around default size of text is not redundant. This is because, first, in some cases the facility to modify page attributes can be quite obscure. The British Dyslexia Association[25], for example, includes a link to 'RokTalk text-to-speech', but when this is activated it produces a toolbar which includes a text-size modifier, and the Foundation for Learning Disabilities has a link to 'Accessibility' in minute letters at the bottom of its home page, which opens a page featuring this facility. The last two examples; the fact that other sites may not have this functionality, and considering possible unawareness by users that a browser can be configured for better accessibility, all suggest that the default text size should be carefully considered. The research reported here did not examine the issue in a manner which could suggest a particular 'perfect;' size, which would be impossible anyway considering the way pages are written and presented on screen. However, it can recommend the factors that need considering, such as the interplay of text and images, as noted above. Further recommendations can be found at the conclusion of this section of the thesis.

Finally, both performance and preferences matched with regard to menu layout. Notwithstanding the fact that only two conditions were explored, a horizontal menu appears of these to be the easiest to use, certainly in pages that also contain a body of text – and preferable with regard to considerations of serial access and the expressed choices of participants. However, the menu list should be clearly distinguishable from the body text, by a border – even where thumbnail pictures are used or the list is otherwise separated from the main text body. Of course, one potential problem with a horizontal arrangement is that, even if the menu spilled onto two rows, the number of entries would be limited. This would therefore require a deeper hierarchy for large sites than would be the case with a vertical menu, as there is, in one sense, no limit to the number of entries. However, Part One of the research showed both that many menu entries could be confusing, and that the scrolling necessary to access longer pages inhibited information access. If possible, small discrete websites may be the answer.

In sum, possible design recommendations, considering both performance and preferences, could consider the following:

- The organization of text-based information such that the most important content is at the beginning. This is a common suggestion (see e.g. Loranger and Nielsen, 2006) and is practiced religiously in journalism, where it is known as the 'inverted pyramid' (e.g.

[23] www.mencap.org.uk/
[24] www.bild.org.uk/
[25] www.bdadyslexia.org.uk/

Pottker, 2003), and particularly relevant in the current context, considering the restrictions of 'serial access' outlined earlier;

- Ensuring the juxtaposition of text and images (and, of course, the relevancy of the image to the text);
- Minimising word count and text density to reduce or maintain short page length;
- Use a fairly large text size, assuming a minimum amount of content (it has been noted that browsers can be configured to display the size of one's choice, but only five examples were noted in this research of a browser or desktop adjusted for individual use);
- Designing a menu layout where all of the entries are clearly visible on the page – and, considering both performance and preference findings – horizontally arranged;
- Accompanying images will not automatically aid comprehension. Findings reported in Study Six showed how difficult it was to match these to accompanying text – particularly abstract concepts;
- With regard to the ambiguity of images, potential users could be consulted so as to arrive at some kind of consensus about the most appropriate representations. Of course, continued exposure to and consequent familiarity with a resource would in time help users learn what represents 'Health', 'Support' etc.;
- Considerable evidence was presented in Study Six that photographs are more effective than symbols, and other literature (e.g. Choi and Bakken, 2010) suggests that these are more effective than clip art. In addition, Poncelas and Murphy (2007) provide evidence that symbols do not provide any additional help in understanding text (although Jones et al, [2007] found the opposite result). Thus, if images are to be used then a photograph appears to be more effective in conveying a particular category of information than an icon or other graphical representation.

Of course, there are other considerations too, such as those of page width, font type, colour combinations etc., as mentioned earlier and – moving from web page layout to the design of complete websites and the attendant issues around structure and navigation.

Meeting the aims of the study

This section outlines how the usability and methodology findings described above meet the aims of the study. It is worth re-iterating that these were to:

- Determine which Web page interface attributes facilitate success in information retrieval by people with Learning Disabilities;
- Explore methods to elicit attribute preferences;
- Determine the extent to which preferences and performance matched.

Regarding the first of these, the 'serial access' behaviour elicited in the fieldwork appeared to be key in determining which interface attributes facilitate information retrieval – at least in terms of speed of access. This method of reading was more suited to a smaller text size and a horizontally oriented menu list. However, in keeping with both the inclusive ethos of the study and the practical consideration that information recourses are more likely to be used if they appear attractive and appealing (Nicholas and Herman, 2009; Costa, 2008) the optimum attributes were considered to require taking account of both performance and preference judgments. These are outlined above.

The aim of exploring preferences was met in Studies Four and Eight, where two rating scales were tested to see whether and to what extent they facilitated expressions of preference. A modified version of the original, which removed the 'neutral' category and split the positive and negative options into two levels each, worked well in terms of promoting a more discerning selection of categories. Difficulties in eliciting preference (or other) information by questioning were outlined. From prior literature (e.g. Sigelman et al, 1981) and personal experience, a major problem regarding the seeking opinions is that of the research participant automatically agreeing to the apparent views of the interviewer – the phenomenon described in the literature as 'acquiescence bias'. The opportunity to do this was minimised by an attempt (not always successful!) to avoid asking questions that required an agree/disagree response (the correct grammatical terminology for these being 'polar interrogatives') which was achieved by asking participants instead to make comparisons. Although many of the comments were basic expressions such as 'I like this one'; 'the pictures are nice', when used with the rating scales the author can claim that not only the aim of 'exploring' methods of eliciting preferences was achieved, but also that some success in this activity was evident in the data accrued.

The final aim, of determining the extent to which preferences and performances matched, was achieved principally because sufficient data was available regarding preferences and partly by asking participants to specifically offer views on the attributes under scrutiny, in addition to any general comments they may have had. An attempt at accommodating differences between performances and preferences was made in offering recommendations for optimising website design for information retrieval.

Future research

The research reported here, although complete in itself, could nevertheless be extended in several ways. This section examines various possible strands, based on either repeating the research as a whole, applying the methods reported here to other cohorts, examining particular website attributes or applying the research to other platforms. Each of these possibilities is discussed in turn, below.

Repeating the current research with other cohorts

As the present research worked principally with literate participants, albeit having a Learning Disability, results may be directly testable with other user groups, such as elderly people (see e.g. Freeman et al, 2005; Hanson, 2001), children (Hutchinson et al*,* 2007) or dyslexics (MacFarlane et al*,* 2010; 2012; Al-Wabil et al*,* 2007). Indeed, a case could be made that the method could be used to test websites for information consumers no matter what their distinguishing factor might be.

In fact, it could be argued that any such study might yield even more data than the present one. For the qualitative phase, for example, respondents may find it easier to articulate their experiences and opinions and to perceive and analyse their own navigational and other difficulties. Similarly, a possibly richer picture could be accumulated of personal preferences – perhaps beyond a consideration of any web page designs presented to them, to an abstraction of other preferred site attributes.

With regard to the quantitative phase, the set tasks would need to be re-considered, since, as noted in Chapter One, the times taken by people with a 'normal' intellectual capacity would be so short as to make statistical analyses difficult. The tasks could therefore be more complex and the text longer. This would almost certainly result in a wider range of task-times and thus possibly reveal more statistically significant results than was possibly with the simple tasks developed in the present study.

Also regarding this possible greater variation in task-times, and generally richer data accrued qualitatively, a greater exploration of information behaviour would be possible. Questions in this context would include those related to the extent to which serial behaviour manifested itself (e.g. do elderly people whose eyesight may be deteriorating begin to adopt this method of accessing information. If so, does it also result in the lack of effectiveness of images?); if images were effective for these cohorts in enabling 'direct access' to content (e.g. by signposting), and do people adopt different web searching behaviours depending on the context of their activity. In other words, do they skim linearly when seeking specific information, and switch to 'random access' behaviour when, for example, browsing a news website or undertaking less directed searches.

With regard to the latter, the present writer was involved in a research project which looked at search terms employed by participants of different age groups ('inter-generational') on questions ranging from the simple fact-finding to highly ambiguous and open ended (Nicholas et al, 2011a). The proposed research could take this one stage further by examining information behaviour after searching has been carried out, during the process of information access at 'page level'.

This research would clearly be of importance in the field of information science, much of which is concerned specifically with the act of searching (i.e. by using specific search terms) (e.g. Spärck-Jones and Willett, 1997; Robertson, 2008; Croft et al, 2010) or more generally in research information from the stage of 'need' to 'fulfilment' (Kuhlthau, 2006; Wilson, 1997). Very little research has been undertaken on 'extracting' information (Ellis, 1989; Marchionini, 1995) once relevant documents have been obtained.

Researching individual page attributes

Besides undertaking a study of similar design with these other cohorts, several possible follow-up areas in which continuing research involving people with Learning Disabilities present themselves with regard to particular page or site attributes:

- Menu positioning and paging versus scrolling;
- Further exploration of images;
- Using audio to aid information retrieval;
- Exploring the usability of mobile devices.

It is tempting to add that research needs to be undertaken on the actual comprehension of web-mediated content and whether there are any implications for the design of websites. This may well be true, but although this is touched on below, it is not considered in any detail, because it was felt that an examination of comprehension would have taken the research into a direction removed from usability.

Menu design and paging versus scrolling

This thesis examined only a horizontal versus a vertical menu arrangement., and used a grid which took up a complete page as a main menu. Research is needed to determine whether other menu arrangements are more effective. The only study found to have addressed this issue with a Learning Disability sample has been that by Rotondi et al, (2007: p213) whose enquiry into website design for people with 'cognitive deficits' found that drop-down menus 'presented the shallowest structure and simplest hierarchy, making it the most difficult in which to get lost'. The same study also examined labeling, and found that which was easiest to use was where labels were 'the longest and most explicit … requiring the least amount of interpretation'. Of course, such verbose labeling requires the most amount of text and space, so again, the idea of a 'trade-off' between description length and comprehension.

Menus, and menu hierarchy, of course, have direct consequences with regard to the length and number of pages in a site. The problems encountered in this series of studies with regard to scrolling long pages have design implications. Further trials would be fruitful that look at 'paging' instead of scrolling. This is where pages are kept short enough to fit on most standard screens, so that where scrolling would be necessary on one long page, the content is placed on several shorter ones, each of which has to be negotiated to access the full content. This is the case with the website Movingonup, used in Study Four. On this site, an arrow on the bottom right of each screen – away from the menu entry navigation area - directs readers to the next page. Research with non-disabled users (e.g. Piolat et al, 1998) has shown that people may have a better mental model of text; be better able to find information, and capture its main ideas in smaller 'chunks' than those who are required to scroll. This suggests that fragmenting content in this way and using a forward arrow key may indeed be more appropriate.

Further exploration of images

There are several possible areas of interest that have emerged from the present research. One would be to examine the extent to which, in menu labels, for example, people with low levels of literacy benefit from a period of exposure and learning. Thus, for example, whilst the picture showing a man cooking was recognized in Study Seven by only 48% of participants as representing 'Living On Your Own' (see Figure 54), once the website hosting this picture and label has been viewed several times by the same person, familiarity could reinforce the meaning.

Figure 54: Study Four: Living On Your Own photo representation

In this case, of interest would be whether this long-term exposure to images and their representations aids information retrieval or if the text label is still as good at facilitating access to content. Second, a more quantitative study than Study Six could explore the perceptions of people with Learning Disabilities with regard to the representation of abstract concepts such as 'support' etc. With a large number of participants categorising various representations, some sort of consensus might emerge that suggests an optimal way to represent each of the concepts related to transition.

Finally, but somewhat removed from the present area of enquiry, would be to look at the extent to which the juxtaposition of images and text aid people's understanding of content. Many studies doing this were described in the literature review (e.g. Hannus and Hyona, 1999; Mansoor and Dowse, 2003) although, as noted, there appears to be a paucity of literature on whether the use specifically of symbols does increase the understanding of written material' (Poncelas and Murphy, 2007; Jones et al*,* 2007) although Zentel et al*,* (2007) is one such example.

Audio as an aid to information retrieval

A strong case could be made from these results for audio rendition of labels. Study Two showed that with guidance people with Learning Disabilities were able to access and understand audio-presented information. It may be that the combination of picture and audio label are more effective than that of picture or text label. As with the further exploration into the efficacy of images as an aid to information retrieval, however, there is a paucity of literature available. Janet Fletcher and Ian Clayton (Fletcher and Clayton, 1994: p53) investigated three methods of eliciting understanding of an audio-delivered story by adolescents with Learning Disabilities, namely 'free recall, verbally prompted recall and visually prompted recall'. However, information technology was not used, and in any case, for a number of reasons, the experimental manipulations proved to be ineffective.

Research using information technology has concentrated particularly on the use of audio to give instructions (e.g. Taber-Doughty, 2005) and/or guide navigation (Davies et al, 2003). Only one study could be found that explored participant understanding of audio-delivered information. This was that by Peter Zentel and colleagues at the Knowledge Media Research Centre, Tuebingen, Germany, (Zentel et al, 2007: p31), who found that the inclusion of an audio rendition of presented text as ‘especially beneficial for people with Learning Disabilities’. Interestingly, audio is a form of serial access in that it is not possible, except with track markers whose position would be described in any case by text, to access information presented in audio form without listening ‘serially’. It might also be observed that the audio information is not retained for reference in the way that a text label remains visible. The latter, of course, can also be considered in the participant’s own time-frame.

Finally, on this topic, rather than representing some kind of conclusion, the studies reported here highlight the need for more research into the effectiveness of information delivery and acquisition by audio – in terms of audio labelling, signposting and information acquisition. Research into the use of audio with for people who have no literacy skills, and therefore who would have to rely only on the spoken word, is also needed.

Applying the research to other platforms

This thesis has limited its scope to ‘computers’, as in desktops and laptops. The results may not be the same even for tablet computers, for a number of reasons: the screen may be smaller; the position of the screen to the user may be different, and the data entry system is different – touch-screen rather than mouse and (physical) keyboard. Clearly, a new set of issues arise when talking about mobile devices such as smart-phones etc. With the screen so small, the issue of text size and scrolling becomes more important. There is also the increasing availability of mobile text to speech – again raising the issue of the effectiveness of audio as an information medium.

As Clayton Lewis and colleagues at the University of Colorado (Lewis, et al, 2009:p387) point out ‘text to speech reading technologies are now available in …smart phones so that users can read signage as they navigate the world. As smart phones become more powerful, they offer the possibility to translate complex information into simpler, more comprehensible forms that are appropriate to an individual's abilities’. Indeed, Joseph Mintz and colleagues at The University of London Institute of Education (Mintz et al, 2012) have recently developed software for mobile phone to help develop social and life skills in children with Autistic Spectrum Disorders. The present writer has recently been involved in a project in which tablet computers (an iPad) were used as museum guides and a repository for accessible exhibit information (Haworth and Williams, 2012), accessible via QR codes.

E-books and e-readers are also becoming common. There is evidence that features in e-books such as audio, animations, dictionaries, etc. support reading and help readers in their comprehension of the written word. (Grimshaw, 2007; Larson, 2010) and may motivate people who struggle with reading (Ash, 2010). Researching all of these areas – both with regard to people with Learning Disabilities and more generally - may be of great interest to librarians, who, 'must continue to study [patrons'] reading habits, then design and redesign our content collections, systems, and services to help them improve and maximize their reading experiences' (Peters, 2010: p39).

The possibilities for further research, both within and beyond the narrow field of usability, appear to be almost endless.

Concluding remarks

It is fitting to conclude this thesis with a word about the research participants – the people for whom (and, indeed, by whom) the aspiration of self-advocacy, inclusion and equality has been part of an on-going social and political movement for some years. As mentioned at the start of this thesis, and the driving force behind it, the provision of accessible, relevant and timely information is one way that can facilitate these aspirations (DH/CNO, 2008). It is hoped that the individuals who were kind enough (and brave enough!) to participate in this research, and the small minority who were too shy or too engaged in other more compelling activities, will go on to both articulate and achieve their long-term aims. If the findings reported here inform how information to facilitate these can best be made more accessible, then it will have been worthwhile.

References

Abbott C (2008) *E-inclusion: Learning Difficulties And Digital Technologies* Bristol: Futurelab Available at: www.futurelab.org.uk/resources/documents/lit_reviews/Learning_Difficulties_Review.pdf (accessed 18.03.09 – now [24.03.13] at: http://archive.futurelab.org.uk/resources/documents/lit_reviews/Learning_Difficulties_Review.pdf)

Adam T, Tatnall A (2008) Using ICT to improve the education of students with learning disabilities In Kendall M, Samways B (Editors) L*earning To Live In The Knowledge Society* Boston: Springer pp63-70

Aitken S, Millar S (2002) *Listening To Children With Communication Support Needs* Edinburgh: CALL Centre

Albright J, Guzman C, Acebo P, Paiva D, Faulkner M, Swanson J (1996) Readability of patient education materials: implications for clinical practice *Applied Nursing Research* 9(3) pp139–143

Alexander D (undated) *Usability And Accessibility: Best Friends Or Worst Enemies?* Available at: www.deyalexander.com.au/publications/usability-accessibility.pdf (accessed 20.09.11)

Ali AZM, Wahid R, Samsudin K, Zaffwan M (2013) Reading on the computer screen: does font type has effects on web text readability? *International Education Studies* 6(3) pp26-35

Al-Wabil A, Zaphiris P, Wilson S (2007) Web navigation for individuals with dyslexia: an exploratory study In Stephanidis C (Editor) *Forth International Conference on Universal Access in Human-Computer Interaction held at the HCI International* 2007 Berlin: Springer-Verlag pp593-602

Anders L (1999) *Great Web Architecture* Foster City, CA: IDG Books Worldwide

Antaki C, Young N, Finlay M (2002) Shaping clients' answers: departures from neutrality in care- staff interviews with people with a learning disability *Disability and Society* 17(4) pp435-455

Arditi A, Knoblauch K, Grunwald I (1990) Reading with fixed and variable character pitch *Journal of the Optical Society of America* A (7) pp2011–2015

Armstrong D, Heathcote V (2003) *Literature Review of ESOL for Learners with Learning Difficulties and/or Disabilities* London: National Research and Development Centre Available at: http://www.nrdc.org.uk/download2.asp?f=425&e=pdf (accessed 07.12.12)

Arnold B (2004) *Caslon Analytics Online Readability: Theory, Tests And Tools* Available at: http://www.caslon.com.au/readabilitynote1.htm (accessed 02.04.13) articles. In: P. Vakkari and B. Cronin (eds), *Conceptions of library and information science* (Taylor

Ash K (2010) Schools test e-readers with dyslexic students Education Week, 4(1) pp.22-

Atkinson D (2002) Self-advocacy and research In: Gray B, Jackson R *Advocacy and Learning Disability* London: Jessica Kingsley pp120-136

Attwood T (1998) *Asperger's Syndrome: A Guide for Parents and Professionals* London: Jessica Kingsley Press

Austin PE, Matlack R, Dunn KA, Kosler C, Brown CK (1995) Discharge instructions: do illustrations help our patients understand them? *Annals of Emergency Medicine* 25(3) pp317–320

Available at: http://www.libraryjournal.com/article/CA6703852.html (accessed 14.06.13)

Baddeley AD (1999) *Human memory* Boston: Allyn and Bacon

Banes D, Walter R (2002) *Internet for All* London: David Fulton (2nd Edition)

BDA (British Dyslexia Association) (undated a) *What Are Specific Learning Difficulties?* Available at: http://www.bdadyslexia.org.uk/about-dyslexia/schools-colleges-and-universities/what-are-specific-learning-difficulties.html (accessed 01.12.12)

BDA (British Dyslexia Association) (undated b) *Dyslexia Style Guide* Available at: http://www.bdadyslexia.org.uk/about-dyslexia/further-information/dyslexia-style-guide.html (accessed 01.04.13)

Beaulieu M (2000) Interaction in information searching and retrieval, *Journal of Documentation* 56(4) pp.431–9.

Beirne-Smith M, Ittenback RF, Patton JR (2005) *Mental Retardation* Upper Saddle River, NJ: Merrill-Prentice Hall (7th Edition)

Benbunan-Fich R (2001) Using protocol analysis to evaluate the usability of a commercial website *Information and Management* 39(2) pp151-163

Bernard M, Hamblin C (2003) Cascading versus Indexed Menu Design *Usability News* 5.1 Available at: http://psychology.wichita.edu/surl/usabilitynews/51/menu.asp (accessed 01.10.12)

Bernard M, Liao C, Mills M (2001) Determining the best online font for older adults *Usability News* 3.1 Available at: http://www.surl.org/usabilitynews/31/fontSR.asp (accessed 16.01.12)

Bernard M, Lida B, Riley S, Hackler T, Janzen K (2001) A comparison of popular online fonts: which size and type is best? *Usability News* 4(1) Available at: http://www.surl.org/usabilitynews/41/onlinetext.asp (accessed 19.12.11)

Bernard M, Lida B, Riley S, Hackler T, Janzen K (2002) A comparison of popular online fonts: which size and type is best? *Usability News* 4(1) Available at: http://www.surl.org/usabilitynews/41/onlinetext.asp (accessed 12.06.09)

Bernard M, Mills M (2000) So what size and type of font should I use on my website? *Usability News* 2(2) Available at: http://www.surl.org/usabilitynews/22/font.asp (accessed 17.01.12)

Bernard M, Mills M, Peterson M, Storrer, K (2001) A comparison of popular online fonts: which is best and when? *Usability News* 3.2 Available at: http://www.surl.org/usabilitynews/32/font.asp (accessed 16.01.12)

Beyer S, Kaehne A, Grey J, Sheppard K, Meek A (2008) *What works? Transition to Employment for Young People With Learning Disabilities* Chippenham: Shaw Trust

BILD (British Institute of Learning Disabilities) (2007) *Frequently Asked Questions* Available at: http://www.bild.org.uk/05faqs_7.htm (accessed 21.12.07)

Bloom BS (1956) *Taxonomy of Educational Objectives* Boston, MA: Allyn and Bacon

Bohman P (2004) *Cognitive Disabilities Part 1: We Still Know Too Little, and We Do Even Less* Available at: http://www.webaim.org/techniques/articles/cognitive_too_little/?templatetype=3 (accessed 23.05.10)

Bohman P, Anderson S (2005) *A Conceptual Framework for Accessibility Tools to Benefit Users with Cognitive Disabilities* Paper presented at the 2nd Annual International Cross-Disciplinary Workshop on Web Accessibility in Chiba, Japan, May 10, 2005 Available at: http://www.w4a.info/2005/ (accessed 07.02.06)

Bohman U (2010) The need for Easy-to-Read information on websites in Miesenberger Klaus J, Zagler W, Karthmer A (Editors) *Computers Helping People with Special Needs, Part I:12th International Conference :ICCHP 2010, Vienna, Austria*: Berlin: Springer-Verlag pp634-640

Booth T, Booth W (1994) The use of depth interviewing with vulnerable subjects: Lessons from a research study of parents with learning difficulties *Social Science and Medicine* 39(3) pp415–424

Booth T, Booth W (1996) Sounds of silence: narrative research with inarticulate subjects *Disability and Society* 11(1) pp55–69

Boyle EA, Rosenberg MS, Connelly VJ, Washburn SG, Brinckerhoff LC, Banerjee M (2003) Effects of audio texts on the acquisition of secondary-level content by students with mild disabilities *Learning Disability Quarterly 26*(3) pp203-214

Bozic N, Murdoch H (1996) Introduction In Bozic N, Murdoch H (Editors) *Learning Through Interaction: Technology and Children with Multiple Disabilities* London: David Fulton pp1-12

Bradburn M (2004) *Asking Questions: The Definitive Guide to Questionnaire Design - For Market Research, Political Polls, and Social and Health Questionnaires* Oxford: Jossey Bass Revised Edition

Brajnik G (2000) Automatic Web Usability Evaluation: What Needs to be Done? Available at: http://users.dimi.uniud.it/~giorgio.brajnik/papers/hfweb00.html (accessed 19.10.08)

Branch JL (2000) Investigating the information-seeking processes of adolescents: the value of using think alouds and think afters *Library and Information Science Research* 22(4) pp371–392

Branch JL (2001) Junior high students and think alouds: generating information-seeking process data using concurrent verbal protocols *Library and Information Science Research* 23(2) pp107-122

Brewer JD (2000) *Ethnograhy* Buckingham: OUP

Brewster SJ (2004) Putting words into their mouths? Interviewing people with learning disabilities and little/no speech *British Journal of Learning Disabilities* 32(4) pp166-69

British Red Cross (2009) *Ten-Minute Briefing - The Social Model Of Disability* London: British Red Cross Available at: http://www.redcross.org.uk/standard.asp?id=58926 (accessed 23.03.10)

Brown DJ, Lawton J (2001) *Design Guidelines and Issues for Web Site Production for Use by People with a Learning Disability* Available at: http://www.learningdisabilities.org.uk/html/content/webdesign.pdf (accessed 13.03.09)

Bryman A, Cramer D (2011) *Quantitative Data Analysis with IBM SPSS 17, 18 and 19: A Guide for Social Scientists* London: Routledge

BSI (British Standards Institution) (2006) *PAS 78 Guide to Good Practice in Commissioning Accessible Websites* London: British Standards Institution

Cameron L, Murphy J (2002) Enabling young people with a learning disability to make choices at a time of transition *British Journal of Learning Disabilities* 30 (3) pp105-112

Cameron L, Murphy J (2007) Obtaining consent to participate in research: The issues involved in including people with a range of learning and communication disabilities *British Journal of Learning Disabilities 35*(2) pp113-120

Carpenter RHS, Kinsler V (1995) Saccadic eye movements while reading music *Vision Research* 35 pp1447-1458

Carr D, Felce D (2000) Application of stimulus equivalence to language intervention for individuals with severe linguistic disabilities *Journal of Intellectual and Developmental Disability* 25(3) pp181–205

Chandler P, Sweller J (1991) Cognitive load theory and the format of instruction *Cognition and Instruction* 8 (4) pp293-332

Chaparro A, Liao C (2003) The effect of text orientation, visual meridian, and inter-character spacing on word identification in the retinal periphery *Perception* 32(11) pp1339-1350

Chen Q, Wells WD (1999) Attitude toward the site *Journal of Advertising Research* 39(5) pp27–37

Chen SY, Ford N (1998) Modelling user navigation behaviours in a hypermedia-based learning system: An individual differences approach *Knowledge Organization* 25(3) pp67-78

Chen Y-H, Germain CA, Rorissa R (2011) Defining usability - how library practice differs from published research *Portal: Libraries and the Academy* 11(2) pp599-628

Choi J, Bakken S (2010) Web-based education for low-literate parents in neonatal intensive care unit: Development of a website and heuristic evaluation and usability testing *International Journal of Medical Informatics* 79(8) pp565-575

Chung STL, Mansfield JS, Legge GE (1998) Psychophysics of reading XVIII The effect of print size on reading speed in normal peripheral vision *Vision Research* 38(19) pp2949-2962

CILIP (the Chartered Institute of

CKUK (Common Knowledge United Kingdom) (2011) *Who we are* Available at: http://www.ckuk.org.uk/index.html?pid=175 (accessed 02.04.13)

Clarke CL, Lhussier M, Minto C, Gibb CE, Perini T (2005) Paradoxes, locations and the need for social coherence: A qualitative study of living with a learning difficulties *Disability and Society* 20(4) pp405-19

Cline T, Frederickson N (2009) *Special Educational Needs, Inclusion and Diversity* Milton Keynes: Open University Press 2nd Edition

COI (Central Office of Information) (2011) *Measuring Website Quality* Available at: http://coi.gov.uk/guidance.php?page=143 (accessed 20.09.11)

Coleman EB, Hahn SC (1966) Failure to improve readability with a vertical typography *Journal of Applied Psychology* 5095) pp434 – 436

Colman MA (2001) *Dictionary of Psychology* Oxford University Press

Combes H, Hardy G, Buchan L (2004) Using Q-Methodology to involve people with intellectual disability in evaluating person-centred planning *Journal of Applied Research in Intellectual Disabilities* 17(3) pp149-159

Costa PJ (2008) Evaluating website design In O'Neill H, Aparicio M, Costa CJ, Protopsaltis A (Editors) *Proceedings of the 26th Annual ACM International Conference on Design of Communication* (SIGDOC '08) New York, NY: ACM pp265-266

Coyne KP, Nielsen J (2002) *Web Usability for Senior Citizens - Design Guidelines Based on Usability Studies with People Age 65 and Older* Available at: http://www.useit.com/alertbox/seniors.html (accessed 03.02.10)

Croft WB, Metzler D, Strohman T (2010). *Search engines: information retrieval in practice.* London: Pearson.

Cullen MA, Lindsay G, Dockrell JE (2009) The role of the Connexions service in supporting the transition from school to post-16 education, employment training and work for young people with a history of specific speech and language difficulties or learning difficulties *Journal of Research in Special Educational Needs* 9(2) pp100-112

Cunningham C, Coombs N (1997) *Information Access and Adaptive Technology* Phoenix: American Council on Education; the Oryx press

Curcio CA, Allen KA (1990) Topography of ganglion cells in the human retina. *Journal of Comparative Neurology* 30 pp5–25

DaCosta B, Seok S (2010) Managing cognitive load in the design of assistive technology for those with learning disabilities In Seok S, Meyen E, DaCosta B (2010) *Handbook of Research on Human Cognition and Assistive Technology: Design, Accessibility and Transdisciplinary Perspectives* New York: Hershey pp20-39

Daintith J, Wright E (2010) *A Dictionary of Computing* Oxford: Oxford University Press (6th Edition)

Dale E, Chall JS (1949) The concept of readability *Elementary English* 26(1) pp.19–26

Davies DK, Stock SE, Wehmeyer ML (2001) Enhancing independent internet access for individuals with mental retardation through use of a specialized web browser: A pilot study *Education and Training in Mental Retardation and Developmental Disabilities 36*(1) pp107-113

Davies DK, Stock SE, Wehmeyer ML (2003) A palmtop computer-based intelligent aid for individuals with intellectual disabilities to increase independent decision making *Research and Practice for Persons with Severe Disabilities* 28(4) pp182–193

Davies H, Crombie I (2003) *What are Confidence Intervals and P-Values?* Newmarket: Hayward Medical Communications Available at: http://www.medicine.ox.ac.uk/bandolier/painres/download/whatis/what_are_conf_inter.pdf (accessed 30.11.12)

Dawe M (2007) Understanding mobile phone requirements for young adults with cognitive disabilities In Pontelli E (Chair) *Proceedings of the 9th international ACM*

SIGACCESS conference on Computers and Accessibility New York, NY: ACM pp179-186

Day RR, Park JS (2005) Developing reading comprehension questions *Reading in a Foreign Language* 17(1) pp60-73

Dean E, Turner S, Cash J, Winterbottom P (1998) Assessing the capacity to give consent *Nursing Times* 94(40) pp58–9

DEE (Department for Education and Employment) (2000) *Freedom to Learn: Basic skills for Learners with Learning Difficulties and/or Disabilities* London: HMSO Available at: http://www.google.co.uk/url?sa=t&rct=j&q=freedom%20to%20learn%20%20dfee&source=web&cd=2&ved=0CC0QFjAB&url=http%3A%2F%2Fwww.lifelonglearning.co.uk%2Ffreedomtolearn%2Freport.pdf&ei=vNMeT5ztKpG38gOqktyxDg&usg=AFQjCNGXHd0pmMruTCxqJSX_JNkB1tbT7Q&cad=rja (accessed 24.01.12)

DeStefano D, LeFevre J (2007) Cognitive load in hypertext reading: A review *Computers in Human Behavior* 23 pp1616-1641

DfES (Department for Education and Skills) (2003) *Teacher Reference File: Literacy* London: DfES

DfES (Department for Education and Skills) (2009) *Adult Education Curriculum Framework: Milestone 8* Available at: http://waes-elearn.waes.ac.uk/moodle-resources/Basic%20Skills/Pre-entry%20%28D%29/level/m8/index.htm (accessed 23.01.12)

DH (Department of Health) (2001) *Valuing People: A New Strategy For Learning Disability for the 21st Century- A White Paper* London: Department of Health

DH (Department of Health) (2005) *Independence, Well-being and Choice* London: Department of Health

DH/CNO (DH Partnerships for Children, Families and Maternity/ CNO Directorate) (2008) *Transition: Moving on Well* London: Department of Health Available at: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_083593.pdf (accessed 02.12.12)

DHHS (Department of Health and Human Services) (undated) The Case for Usability in Government http://www.usability.gov/government/case_for/index.html (accessed 20.09.11)

DHHS (Department of Health and Human Services) (undated) *Usability Basics* Available at: http://www.usability.gov/basics/index.html (accessed 20.09.11)

Dillon A, McKnight C, Richardson J (1993) Space – the final chapter or why physical representation are not semantic intentions In McKnight C, Dillon A, Richardson A

(Editors) *Hypertext: A Psychological Perspective* Chichester: Ellis Horwood pp169–191

Dolch EW (1948) *Problems in Reading* Champain, IL: The Garrard Press

Doyal L (1997) Informed consent in medical research: journals should not publish research to which patients have not given fully informed consent – with three exceptions *British Medical Journal*, 314(7087) p1107

Drake RS (1999) *Understanding Disability Policies* London: MacMillan

DuBay WH (2004) *The Principles of Readability* Costa Mesa, CA: Impact Information

DuBay WH (2006) *Smart Language: Readers, Readability, and the Grading of Text* Costa Mesa: Impact Information

Easy-to-read Network (undated) *What is easy-to-read?* Available at: http://www.easytoread-network.org/index.php?option=com_content&view=article&id=69&Itemid=2 (accessed 20.01.12)

Edwards W, Luckasson RA (1992) *Mental retardation: Definition, Classification, And Systems of Supports* Washington, DC: American Association on Mental Retardation

Ellis D (1989) A Behavioural Model for Information Retrieval System Design *Journal of Information Science,* 15(4/5) pp.237-247.

Ellis D (1989). A behavioural approach to information retrieval design. *Journal of Documentation* 45(3) pp.318-338.

Erickson HL (2007) *Concept-Based Curriculum And Instruction For The Thinking Classroom* Thousand Oaks, CA: Corwin Press

Ericsson KA, Simon HA (1993) *Protocol Analysis: Verbal Reports as Data* Cambridge, MA: MIT Press

Evans P (1993) Some implications of Vygotsky's work for special education In Daniels H *Charting the Agenda: Educational Activity After Vygotsky* London: Routledge pp30-45

Fanou S (2008) Web 2.0: Engaging those with learning disabilities In Williams R, Remenyi D *7TH European Conference on e-Learning* 1 pp354-360

Fennell EB, Dikel TN (2001) Cognitive and neuropsychological functioning in children with cerebral palsy *Journal of Child Neurology* 16(1) pp58-63

Fidel R, Davies R, Douglass M, Holder J, Hopkins C, Kushner E, Miyagishima B, Toney C (1999) A visit to the information mall: web searching behavior of high school students *Journal Of The American Society For Information Science* 50(1) pp24 –37

Fidgeon T (2006) *Learning Difficulties and Web Accessibility* Available at: http://www.webcredible.co.uk/user-friendly-resources/web-accessibility/learning-difficulties.shtml (accessed 30.07.10)

Field A (2005) *Discovering Statistics Using SPSS* London: Sage

Fillippatou D, Pumfrey PD (1996) Pictures, titles, reading accuracy and reading comprehension: a research review (1973–95) *Educational Research* 38(3) pp259–91

Finlay WML, Lyons E (2001) Methodological issues in interviewing and using self-report questionnaires with people with mental retardation *Psychological Assessment* 13(3) pp319-335

Finlay WML, Walton C, Antaki C (2008) Promoting choice and control in residential services for people with learning disabilities *Disability and Society* 23(4) pp349–60

Fletcher J, Clayton I (1994) Measuring listening comprehension in adolescents with intellectual disability *Australia and New Zealand Journal of Developmental Disabilities* 19 (1) pp53-59

Florian L (2004) Uses of technology that support pupils with special educational needs In Florian L, Hegarty J (Editors) *ICT and Special Educational Needs: a Tool for Inclusion*, Milton Keynes: Open University Press pp7-20

Forczek E (2011) Metadata and information structure design on websites – towards a web for all *International Journal of Knowledge and Web Intelligence* 2(1) pp3-14

Franck I, Brownstone D (1994) *The Parent's Desk Reference: The Ultimate Family Encyclopedia from Conception to College* New York: Macmillan

Frank GH (1988) Reflections on NoteCards: Seven issues for the next generation of hypermedia systems *Communications of the ACM* 31(7) pp36–852

Fredericks AD (2005) *The Complete Idiot's Guide to Success as a Teacher* New York: Penguin

Frederickson N, Reason R (1995) Discrepancy definitions of specific learning difficulties *Educational Psychology in Practice* 10(4) pp195-205

Freeman E, Clare L, Savitch N, Royan L, Literhland R, Lindsay M (2005) Improving website accessibility for people with early-stage dementia: A preliminary investigation *Aging and Mental Health 9*(5) pp442-448

Friedman B (1996) Value-sensitive design *Interactions 3*(6) pp16-23

Friend M (2005) *Special Education: Contemporary Perspectives for School Professionals* Boston: Pearson Education

George CA (2008) *User-Centred Library Websites: Usability evaluation methods* Oxford: Chandos

Gerber C (undated) *Printable Spelling Lists* Available at: http://home-school.lovetoknow.com/Printable_Spelling_Lists (accessed 09.02.12)

Gittelman MA, Mahabee-Gittens EM, Gonzalez-del-Rey J (2004) Common medical terms defined by parents: Are we speaking the same language? *Pediatric Emergency Care* 20(11) pp754-8

Graham, London pp. 129-144

Grimshaw, S (2007) Electronic books: Children's reading and comprehension *British*

Grove N, Bunning K, Porter J, Morgan M (2000) *See What I Mean: Guidelines to Aid Understanding of Communication by People with Severe and Profound Learning Disabilities* Kidderminster: BILD and Mencap

Gunning R (1952) *The Technique of Clear Writing* New York: McGraw–Hill

Hannus M, Hyönä J (1999) Utilization of illustrations during learning of science textbook passages among low- and high-ability children *Contemporary Educational Psychology* 24(2) pp95-123

Hanson VL (2001) Web access for elderly citizens In *Proceedings of the 2001 EC/NSF workshop on Universal accessibility of ubiquitous computing: providing for the elderly* (WUAUC'01) New York, NY: AMC pp14-18

Harber JN (1983) The effects of illustrations on the reading performance of learning disabled and normal children *Learning Disability Quarterly* 6(1) pp55–60

Harding A (2010) Supporting children and young people with special educational needs *CILIP Library and Information Update,* December 2010 Available at: http://www.anneharding.net/cilip-sen-article.html (accessed 14.06.13)

Hargis G (2000) Readability and computer documentation *ACM Journal of Computer Documentation* 24(3) pp122-131

Harrysson B (2003) *Web Design for Cognitive Accessibility Licentiate Thesis* Lund: Department of Design Sciences, Lund University, Sweden Available at: www.eat.lth.se/Staff/Bjorn/Aktuell%20lic.centrerad.pdf (accessed 10.04.05)

Harrysson B, Svensk A, Johansson GI (2004) How people with developmental disabilities navigate the internet *British Journal of Special Education* 31(3) pp138-142

Harth SC, Thong YH (1995) Parental perceptions and attitudes about informed consent in clinical research involving children *Social Science and Medicine* 41(12) pp1573–1577

Hassell J (2005) *BBCi Standards and Guidelines Accessibility Checklist v0.20* Available at: http://www.bbc.co.uk/guidelines/newmedia/accessibility/

Haupt EJ (1977) Writing and using literal comprehension questions *The Reading Teacher* 31(2) pp193-199

Haworth A, Williams P (2012) Using QR codes to aid accessibility in a museum *Journal of Assistive Technologies* 6(4) pp285-292

Heal LW, Sigelman KC (1995) Response biases in interviews of individuals with limited mental ability *Journal of Intellectual Disability Research* 39(4) pp331–340

Heath C, Hindmarsh J (2002) Analysing Interaction: Video, ethnography and situated conduct. In May, T. (ed.) *Qualitative Research in Action.* London: Sage. pp.99-121

Heron J (1998) *Co-Operative Inquiry: Research into the Human Condition* London: Sage

HMG (Her Majesty's Government) (1995) *Disability Discrimination Act 1995* London: HMSO

HMG (Her Majesty's Government) (1996) *Education Act 1996* London: HMSO

HMG (Her Majesty's Government) (2005) *Mental Capacity Act 2005* London: HMSO

HMG (Her Majesty's Government) (2010) *Equality Act 2010* London: HMSO

HMG (Her Majesty's Government) (2001) *The Special Educational Needs and Disability (SENDA) Act* London: HMSO

Hogg J, Sebba J (1986a) *Profound Retardation and Multiple Impairment Volume 1: Development and Learning* Beckenham: Croom Helm

Hogg J, Sebba J (1986b) *Profound Retardation and Multiple Impairment Volume 2: Education and Therapy* Beckenham: Croom Helm

Holmes JL (2008) Patrons with developmental disabilities: a needs assessment survey *New Library World* 109 (11/12) pp533–545

Holsanova J, Holmberg N, Holmqvist K (2006) Tracing integration of text and pictures in newspaper reading *Lund University Cognitive Studies 125* Available at: *www.lucs.lu.se/LUCS/125/LUCS125.pdf* (accessed 15.11.12)

Hornbaek K (2006) Current practice in measuring usability: challenges to studies and research *International Journal of Human–Computer Studies*, 64(2) pp79–102

Horton S (2005) *Access by Design: A Guide to Universal Usability for Web Designers* San Francisco: New Riders

Houts PS, Doak CC, Doak LG, Loscalzo MJ (2006) The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence *Patient Education and Counseling* 61(2) pp173-90

Hudson R, Weakley R, Firminger P (2005) An accessibility frontier: Cognitive disabilities and learning difficulties. (Paper presented at OZeWAI 2004 Conference, La Trobe University, Melbourne, Australia, 2 December 2004, revised January 2005) Available at: http://usability.com.au/2004/12/an-accessibility-frontier-cognitive-disabilities-and-learning-difficulties-2004/ (accessed 03.04.13)

Hudson RA (1975) The meaning of questions *Language* 51(1) pp1-31

Hult M, Lennung S (1980) Towards a Definition of Action Research: A Note and Bibliography *Journal of Management Studies* 17(2) pp241-250

Hutchinson H, Bederson B, Druin A (2005) The Evolution of the International Children's Digital Library searching and browsing interface *Proceedings of the 2006 Conference on Interaction Design and Children* pp105-112

Hutchinson H, Druin A, Bederson B (2007) Supporting elementary-age children's searching and browsing: Design and evaluation using the international children's digital library *Journal of the American Society of Information Science and Technology* 58(11) pp1618-1630

Hyojung SH, Lee C (2002) Head-free reading of horizontally and vertically arranged texts *Vision Research* 42(10) pp.1325-133

ISO (International Organization for Standardization) (1998) *Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs)-Part 11: Guidance on Usability* Geneva, Switzerland: ISO

Jacko JA, Salvendy G (1996) Hierarchical menu design: breadth, depth and task complexity *Perceptual and Motor skills* 82(3) pp1187-1201

Jacko JA, Salvendy G, Koubek RJ (1995) Modeling of menu design in computerized work *Interacting With Computers* 7(3) pp304-330

Jarvelin K, Vakkari J (1992) The evolution of information science 1965–1985: a content analysis of journal

Jiwnani K (2001) *Designing for Users with Cognitive Disabilities* Available at: http://www.otal.umd.edu/uupractice/cognition/ (accessed 09.08.09)

Johnstone CJ, Bottsford-Miller NA, Thompson SJ (2006) *Using the Think Aloud Method (Cognitive Labs) to Evaulate Test Design for Students with Disabilities and English Language Learners (Technical Report 44)* Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes Available at: http://www.cehd.umn.edu/nceo/OnlinePubs/Tech44/ (accessed 26.10.11)

Jones FW, Long K, Finlay W (2007) Symbols can improve the reading comprehension of adults with learning disabilities *Journal of Intellectual Disability Research* 51 (7) pp545-550

Journal of Educational Technology, 38(4) pp.583-599

Kaehne A (2009) Choice for young people with learning disabilities in post-education transition *Mental Health Review Journal* 14(2) pp37-43

Kaehne A, Beyer S (2008) Carer perspectives on the transition of young people with learning disabilities to employment *Journal of Developmental Disabilities* 14(1) pp95-104

Kagolovsky Y, Moehr JR (2003) Terminological Problems in Information Retrieval *Journal of Medical Systems*, 27(5) pp.399-408

Kalyuga S, Chandler P, Sweller J (1998) Levels of expertise and instructional design *Human Factors* 40(1) pp1-17

Kaplan S, Alsup R (1995) Participatory action research: A creative response to AIDS prevention in diverse communities *Convergence* 28(1) pp38-55

Karreman J, van der Geest V, Buursink E (2007) Accessible website content guidelines for users with intellectual disabilities *Journal of Applied Research in Intellectual Disabilities* 20(6) pp510-518

Keevil B (1998) Measuring the usability index of your website *Proceedings of the 16th Annual International Conference on Computer Documentation, SIGDOC* pp271–277

Kelly B, Nevile L, Sloan D, Fanou S, Ellison R, Herrod L (2009) From web accessibility to web adaptability *Disability and Rehability: Assistive Technology* 4(4) pp212 – 226

Kennedy H (2008) New media's potential for personalization *Information Communication and Society* 11(3) pp307-325

Kiernan C (1999) Participation in research by people with learning disability: Origins and issues *British Journal of Learning Disabilities 27*(2) pp43-47

King A (1993) From sage on the stage to guide on the *side College Teaching* 41(1) pp30-35

Kintsch W (1988) The role of knowledge in discourse comprehension: a construction-integration model *Psychological Review* 95(2) pp163–182

Krathwohl DR (2002) A revision of bloom's taxonomy: An overview *Theory into Practice* 41(4) pp212-218

Krosnick JA, Holbrook AL, Berent MK, Carson RT, Hanemann WM, Kopp RJ, Mitchell RC, Presser S, Ruud PA, Smith VK, Moody WR, Green MC, Conaway M (2002) The impact of "no opinion" response options on data quality: Non-attitude reduction or an invitation to satisfice? *Public Opinion Quarterly* 66(3) pp371-403

Krug S (2006) *Don't Make Me Think: A Common Sense Approach to Web Usability* Berkeley, CA: New Riders Press 2nd Edition

Kuhlthau CC (1993) A principle of uncertainty for information seeking. *Journal of Documentation* 49 (4) pp.339-355.

Kuhlthau, C (2006). Kuhlthau's Information Search Process, in Fisher KE, Erdelez S, McKechnie L (Eds.)*Theories of Information Behavior* New Jersey: Information Today pp.230–234.

Laarni J, Simola J, Kojo I, Näsänen R (2004): Reading vertical text from a computer screen *Behaviour and Information Technology* 23(2) pp75-82

Large A, Beheshti J, Breuleux A (1998) Information seeking in a multimedia environment by primary school students *Library and Information Science Research* 20(4) pp343-376

Larson LC (2010) Digital readers: The next chapter in e-book reading and response

Last JM (1988) *A Dictionary of Epidemiology* Oxford: Oxford University Press

Lawton A (2006) *A Voice of Their Own: A toolbox of Ideas and Information for Non-Instructed Advocacy* Kidderminster: BILD Publications

LDAA (Learning Disabilities Association of America) (2010) *Symptoms of Learning Disabilities* Available at: http://www.ldaamerica.org/aboutld/teachers/understanding/symptoms.asp (accessed 26.09.10)

Lehman JP, Davies TG, Laurin KM (2000) Listening to student voices about postsecondary education *Teaching Exceptional Children* 32(5) pp60–65

Lepisto A, Ovaska S (2004) Usability evaluation involving participants with cognitive disabilities *NordiCHI '04 Third Nordic Conference on Human-Computer Interaction* Tampere, Finland ACM Press: pp305-308

Lerner J, Johns B (2009) *Learning Disabilities and Related Mild Disabilities: Characteristics, Teaching Strategies, and New Directions* Singapore: Cengage Learning 11th Edition

Lewis A, Newton H, Vials S (2008) Realising child voice: the development of cue cards *Support for Learning* 23(1) pp26-31

Lewis A, Porter J (2004) Interviewing children and young people with learning disabilities *British Journal of Learning Disabilities 32*(4) pp191-197

Lewis C, Sullivan J, Hoehl J (2009) Mobile Technology for People with Cognitive Disabilities and Their Caregivers – HCI Issues In Stephanidis C (Editor) *Universal Access in Human-Computer Interaction: Addressing Diversity 5th International Conference, UAHCI 2009, Held as Part of HCI International 2009, San Diego, CA, USA, July 19-24, 2009 Proceedings, Part I* Berlin Heidelberg: Springer (Lecture Notes in Computer Science series) pp385-394

Library and Information Professionals) (2011) *CILIP Public Libraries briefing : Key facts about public libraries* Available at: http://www.cilip.org.uk/get-involved/advocacy/public-libraries/Documents/Public_libraries_briefing_CILIP_March2011.pdf (accessed 14.06.13)

Ling C, Salvendy G (2009) Effect of evaluators' cognitive style on heuristic evaluation: Field dependent and field independent evaluators *International Journal of Human-Computer Studies* 67(4) pp382-393

Ling J, van Schaik P (2006) The influence of font type and line length on visual search and information retrieval in web pages *International Journal of Human-Computer Studies* 64 pp395–404

Lloyd V, Gatherer A, Kalsy S (2003) Conducting qualitative interview research with people with expressive language difficulties *Qualitative Health Research* 16(10) pp1386-404

Loh CS, Williams MD (2002) What's in a website? Student perceptions *Journal of Research on Technology in Education* 34(3) pp351-363

Loranger H, Nielsen J (2006) *Prioritizing Web Usability* Berkeley CA: New Riders

Lowrance WW (2002) *Learning from Experience* London: The Nuffield Trust

Lui M, Read W (1994) The relationship between the learning strategies and learning styles in a hypermedia environment *Computers in Human Behaviour* 10(4) pp419-434

Lyons J (1995) *Lingustic Semantics: An Introduction* Cambridge: Cambridge University Press

MacFarlane A, Al-Wabil A, Marshall C, Jones A, Albrair A, Zaphiris P (2010) The effect of dyslexia on information retrieval: A pilot study *Journal of Documentation* 66(3) pp307-326

MacFarlane A, Marshall CM, Buchanan G, Albrair A (2012). Phonological working memory impacts on information searching: An investigation of dyslexia. *Proceedings of IIiX 2012 the Fourth Information Interaction in Context Symposium,* pp.27-34.

Madden AD, Ford NJ, Miller D, Levy P (2006) Children's use of the internet for information-seeking *Journal of Documentation* 62(6) pp744-761

Mansoor LE, Dowse R (2003) Effect of pictograms on readability of patient information materials *Annals of Pharmacotherapy* 37(7) pp1003–9

Marchionini GM (1995) *Information Seeking in Electronic Environments.*Cambridge: Cambridge University Press

Mariger H (2006) *Cognitive Disabilities and the Web: Where Accessibility and Usability Meet* Available at: http://ncdae.org/tools/cognitive/ (accessed 14.12.09)

Matausch K, Peboeck B (2010) EasyWeb – A study of how people with specific learning difficulties can be supported on using the internet In Miesenberger K, Klaus J, Zagler W *Computers Helping People with Special Needs 12th International Conference, ICCHP 2010, Vienna, Austria, July 14-16, 2010, Proceedings* pp641-648

McCarthy J, Swierenga S (2010) What we know about dyslexia and web accessibility: a research review *Universal Access in the Information Society* 9(2) pp147-152

McLaughlin GH (1969) SMOG Grading — a new readability formula *Journal of Reading* 12 (8) pp639–646

Meisenberg G, Williams A (2008) Are acquiescent and extreme response styles related to low intelligence and education? *Personality and Individual Differences*, 4497) pp1539-1550

Mencap (2005) *What is a Learning Disability?* Available at: http://www.mencap.org.uk/html/about_learning_disability/what_is_learning_disability.htm (accessed 08.07.09)

Mencap (undated) Making Your Website Accessible for People with a Learning Disability Available at: www.mencap.org.uk/download/webaccess.pdf (accessed 26.07.07 - now at: www.intrasolutions.co.uk/website_accessibility.pdf - accessed 20.10.11)

Michielutte R, Bahnson J, Digman MB, Schroeder E (1992) The use of illustrations and narrative text style to improve readability of a health education brochure *Journal of Cancer Education* 7(3) pp251–60

Miles WR, Shen E (1925) Photographic recording of eye movements in the reading of Chinese in vertical and horizontal axes: Method and preliminary results *Journal of Experimental Psychology* 8(5) pp344-362

Mills CB, Weldon LJ (1987) Reading test from computer screens *ACM Computing Surveys* 19 (4) pp329-358

Minnion A, Staples P, Singh R, Williams P (2008) *Beyond the Road Ahead* London: University of East London Report submitted to the Social Care Institute of Excellence

Minnion A, Williams P, Kennedy H, Bunning K (2006) *Project @pple: e-learning and the World Wide Web* Report submitted to the ESRC PACCIT Programme

Mintz J, Branch C, March C, Lerman S (2012) Key factors mediating the use of a mobile technology tool designed to develop social and life skills in children with Autistic Spectrum Disorders *Computers and Education*, *58*(1) pp53-62

Mirchandani N (2003) Web accessibility for people with cognitive disabilities: Universal design principles at work! *Research Exchange 8*(3) Available at: http://www.ncddr.org/products/researchexchange/v08n03/8_access.html (accessed 03.04.13)

Moll J (1986) Doctor-patient communication in rheumatology: studies of visual and verbal perception using educational booklets and other graphic material *Annals of Rhuematic Disease* 45(3) pp198-209

Monk AG, Wright P(1993) *Improving Your Human–Computer Interface: A Practical Technique* London: Prentice Hall

Morris J (2001) Social exclusion and young disabled people with high levels of support needs *Critical Social Policy* 21(2) pp161-183

Morris J (2002) *Young Disabled People Moving into Adulthood* York: Joseph Rowntree Foundation

Morrow DG, Hier CM, Menard WE, Leirer VO (1998) Icons improve older and younger adults' comprehension of medication information *Journal of Gerontology: Psychological Sciences* 53(4) pp240–P254

Moser C (Chair) (1999) *A Fresh Start - Improving Literacy and Numeracy* London: HMSO Available at: http://www.lifelonglearning.co.uk/mosergroup/ (accessed 10.08.10)

Moss T (2006) *WCAG 2.0: The New W3C Accessibility Guidelines Evaluated* Available at: http://www.webcredible.co.uk/user-friendly-resources/web-accessibility/wcag-guidelines-20.shtml (accessed 23.05.12)

Murphy J (1997) *Talking Mats: a Low-Tech Communication Resource to Help People Express Their Views and Feelings* Stirling: University of Stirling

Murphy J, Cameron L (2002) Let your mats do the talking *Speech and Language Therapy in Practice* Spring pp18-20

Muter P, Maurutto P (1991) Reading and skimming from computer screens and books: The paperless office revisited? *Behaviour and Information Technology* 10(4) pp257-266

My Learning UK (undated) *About Widgit* Available at: http://www.mylearningltd.co.uk/view/partner-widgit/ (accessed 05.10.12)

Myung R (2003) Conjoint analysis as a new methodology for Korean typography guideline in Web environment *International Journal of Industrial Ergonomics* 32(5) pp341-348

Nicholas D, Dobrowolski T, Withey R, Russell C, Huntington P, Williams P (2003) Digital information consumers, players and purchasers: information seeking behaviour in the new digital interactive environment *Aslib Proceedings* 55 (1-2) pp23-31

Nicholas D, Herman E (2009) *Assessing information needs in the age of the digital consumer* Abingdon: Taylor & Francis

Nicholas D, Huntington P, Jamali HR, Watkinson A (2006) The information seeking behaviour of the users of digital scholarly journals *Information Processing and Management* 42(5) pp1345-1365

Nicholas D, Huntington P, Watkinson A (2003) Digital journals, big deals and online searching behaviour: a pilot study *Aslib Proceedings* 55 (1/2) 84-109

Nicholas D, Huntington P, Watkinson A (2005) Scholarly journal usage: the results of deep log analysis *Journal of Documentation* 61(2) pp248-280

Nicholas D, Huntington P, Williams P, Dobrowolski T (2004) Re-appraising information seeking behaviour in a digital environment: bouncers, checkers, returnees and the like *Journal of Documentation* 60(1) pp24-43

Nicholas D, Huntington P, Williams P, Gunter B (2002b) Digital visibility: menu prominence and its impact on use of the NHS Direct information channel on Kingston Interactive Television *Aslib Proceedings* 54(4) pp213-221

Nicholas D, Rowlands I, Clarke D, Williams P (2011a) Google Generation II: web behaviour experiments with the BBC *Aslib Proceedings* 63(1) pp28-45

Nicholas D, Rowlands I, Williams P, Brown D, Clark D (2011b) *E-journals, Their Use, Value and Impact* London: RIN

Nielsen J (1990) *Hypertext and Hypermedia* San Diego, CA: Academic Press

Nielsen J (1994a) Heuristic evaluation In Nielsen J, Mack R *Usability Engineering Methods* London: Wiley pp25–62

Nielsen J (1994b) Report From a 1994 *Web Usability Study* Available at: http://www.useit.com/papers/1994_web_usability_report.html (accessed 25.02.09)

Nielsen J (1996) *Top Ten Mistakes in Web Design* Available at: http://www.useit.com/alertbox/9605.html (accessed 21.01.09)

Nielsen J (2003) Usability 101: introduction to usability *Alertbox* Available at: http://www.useit.com/alertbox/20030825.html (accessed 20.09.11)

NOCN (National Open College Network) (2010) *Qualifications Guide: NOCN Entry Level Certificate in Adult Literacy (Including Spoken Communication)* Available at: http://www.nocn.org.uk/document/6476 (accessed 07.11.11)

Norlin D (1995) Helping adults with mental retardation satisfy their information needs In Walling LL, Irwin MM (Editors) *Information Services for People with Developmental Disabilities: The Library Manager's Handbook* Westport, CT: Greenwood Press pp181-1995

Ojanpää H, Näsänen R, Kojo I (2002) Eye movements in the visual search of word lists *Vision Research* 42(12) pp1499 – 1512

Oliver M (1990) *The politics of Disablement* London: MacMillan

Oliver M (1992) Changing the social relations of research production *Disability Handicap and Society* 7(2) pp101-115

Oliver M (1996) *Understanding Disability, from Theory to Practice* London: Macmillan

O'Sullivan T (2001) *Young Adults Transition Project: Draft Summary,* London: Optimum Health Services NHS Trust (now Community Health South London NHS Trust)

Oztekin A, Kong ZJ, Uysal O (2010) UseLearn: A novel checklist and usability evaluation method for eLearning systems by criticality metric analysis *International Journal of Industrial Ergonomics* 40(4) pp455-469

Pack T (2003) Fiddling with the internet dials: understanding usability *Online* 27(2) p36

Pallant J (2007) *SPSS Survival Manual* Milton Keynes: Open University Press (3rd Edition)

Pavio A (1986) *Mental Representations: A Dual Coding Approach* New York: Oxford University Press

Pearson E, Koppi T (2003) Developing inclusive practices: Evaluation of a staff development course in accessibility *Australian Journal of Educational Technology* 19(3) pp275-292 Available at: http://www.ascilite.org.au/ajet/ajet19/pearson.html (accessed 24.04.10)

Pearson M, Flynn M, Maugham J Russell P (undated) *Positive Health in Transition. A Guide to Effective and Reflective Transition Planning for Young People with Learning Disabilities* Manchester: National Development Team

Peck W (2003) *Great Web Typography* Indiana: Wiley Publishing

Pedley M (2006) *Designing for Dyslexics: Part 2 of 3* Available at: http://accessites.org/site/2006/11/designing-for-dyslexics-part-2-of-3/ (accessed 01.04.13)

Perry J, Felce D (2002) Subjective and objective quality of life assessment: Responsiveness, response bias and resident proxy concordance *Mental Retardation* 40(6) pp445-456

Peters T (2010) The future of reading Library Journal Newsletter, November 1, 2010

Peterson BS, Pine DS, Cohen P, Brook JS (2001) Prospective, longitudinal study of tic, obsessive-compulsive, and attention-deficit/hyperactivity disorders in an epidemiological sample *Journal of the American Academy of Child and Adolescent Psychiatry* 40(6) pp685–695

PHGF (Public Health Genetics Foundation) (2007) *A Descriptive Summary of the Epidemiological and Molecular Characteristics of Learning Disability* Available at: http://phgu.org.uk/file_gateway?file_ID=643 (accessed 07.08.08)

Pilnick A, Clegg J, Murphy E, Almack K (2010) Questioning the answer: Questioning style, choice and self-determination in interactions with young people with intellectual disabilities *Sociology of Health and Illness* 32(3) pp415-436

Piolat A, Roussey JY, Thunin O (1998) Effects of screen presentation on text reading and revising *International Journal of Human Computer Studies* 47(4) pp565-589

Poncelas A, Murphy G (2007) Accessible Information for People with Intellectual Disabilities: Do Symbols Really Help? *Journal of Applied Research in Intellectual Disabilities* 20(5) pp466–474

Porter JM, Lacey PJ (2005) *Researching Learning Difficulties* London: Paul Chapman

Pottker H (2003) News and its communicative quality: the inverted pyramid—when and why did it appear? *Journalism Studies* 4(4) pp501-511

Powell AT (2002) *Web design: The Complete Reference* Osborne: McGraw-Hill (2nd Edition)

Presland JL (1991) Problem behaviours and people with profound and multiple handicaps *Mental Handicap* 19 pp66-72

Proud D (2008) Acting on inclusion *Inclusion Now* 20 Available at: http://www.allfie.org.uk/pages06/articles/vol20.html#proud (accessed 04.12.11)

Quesenbery W (2002) *What Does Usability Mean: Looking Beyond 'Ease of Use'* Available at: http://www.wqusability.com/articles/more-than-ease-of-use.html (accessed 14.09.10)

Rapley M, Antaki C (1996) A conversation analysis of the acquiescence of people with learning disabilities *Journal of Community and Applied Social Psychology* 6(3) pp207-227

Readance JE, Moore DW (1981) A meta-analytic review of the effect of adjunct pictures on reading comprehension *Psychology in the Schools* 18(2) pp218–24

Redmond M (2005) Co-researching with adults with learning disabilities: roles, responsibilities and boundaries *Qualitative Social Work*, *4*(1) pp75-86

Riddell S, Baron S, Wilson A (2001) *The Learning Society and People with Learning Difficulties*, Bristol: Policy Press

Rix Centre (2012) *Welcome to the Rix Centre* Available at: http://www.rixcentre.org/ (accessed 18.04.12)

Robertson SE (2008). On the history of evaluation in IR. *Journal of Information Science*, 34(4) pp.439–456.

Rocha T, Bessa M, Gonçalves M, Cabral L, Godinho F, Peres E, Reis MC, Magalhães L, Chalmers A. (2012) The Recognition of Web Pages' Hyperlinks by People with Intellectual Disabilities: An Evaluation Study *Journal of Applied Research in Intellectual Disabilities* 25(6) pp.542–552

Rogers J (1999) Trying to get it right: undertaking research involving people with learning difficulties *Disability and Society* 14(4) pp421–33

Rolph J (2000) *The History of Community Care for People with Learning Difficulties in Norfolk 1930-1980* Milton Keynes: Open University (unpublished PhD thesis)

Rose J (2009) *Identifying and Teaching Children and Young People with Dyslexia and Literacy Difficulties; An independent report from Sir Jim Rose to the Secretary of State for Children, Schools and Families* London: Department for Education Available at: https://www.education.gov.uk/publications/standard/Download?DownloadPublicationReference=DCSF-00659-2009&DownloadItemReference=Identifying%20and%20Teaching%20Children%20and%20Young%20People%20with%20Dyslexia%20and%20Literacy%20Difficu

lties%20PDF(DfES%20Online%20Store)&DocumentType=PDF&Url=%2Fpublications%2FeOrderingDownload%2F00659-2009DOM-EN.pdf (accessed 01.12.12)

Rosenbaum SE, Glenton C, Cracknell J (2008) User experiences of evidence-based online resources for health professionals: User testing of The Cochrane Library *BMC Medical Informatics And Decision Making* 8, Article number 34 Available at: http://www.biomedcentral.com/1472-6947/8/34 (accessed 23.07.10)

Rotondi AJ, Sinkule J, Haas GL, Spring MB, Litschge (Sarteschi) CM, Newhill CE, Ganguli R, Anderson CA (2007) Designing websites for persons with cognitive deficits: Design and usability of a psychoeducational intervention for persons with severe mental illness *Psychological Services* 4(3) pp202-224

Rowland C (2004) *Cognitive Disabilities Part 2: Conceptualising Design Considerations* Available at: http://www.webaim.org/techniques/articles/conceptualize/ (accessed 16.07.09)

Rudnicky AI, Kolers PA (1984) Size and case of type as stimuli in reading *Journal of Experimental Psychology in Human Perception and Performance* 10(2) pp231-249

Rutter S (2002) *Down's Syndrome* Available at: http://www.intellectualdisability.info/diagnosis/downs-syndrome (accessed 27.03.13)

Sabaratnam M, Thakker Y (2011) Fragile-X Syndrome Available at: http://www.intellectualdisability.info/diagnosis/downs-syndrome (accessed 27.03.13)

Sample P (1996) Beginnings: participatory action research and adults with developmental disabilities *Disability and Society* 11(3) pp317-332

Scott J, Wishart J, Bowyer D (2006) Do current consent and confidentiality requirements impede or enhance research with children with learning disabilities? *Disability and Society* 21(3) pp273-287

SEDL (Southwest Educational Development Laboratory) (2003) Web accessibility for people with cognitive disabilities: Universal design principles at work *Southwest Educational Development Laboratory (SEDL) Research Exchange Newsletter 8*(3) Available at: http://www.ncddr.org/du/researchexchange/v08n03/8_access.html (accessed 04.12.10)

Seely J (2009) *Oxford A-Z of Grammar and Punctuation* Oxford: OUP

Seeman L (2006) *Formal Objection to WCAG 2.0* Accessible at: http://lists.w3.org/Archives/Public/w3c-wai-gl/2006AprJun/0368.html (accessed 19.09.11)

Sevilla J, Herrera G, Martinez B, Alcantud F (2007) Web accessibility for individuals with cognitive deficits: A comparative study between an existing commercial web and its cognitively accessible equivalent *ACM Transactions on Computer-Human Interaction 14*(3) pp1-23

Shackel B (1991) Usability—context, framework, definition, design and evaluation In Shackel B, Richardson S (Editors) *Human Factors for Informatics Usability* Cambridge: Cambridge University Press pp21–38

Shamir A, Margalit M (2011) Technology and students with special educational needs: new opportunities and future directions *European Journal of Special Needs Education* 26(3) pp279-282

Shneiderman B (1998) *Designing the User Interface: Strategies for Effective Human–Computer Interaction* Menlo Park, CA: Addison Wesley (3rd Edition)

Shneiderman B (2000) Universal usability *Communications of the ACM* 43(5) pp84-91

Sidman M (1990) Equivalence relations: where do they come from? In Blackman DE, Lejeune H (Editors) *Behavior Analysis in Theory and Practice: Contributions and Controversies* Hillsdale, NJ: Erlbaum pp93–114

Sigelman CK, Budd EC, Spanhel CL, Schoenrock CJ (1981) When in doubt, say yes: Acquiescence in interviews with mentally retarded persons *Mental Retardation* 19(2) pp53–58

Singh S, Domonkos T, Rho Y (1998) Enhancing comprehension of web information for users with special linguistic needs *Journal of Communication* 48 (2) pp86-108

Singleton CH (2009) *Visual stress and dyslexia* In Reid G (Editor) The Routledge Companion to Dyslexia London: Routledge pp43-57

Small J, Schallau P, Brown K, Appleyard R (2005) Web accessibility for people with cognitive disabilities In van der Veer G *CHI '05 Extended Abstracts on Human Factors in Computing Systems. CHI EA '05* New York, NY: ACM pp1793-1796

Souza *A,* Ramcharan P (1997) Everything you ever wanted to know about Down's Syndrome … but never bothered to ask In Ramcharan P, Roberts G, Grant G, Borland J *Empowerment in Everyday Life* London: Jessica Kingsley pp194-220

Spärck-Jones K, Willett P (1997). *Readings in information retrieval*. San Francisco, CA: Morgan Kaufmann Publishers, Inc.

Summers K, Summers M (2005) Reading and navigational strategies of web users with lower literacy skills *ASIS and T Proceedings, Oct 2005 Charlotte, NC* Available at: http://iat.ubalt.edu/summers/papers/Summers_ASIST2005.pdf (accessed 30.11.12)

Sutcliffe A, Fickas S, Sohlberg MM, Ehlhardt LA, (2003) Investigating the usability of assistive user interfaces *Interacting with Computers*15(4) pp577-602

Sweller J (1988) Cognitive load during problem solving: Effects on learning *Cognitive Science*, 12(1) pp257–285

Sweller J, Van Merrienboer J, Paas F (1998) Cognitive architecture and instructional design *Educational Psychology Review* 10(3) pp251–296

Swindon People First (2002) *Journey to Independence: Direct Payments for People with Learning Disabilities* Report to BILD Swindon: People First

Tabachnick GG, and Fidell LS (2007) *Experimental Designs Using ANOVA* Belmont, CA: Duxbury

Taber-Doughty T (2005) Considering student choice when selecting instructional strategies: a comparison of three prompting systems *Research in Developmental Disabilities* 26(5) pp411–432

Tarleton B (2004) *The Road Ahead? Information for Young People with Learning Difficulties, Their Families and Supporters at Transition,* Bristol: Norah Fry Research Centre, University of Bristol

Test DW, Fowler CH, Wood WM, Brewer DM, Eddy S (2005) A conceptual framework of self-advocacy for students with disabilities *Remedial and Special Education 26*(1) pp43-54

Thatcher J (2004) *508 Web Accessibility* Available at: http://www.jimthatcher.com/webcourse1.htm (accessed 20.09.11)

The Reading Teacher, 64(1) pp.15-22

Theofanos MF, Mulligan CP, Redish JC (2004) Peak performance: Redesigning the portal of the Department of Health and Human Services *User Experience* 3(6) pp4-7

Thomas D, Woods H (2003) *Working With People With Learning Disabilities: Theory And Practice* London: Jessica Kingsley

Tinker M (1955) Perceptual and oculomotor efficiency in reading materials in vertical and horizontal arrangements *American Journal of Psychology* 68(3) pp444 – 449

Tinker M (1963) *Legibility of Print* Ames, IA: Iowa State University Press

Townsley R (2004) *The Road Ahead? Literature Review: What Does the Literature Tell us About the Information Needs of Young People with Learning Difficulties and Their Families at Transition?* Bristol: Norah Fry Research Centre University of Bristol

Tractinsky N, Katz AS, Ikar D (2000) What is beautiful is usable *Interacting with Computers* 13(2) pp127–145

Tuffrey-Wijne I, Bernal J, Jones A, Butler G, Hollins S (2006) People with intellectual disabilities and their need for cancer information *European Journal of Oncology Nursing*, 10(2) pp106-116

Tullis T (2005) Web-based presentation of information: The top ten mistakes and why they are mistakes *HCI International 2005 Conference Proceedings Las Vegas, Nevada, USA, July 22-27, 2005* Available at:

http://www.eastonmass.net/tullis/presentations/WebInfoPresentation.pdf (accessed 01.10.12)

Tullis TS, Boynton JL, Hersh H (1995) Readability of fonts in the windows environment *CHI'95 Conference Proceedings - Extended Abstracts* pp127-128

Tullis TS, Fleischman S (2002) *The Latest Word on Fonts for the Web* Available at: http://www.eastonmass.net/tullis/publications/fonts.htm (accessed 16.01.12)

van Schaik P, Ling J (2003) The effects of screen ratio and order on information retrieval in web pages *Displays* 24 (4-5) pp187–195

Van Someren MW, Barnard YF, Sandberg JAC (1994) *The Think-Aloud Method: A Practical Guide to Modeling Cognitive Processes* San Diego, CA: Academic Press Ltd

VanReusen AK, Bos CS, Schumaker JB, Deshler DD (1994) *The Self-Advocacy Strategy for Education and Transition Planning* Lawrence, KS: Edge Enterprises

Vygotsky L (1978) *Mind in Society: The Development of Higher Psychological Processes* Cambridge: Harvard University Press

W3C (World Wide Web Consortium) (2006) *Web Content Accessibility Guidelines 2.0 Appendix A: Glossary (Normative)* Available at: http://www.w3.org/TR/2006/WD-WCAG20-20060427/appendixA.html (accessed 26.09.11)

W3C (World Wide Web Consortium) (2011) *How People with Disabilities Use the Web:* http://www.w3.org/WAI/intro/people-use-web/diversity

W3C (World Wide Web Consortium) (1999) *Web Content Accessibility Guidelines 1.0* Available at: http://www.w3.org/TR/WAI-WEBCONTENT/ (accessed 26.09.11)

W3C (World Wide Web Consortium) (2008) *Web Content Accessibility Guidelines (WCAG) 2.0 W3C Recommendation 11 December 2008* Available at: http://www.w3.org/TR/WCAG/ (accessed 19.09.11)

Walmsley J (2001) Normalisation, emancipatory research and learning disability *Disability and Society* 16(2) pp187–205

Walmsley J, Johnson K (2003) *Inclusive Research with People with Learning Disabilities: Past, Present and Futures* London: Jessica Kingsley

Ward L, Heslop P, Mallett, R Simons, K (2003) Transition: the experiences of young people with learning disabilities and their families in England *Tizard Learning Disability Review* 8(4) pp19-28

Ware J (1996) *Creating Responsive Environments for People with Profound Learning and Multiple Disabilities* London: David Fulton

Warnock M (Chair) (1978) *Special Educational Needs: Report of the Committee of Enquiry into the Education of Handicapped Children and Young People* London: HMSO

Webcredible (2005) *Website Content and Usability* Available at: http://www.webcredible.co.uk/user-friendly-resources/web-usability/web-content.shtml (accessed 14.09.08)

Wehmeyer ML (1999) Assistive technology and students with mental retardation: utilization and barriers *Journal of Special Education Technology* 14 (1) p48.

Westwood P (2008) *A Parent's Guide to Learning Difficulties: How to Help Your Child* Melbourne: ACER Press

Whittington JE, Holland AJ (2004) *Prader-Willi Syndrome: Development and Manifestations* Cambridge: Cambridge University Press

WHO (World Health Organisation) (1992) *The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines* Geneva: WHO Available at: http://www.who.int/classifications/icd/en/bluebook.pdf (accessed 03.04.13)

Whyte WF, Greenwood DJ, Lazes P (1989) Participatory action research: Through practice to science in social research *American Behavioral Scientist* 32 pp513-551

Widgit (undated) *About Widgit* Available at: http://www.widgit.com/aboutus.htm (accessed 24.07.12)

Wilkinson S, Payne S (2006) Eye tracking to identify strategies used by readers seeking information from on-line texts In *Proceedings of the 13th European conference on Cognitive ergonomics: trust and control in complex socio-technical systems* (ECCE '06) New York, NY: ACM pp115-116

Williams C, Peters SU, Calculator S (2009) *Facts About Angelman Syndrom* Available at: http://www.angelman.org/_angelman/assets/File/facts%20about%20as%202009%203-19-10.pdf (accessed 27.03.13)

Williams P (2006) Developing methods to evaluate web usability with people with learning difficulties *British Journal of Special Education* 33 (4) pp173-179

Williams P (2008) Transition and people with learning disabilities: Reflections on the quality of content that emerges from the process of involving service-users in information provision *Aslib Proceedings* 60(5) pp474-492

Williams P (2011) Barriers to the creation and use of an accessible web portal for people with learning disabilities *International Journal of Education* 3(2) e21 Available at: http://www.macrothink.org/journal/index.php/ije/article/view/1283 (accessed 02.04.13)

Williams P, Hanson-Baldauf D (2010) Testing a web information portal for people with learning disabilities *Journal of Research in Special Educational Needs* 10(1) pp42-51

Williams P, Jamali HR, Nicholas D (2006) Using ICT with people with special educational needs: What the literature tells us *Aslib Proceedings* 58(4) pp330-345

Williams P, Madle G, Weinberg J, Kostova P, Mani-Saada J (2004) Information for the public about disease: Usability issues in the development of the National Electronic Library for Communicable Diseases *Aslib Proceedings* 56(2) pp99-103

Williams P, Nicholas D (2001) Navigating the news net: How news consumers read the electronic version of a daily newspaper *Libri* 51(1) pp8-16

Williams P, Nicholas D (2006) Testing the usability of information technology applications with learners with special educational needs *Journal of Research in Special Educational Needs* 6(1) pp31-41

Williams P, Nicholas D, Huntington P, McClean F (2002) Surfing for health: user evaluation of a health information website Part 2 - fieldwork *Health Information and Libraries Journal* 19(4) pp214-225

Williams V (1999) Researching together *British Journal of Learning Disabilities* 27(2) pp48-51

Williams V, St Quintin P, Hoadley S (2006) 'Take your partners': reflections on a partnership project in learning disability research *Action Research* 4(3) pp295-314

Williamson K, Wright S, Schauder D, Jenkins L, Stillman L (2000), "Levelling the playing field: the role of libraries in providing online services for people with disabilities", *ALIA(Australian Library and Information Association) 2000 Proceedings*, ERIC Document 452881, available at: http://conferences.alia.org.au/alia2000/proceedings/kirsty.williamson.html (accessed 14.06.13)

Wilson RF (2001) *HTML E-Mail: Text Font Readability Study* Available at: http://www.wilsonweb.com/wmt6/html-email-fonts.htm (accessed 12.01.08)

Wilson TD (1997) Information Behaviour: An Interdisciplinary Perspective *Information Processing & Management,* 33(4) pp. 551-572.

Wilson TD (1997). Information behaviour: an inter-disciplinary approach. *Information Processing and Management*,33(4) pp.551-572

Wissick CA (1996) Enhancing instruction for students with learning disabilities *Journal of Learning Disabilities* 29(5) pp494-503

Witkin HA, Moore C, Goodenough DR, Cox PW (1977) Field dependent and field independent cognitive styles and their educational implications *Review of Educational Research* 47 (1) pp1–64

Yau N (2013) State of the Union address decreasing reading level Available at: http://flowingdata.com/2013/02/12/state-of-the-union-address-decreasing-reading-level/ (accessed 02.04.13)

Yu BM, Roh RH (2002) The effects of menu design on information-seeking performance and user's attitude on the World Wide Web *Journal Of The American Society For Information Science And Technology* 53(11) pp923–933

Yu D, Park H, Gerold D, Legge GE (2010) Comparing reading speed for horizontal and vertical English text *Journal of Vision* (2010) 10(2) pp1–17

Zentel P, Opfermann M, Krewinkel J (2007) Multimedia learning and the Internet: Ensuring accessibility for people with learning disabilities *Journal of Assistive Technologies* 1(1) pp22-33

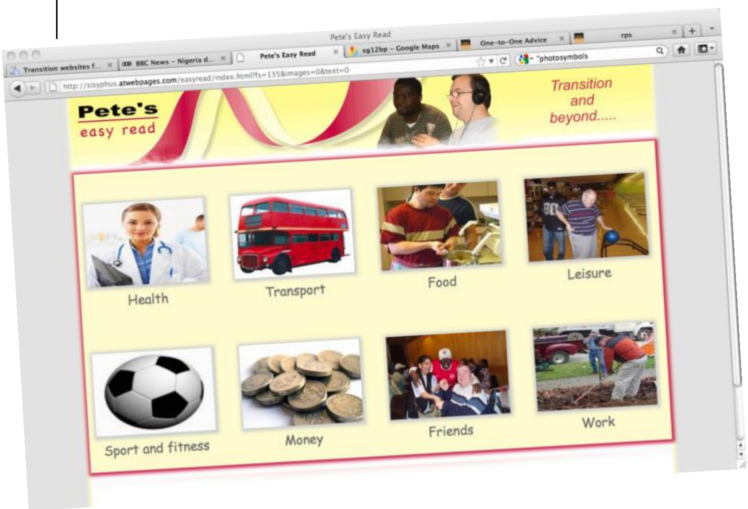
Appendix 1: Accessible information sheet

The information sheet shown below is the last one used on the project. Earlier versions used a screenshot of Newham Easy Read, and a version for Study Two, which required participants activating an audio link, specifically mentioned 'sound'. The sheet was projected onto a screen via a data projector at most locations and read with participants in a group, and also individually. Note that due to these introductory notes, the page break in the sheet is not the same, and the wider margins of the current document have caused a slight resizing and positioning of the text and pictures.

Pete's Web Project

What is it about?

It is about the best way to show a web page, to make it easier for people to find information and to move from page to page.



If I take part, what will I do?

First, I will sit with you and ask you about your computer use.

Next I will show you some web pages. I will ask you to find some information on each page.

I will also as which pages you like, and why.

I won't be testing YOU. It is the website we are testing!

Do I have to take part?

I hope you will, but is your choice! If you say 'no' that's fine. Even if you say YES, You can still say NO later.

What happens when the project ends?

The project will end in December. I hope to be able to say which is the best web page design by then.

Will you write about me?

I may write what you tell me, but I will not put your name into my report.

How can I get more information?

You can ask your teacher, carer or parent to contact me for you, or you can email me yourself:
peter.williams@ucl.ac.uk

If you would like to take part, please sign below. If not – don't worry, that's fine.

My name:
Today's date:

Appendix 2: set-task questions used

Subject menu page questions

The following are the questions asked once the subject or topic had been chosen from the main (grid) menu as shown in Figure 9.

Task no.	Topic & subtopic	Question	Answer phrase
1	Leisure	Name one place where you can go out?	You can go out - such as to the cinema or to play a sport.
2	Sport	Can you name a solo sport?	Running is a solo sport.
3	Travel	What is one way you can travel in London?	In London and other big cities you can travel by tube train
4	Friends	Friends are not the same as what?	Friends are not the same as families.
5	Money	What do we have to buy?	We have to buy food, drink and clothes.
6	Food	When is food good for us?	Food is good for you if you eat well
7	Health	What is one way to stay healthy?	There are many ways to stay healthy. One way is to eat food such as fruit and veg.
8	Work	Where can you work?	You can work in an office. You can work in gardens or parks.

Table 23: subject page questions

Information page questions

The following are the questions relating to the text on each information page, accessed from the main subject pages (see Figure 10 for the site structure). The 'menu' coumn indicates the position of the menu entry on the list on the subject page leading to the information page.

Task no.	Topic & subtopic	Menu*	Answer*	Question	Answer phrase
1	Leisure: Going bowling	Top	Bottom	What do you have to wear?	You have to wear shoes they give you!
2	Sport: running	Bottom	Top	What must you make sure you take?	Make sure you take a watch
3	Travel: trains	Top	Bottom	What do you have to buy for trains?	You have to buy a ticket.
4	Friends: making	Bottom	Top	Where might you have many friends?	You might have many friends at school.
5	Money: banks	Top	Bottom	What will the bank give you?	You need a bank card. The bank will give you one.
6	Food: Good and bad	Bottom	Top	What is one of the bad foods?	Salt is one of the bad foods.
7	Health: going to the hospital	Top	Bottom	What can people bring you in hospital?	People can come and see you. They may bring you sweets or fruit.
8	Work: people's	Bottom	Top	Where does Nina work?	Nina works at the checkout in a

Task no.	Topic & subtopic	Menu*	Answer*	Question	Answer phrase
	stories				supermarket.
9	Sport: cycling	Top	Bottom	What do you have to tell someone?	Tell someone where you are going.
10	Travel: coaches	Bottom	Top	Coaches are like what?	Coaches are like buses - but they go further.
11	Friends: Dating	Top	Bottom	What do you have to tell someone?	Tell someone where you are going.
12	Money: earning money	Bottom	Top	Where are there many jobs?	There are many jobs... In a shop ... Or an office ...
13	Food: Recipes	Top	Bottom	What is fine when cooked?	Some things cannot be eaten raw. They are fine cooked. These include flour or meat.
14	Health: At the doctor's	Bottom	Top	What can you do if you feel ill?	If you feel ill you can go to the doctors.
15	Work: getting a job	Top	Bottom	Who can you ask about a job?	You can ask your tutor or carer.
16	Leisure: going to the cinema	Bottom	Top	What do you need to know before you can go to the cinema?	You need to know: What films are on… Where the cinema is… How to get there.

Table 24: Information page questions

Notes:

1. The task numbers are for researcher reference only. They are simply labels to identify tasks, and do not denote task *order*, which was randomised.

2. Answer phrase at situated at the bottom of the page do not necessarily require scrolling to see.

3. Only questions 1 – 8 were used. Questions 9-16 were created to provide alternatives, should a participant not be able to answer the first question asked. However, it became clear that in these cases it was best to proceed with the next interface and then switch to the alternative activity of the participant 'showing off' their computer skills if the second task also proved too difficult.

Appendix 3: Letter of approval from the UCL Ethics Committee.

The study was later given a Project ID Number (0343/003). Note that Dr Rowlands, to whom the letter is addressed, was the candidate's first tutor at the time of the ethics submission.

UCL RESEARCH ETHICS COMMITTEE
GRADUATE SCHOOL OFFICE

Dr Ian Rowlands
SLAIS
UCL

13 January 2009

Dear Dr Rowlands

Notification of Ethical Approval
Ethics Application: 0343/003: The Internet as a platform for information provision by and for people with learning disabilities

I am pleased to confirm that in my capacity as Chair of the UCL Research Ethics Committee, I have approved the above study for the duration of the project i.e. until December 2012

Ethical approval is subject to the following conditions:

You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: http://www.grad.ucl.ac.uk/ethics/ and clicking on the button marked 'Key Responsibilities of the Researcher Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.
Reporting Non-Serious Adverse Events**.**
For non-serious adverse events you will need to inform Ms Helen Dougal, Ethics Committee Administrator (h.dougal@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

Reporting Serious Adverse Events
The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.
Yours sincerely

Sir John Birch
Chair of the UCL Research Ethics Committee

Cc: Peter Williams, SLAIS, UCL

Appendix 4: Statistical tables

Details included in the tables

The output generated by SPSS includes the following, much of which is too technical or not relevant for present purposes, and is included here merely for completeness:

- Sum of squares: This is the sum of the difference between each observed data point (or case) and the mean of all the scores (the 'grand mean') squared, the latter undertaken to eliminate the problem of positive and negative differences cancelling each other out. It is a measure of the total variation within the data;
- df (Degrees of freedom): This is the number of observations minus one – in other words, the number of observations that are free to vary (the reason the last one cannot is because in the calculations, one parameter is held constant - the sample mean);
- Mean square: This relates to the deviance of the observed data to that of the model, and is the sum of squares divided by the degrees of freedom;
- F (F-ratio): This is a measure of the ratio of the variation explained by the model and the variation explained by other factors. It is calculated by dividing the model mean squares by the residual mean squares, 'residual' being the differences of the observed data from that predicted by the model;
- Standard deviation: This is a measure of the dispersion of a set of data from its mean. The more spread apart the data, the higher the deviation. Standard deviation is calculated as the square root of variance – the latter being the sum of squares divided by the number of observations minus one (by the degrees of freedom, in other words);
- Standard error of the mean: This is the sample standard deviation divided by the square root of the sample size and is an estimate of how representative the sample is of the population.
- Confidence interval: This figure indicates 'a range of values for a variable of interest constructed so that this range has a specified probability of including the true value of the variable. The specified probability is called the confidence level, and the end points of the confidence interval are called the confidence limits' (Last, 1988, quoted in Davies and Crombie, 2003: p2). The 'specified probability' for present purposes was 95%, a typical figure, and the 'true value' refers to the value that would be obtained for the whole population, rather than just a sample.
- Standardised Coefficients Beta: these are the estimates resulting from an analysis of independent variables that have been standardized so that their variances are 1. Standardised coefficients refer to how many standard deviations a dependent variable will change, per standard deviation increase in the predictor (or independent)

variable. The variable is standardised by subtracting its mean from each of its values and then dividing these new values by the standard deviation of the variable.

- Levene's Test for Equality of Variances: This is used in an independent t-test. It tests whether two groups have approximately equal variance on the dependent variable. If the Levene's Test is significant (the value under 'Sig.' is less than .05), the two variances are significantly different. If it is not significant (Sig. is greater than .05), the two variances are not significantly different; that is, the two variances are approximately equal. This result shows which of the generated two tailed t-test significance results to use – one where variances are assumed equal (Levene's Test $p>0.05$), or one where they are not ($p\leq0.05$).
- Standard residual: This is the difference between the values of the outcome predicted by the model and the value of the observed outcome in the sample, divided by an estimate of the standard deviation.

Testing the appropriateness of the statistics

General

For the parametric statistical tests used in this thesis, certain assumptions or requirements for the data which need to be met, which are common to all such tests. In addition to having normally distributed data, these are:

- Random: For the research reported in this thesis, an assumption of randomness was made by the researcher on the basis of the environments (places of learning or interacting for people with Learning Disabilities) from which the participants were drawn. There was an inevitable element of non-randomness in that, on ethical grounds, potential subjects were offered the choice of whether to participate or not and so in that case, there was an element of self-selection. This is, of course, the case in any ethically conducted study with human subjects. As Pallant (2007) states, this condition is often not met in 'real-life' research, and, in any case, non-parametric tests are not very 'stringent' about this , and also parametric tests are also tolerant of violations of this assumption (Field, 2005);
- Independence of observation: the observations must be independent of each other. This was not violated as each task was independent, related to a different topic and undertaken on a different interface (with each of these conditions randomised). Also, participants worked individually and were therefore not influenced by their peers;
- Dependent variable measured as an interval or ratio: This was met by using time in seconds (a 'ratio' measure);
- Homogeneity of variance: this is the assumption that samples are obtained from populations of equal variances. As it relates to more than one sample, for present

purposes this assumption does not apply.

Multiple regression

The above conditions also have to be met to make a multiple regression analysis valid, in addition to the conditions described above, and the data need to be tested to determine if the other conditions are met. These are:

- Multicolliniarity and singularity: This is where the independent variables are highly correlated, invalidating the statistic. VIF (Variance Inflation Factor) and 'Tolerance' (the reciprocal of VIF) are calculated to determine this. The VIF provides an index that measures how much the variance (the square of the estimate's standard deviation) of an estimated regression coefficient is increased because of collinearity. In this case, the VIF figure being well below 10, the level at which there might be 'cause for concern' (Field, 2005: p196) and the 'Tolerance' well above 0.2, which would indicate 'a potential problem' (Table 25, p303).
- Absence of outliers: There were three outliers in the data, shown in Table 26. These do not present a problem however, as firstly they represent less than 1% of cases, the figure above which the model is considered a poor fit to the data, and secondly, 'Cook's Distance' (Table 27) for these is well below 1, the figure at which it is advisable to remove cases (Pallant, (2007). Cook's Distance is a metric for deciding whether a particular case alone affects the regression model significantly.

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	ImagesYorN	.999	1.001
	MenuHorV	1.000	1.000
	textSorL	.999	1.001

Table 25: Study Seven: Multiple regression: Collinearity Statistics (SPSS Output)

Casewise Diagnostics[a]				
Case Number	Std. Residual	Sqrt_tasktime	Predicted Value	Residual
29	-3.305	.00	6.0302	-6.03024
220	3.129	12.17	6.4556	5.70995
582	3.421	12.81	6.5638	6.24248

Table 26: Study Seven: Multiple regression: casewise diagnostics showing the outlier cases (SPSS Output)

	Minimum	Maximum	Mean	Std. Deviation	N
Cook's Distance	.000	.019	.002	.002	644

Table 27: Study Seven: Multiple regression: Cook's Distance, from 'Residuals' table (SPSS Output)

Study results tables

These tables have been reproduced exactly from the SPSS output files. To preserve the integrity of the output. Abbreviations used, with their full meanings are:

- Sqrt_tasktime: square root of task-time;
- Sig.: Significance (the p value);
- menu_V and menu_H: Vertical and Horizontal menus;
- MenuHorV: Menu Horizontal or Vertical;
- ImagesYorN: With or without images;
- textSorL: Small or large text;
- text_S and text_L: small and large text;
- Lower_higher_lit: Lower or higher literacy level;
- Lower: Lower literacy level;
- Higher: Higher literacy level.

Study Five: web page menu orientation

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Horizontal	3.3236	76	.73187	.08395
	Vertical	3.3643	76	.76582	.08785

Paired Samples Test

		Paired Differences					t
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
					Lower	Upper	
Pair 1	Horizontal - Vertical	-.04067	.44708	.05128	-.14283	.06150	-.793

Paired Samples Test

		df	Sig. (2-tailed)
Pair 1	Horizontal - Vertical	75	0.430
	Summary report: t(75) = -0.793; p = 0.43		

Table 28: Study Five: Paired samples t-test: horizontal versus vertical menu (all participants who took both tests)

Group Statistics					
	Menu_position	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Horizontal	1423	3.4049	1.29260	.03427
	Vertical	1328	3.3682	1.30818	.03590

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Sqrt_tasktime	Equal variances assumed	.013	.909	.739	2749	.460	.03666	.04961	-.06061	.13393
	Equal variances not assumed			.739	2731.035	.460	.03666	.04963	-.06065	.13397
Summary report t(2749) = 0.739; p = 0.909										

Table 29: Study Five: Independent Samples Test (Horizontal v vertical menu) - all iterations

Group Statistics

	Menu_position	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Horizontal	879	3.4639	1.35409	.04567
	Vertical	656	3.4634	1.31382	.05130

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Sqrt_tasktime	Equal variances assumed	1.354	.245	.007	1533	.994
	Equal variances not assumed			.007	1433.206	.994

		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Lower	Upper
Sqrt_tasktime	Equal variances assumed	.00050	.06898	-.13481	.13581
	Equal variances not assumed	.00050	.06868	-.13423	.13523

Summary result: t(1533) = 0.007; p = 0.994 (equal variances – in the two populations – assumed)

Table 30: Study Five: Independent t-test: horizontal v vertical menu, first attempt / condition only

Group Statistics

	Menu_position	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Horizontal	544	3.3096	1.18153	.05066
	Vertical	672	3.2754	1.29692	.05003

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Sqrt_tasktime	Equal variances assumed	2.715	.100	.476	1214	.634
	Equal variances not assumed			.481	1197.169	.631

		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Lower	Upper
Sqrt_tasktime	Equal variances assumed	.03425	.07190	-.10681	.17531
	Equal variances not assumed	.03425	.07120	-.10544	.17393
Summary result: t(1214) = 0.476; p = 0.634 (equal variances – in the two populations – assumed)					

Table 31: Study Five: Independent t-test, horizontal v vertical menu, second attempt/condition only

ANOVA

Sqrt_tasktime

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	35.621	5	7.124	4.308	.001
Within Groups	3761.992	2275	1.654		
Total	3797.613	2280			
Results summary: F(5,2275) = 4.308; p = 0.001					

Table 32: Study Five: ANOVA comparison of times taken to find words, depending on position: all iterations

Target position	All iterations			Iterations by participants scoring at least 75% correct			Iterations by participants scoring <75% correct		
	n	**Sqrt_tasktime**	**Time**	**n**	**Sqrt_tasktime**	**Time**	**n**	**Sqrt_tasktime**	**Time**
Horizontal Left	378	3.2470	12.09	341	3.2011	11.61	37	3.6702	15.25
Horizontal Middle	508	3.3234	12.61	450	3.2146	11.74	58	4.1672	20.39
Horizontal Right	322	3.5478	14.29	284	3.4360	13.23	38	4.3835	22.30
Vertical Top	332	3.2469	12.03	297	3.2191	11.82	35	3.4827	13.81
Vertical Centre	458	3.4017	13.29	407	3.3704	13.10	51	3.6518	14.77
Vertical Bottom	283	3.5871	14.75	247	3.5882	14.72	36	3.5799	14.91
Total	2751	3.3872	13.16	2447	3.3277	12.64	255	3.8474	17.13
Summary results:									

Table 33: Study Five: Mean times taken to find words, depending on position: individual means (n = no. iterations)

(I) Target_position_coded	(J) Target_position_coded	Mean Difference (I-J)	Std. Error	Sig.
Horizontal_left	Horizontal_Middle	-.07638	.08735	1.000
	Horizontal_Right	-.30082*	.09752	.031
	Vertical_Bottom	-.34012*	.10108	.012
	Vertical_Centre	-.15476	.08936	1.000
	Vertical_Top	.00009	.09672	1.000
Horizontal_Middle	Horizontal_left	.07638	.08735	1.000
	Horizontal_Right	-.22444	.09160	.215
	Vertical_Bottom	-.26374	.09539	.086
	Vertical_Centre	-.07837	.08286	1.000
	Vertical_Top	.07647	.09075	1.000
Horizontal_Right	Horizontal_left	.30082*	.09752	.031
	Horizontal_Middle	.22444	.09160	.215
	Vertical_Bottom	-.03930	.10478	1.000
	Vertical_Centre	.14606	.09352	1.000
	Vertical_Top	.30091*	.10058	.042
Vertical_Top	Horizontal_left	-.00009	.09672	1.000
	Horizontal_Middle	-.07647	.09075	1.000
	Horizontal_Right	-.30091*	.10058	.042
	Vertical_Bottom	-.34021*	.10404	.016
	Vertical_Centre	-.15485	.09269	1.000
Vertical_Centre	Horizontal_left	.15476	.08936	1.000
	Horizontal_Middle	.07837	.08286	1.000
	Horizontal_Right	-.14606	.09352	1.000
	Vertical_Bottom	-.18537	.09723	.851
	Vertical_Top	.15485	.09269	1.000
Vertical_Bottom	Horizontal_left	.34012*	.10108	.012
	Horizontal_Middle	.26374	.09539	.086
	Horizontal_Right	.03930	.10478	1.000
	Vertical_Centre	.18537	.09723	.851
	Vertical_Top	.34021*	.10404	.016

Table 34: Study Five: ANOVA comparison of times taken to find words, depending on position: individual position comparisons - all iterations

(I) Target_position_coded	(J) Target_position_coded	Mean Difference (I-J)	Std. Error	Sig.
Horizontal_left	Horizontal_middle	-.01354	.08904	1.000
	Horizontal_right	-.23492	.09962	.277
	Vertical_bottom	-.38709*	.10362	.003
	Vertical_centre	-.16934	.09104	.945
	Vertical_top	-.01805	.09843	1.000
Horizontal_middle	Horizontal_left	.01354	.08904	1.000
	Horizontal_right	-.22138	.09398	.279
	Vertical_bottom	-.37355*	.09820	.002
	Vertical_centre	-.15580	.08483	.996
	Vertical_top	-.00451	.09271	1.000
Horizontal_right	Horizontal_left	.23492	.09962	.277
	Horizontal_middle	.22138	.09398	.279
	Vertical_bottom	-.15217	.10789	1.000
	Vertical_centre	.06558	.09588	1.000
	Vertical_top	.21687	.10292	.528
Vertical_top	Horizontal_left	.01805	.09843	1.000
	Horizontal_middle	.00451	.09271	1.000
	Horizontal_right	-.21687	.10292	.528
	Vertical_bottom	-.36904*	.10679	.008
	Vertical_centre	-.15129	.09464	1.000
Vertical_centre	Horizontal_left	.16934	.09104	.945
	Horizontal_middle	.15580	.08483	.996
	Horizontal_right	-.06558	.09588	1.000
	Vertical_bottom	-.21775	.10002	.444
	Vertical_top	.15129	.09464	1.000
Vertical_bottom	Horizontal_left	.38709*	.10362	.003
	Horizontal_middle	.37355*	.09820	.002
	Horizontal_right	.15217	.10789	1.000
	Vertical_centre	.21775	.10002	.444
	Vertical_top	.36904*	.10679	.008

Table 35: Study Five: ANOVA comparison of times taken to find words, depending on position: individual position comparisons – iterations of participants achieving 75% success rate.

Study Seven: Testing the usability by comparing various accessible interfaces

Sqrt_tasktime/different tasks	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	38.672	7	5.525	1.635	.123
Within Groups	2152.401	637	3.379		
Total	2191.073	644			
Summary result: F(7,637) = 1.64, p = 0.12					

Table 36: Study Seven: Univariate ANOVA results comparing task-times (Sq Rt) for different tasks

Sqrt_tasktime/ task order	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	31.293	7	4.470	1.302	.248
Within Groups	1359.870	396	3.434		
Total	1391.163	403			
F(7,396)=1.30, p=0.248					

Table 37: Study Seven: Univariate ANOVA comparing task-times (sq rt) by task order

Task order	Mean task-time (sq rt)	Ranked order of mean task-time				Task_order	Rank_task_time
1	6.7110	6	Spearman's rho	Task_order	Correlation Coefficient	1.000	-.500
2	6.4717	5			Sig. (2-tailed)	.	.207
3	7.0486	8			N	8	8
4	6.2554	1		Rank_task_time	Correlation Coefficient	-.500	1.000
5	6.7434	7			Sig. (2-tailed)	.207	.
6	6.2836	3			N	8	8
7	6.2910	4					
8	6.2647	2					

Table 38: Study Seven: task order versus task-time: Spearman's correlation result

Independent Samples Test: t-test for equality of means

		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
sqrt_tasktime	Equal variances assumed	.000	.67713	.18367
	Equal variances not assumed	.000	.67713	.16277

Table 39: Study seven: independent t-test comparing task-time for answers to be found near the top and near the bottom of web pages

	Paired Differences	t	df	Sig. (2-

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				tailed)
					Lower	Upper			
Pair 1	images_yes - images_no	.141	1.368	.146	-.149	.430	.964	87	.338
Summary result: t(87) = 0.964; p = 0.338									

Table 40: Study Seven: Paired samples T-test for equality of means: presence or absence of images

		Paired Differences					df	t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	menu_V - menu_H	.413	1.397	.149	.117	.709	87	2.774	.007
Summary result: t(87) = 2.774; p = 0.07									

Table 41: Study Seven: Paired samples T-test for equality of means: menu position

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	text_S - text_L	-.367	1.358	.145	-.655	-.079	-2.536	87	0.13
Summary result: t(87) = 2.536; p = 0.13									

Table 42: Study Seven: Paired samples T-test for equality of means: text size

Dependent Variable: Sqrt_tasktime Tukey HSD						
(I) Interface	(J) Interface	Mean Difference (I-J)	Std. Error	Sig.*	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.47138	.28777	.727	-1.3465	.4037
1	3	-.07932	.28301	1.000	-.9400	.7813
1	4	-.40184	.28040	.842	-1.2545	.4509
1	5	-.27351	.28125	.978	-1.1288	.5818
1	6	-.86054	.28777	.058	-1.7356	.0146
1	7	-.65778	.28485	.290	-1.5240	.2085
1	8	-.88727*	.28392	.039	-1.7507	-.0239
2	3	.39206	.29190	.882	-.4956	1.2797
2	4	.06954	.28937	1.000	-.8104	.9495
2	5	.19787	.29020	.997	-.6846	1.0804
2	6	-.38916	.29651	.894	-1.2909	.5125
2	7	-.18640	.29369	.998	-1.0795	.7067
2	8	-.41589	.29278	.848	-1.3063	.4745
3	4	-.32252	.28464	.949	-1.1881	.5431
3	5	-.19419	.28548	.997	-1.0623	.6740
3	6	-.78123	.29190	.132	-1.6689	.1065
3	7	-.57846	.28903	.482	-1.4574	.3005
3	8	-.80795	.28811	.096	-1.6841	.0682
4	5	.12833	.28289	1.000	-.7319	.9886
4	6	-.45871	.28937	.759	-1.3387	.4213
4	7	-.25594	.28647	.987	-1.1271	.6152
4	8	-.48543	.28555	.687	-1.3538	.3829
5	6	-.58704	.29020	.467	-1.4695	.2955
5	7	-.38427	.28730	.884	-1.2580	.4894
5	8	-.61376	.28638	.388	-1.4847	.2571
6	7	.20276	.29369	.997	-.6903	1.0959
6	8	-.02673	.29278	1.000	-.9171	.8636
7	8	-.22949	.28992	.994	-1.1111	.6522
*The mean difference is significant at the 0.05 level.						

Table 43: Study Seven: ANOVA: multiple comparisons of interface performance

Correlations (n = 645)					
		Sqrt_tasktime	ImagesYorN	MenuHorV	textSorL
Pearson Correlation	Sqrt_tasktime	1.000	.032	.115	.109
	ImagesYorN	.032	1.000	-.006	.030
	MenuHorV	.115	-.006	1.000	-.003
	textSorL	.109	.030	-.003	1.000
Sig. (1-tailed)	Sqrt_tasktime	.	.210	.002	.003
	ImagesYorN	.210	.	.438	.227
	MenuHorV	.002	.438	.	.466
	textSorL	.003	.227	.466	.

Table 44: Study Seven: Multiple regression: correlations (SPSS Output)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	56.949	3	18.983	5.702	.001[b]
	Residual	2130.722	640	3.329		
	Total	2187.671	643			
a. Dependent Variable: Sqrt_tasktime						
b. Predictors: (Constant), textSorL, MenuHorV, ImagesYorN						
Summary result: F(3,640) = 5.702; p = 0.01						

Table 45: Study Seven: Multiple regression: Analysis of Variance (SPSS Output)

Model		Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B	
					Lower Bound	Upper Bound
1	(Constant)		42.431	.000	5.751	6.309
	ImagesYorN	.029	.752	.452	-.174	.391
	MenuHorV	.115	2.957	.003	.143	.708
	textSorL	.109	2.783	.006	.118	.683

Table 46: Study Seven: Multiple regression: co-efficients (SPSS Output)

Paired Samples Correlations lower literacy group				
		N	Correlation	Sig.
Pair 1	menu_V & menu_H	35	.113	.517
Pair 2	text_S & text_L	35	.282	.101
Pair 3	images_yes & images_no	35	.210	.225
Paired Samples Correlations higher group				
		N	Correlation	Sig.
Pair 1	menu_V & menu_H	30	.255	.175
Pair 2	text_S & text_L	30	-.027	.887
Pair 3	images_yes & images_no	30	.059	.758

Table 47: Study Seven: paired Samples Correlations

Paired Samples Statistics: lower literacy group					
		t	df	Sig. (2-tailed)	
Pair 1	menu_V - menu_H	1.182	34	.246	
Pair 2	text_S - text_L	-2.976	34	.005	
Pair 3	images_yes - images_no	.284	34	.778	
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	menu_V	6.94	35	1.185	.200
	menu_H	6.63	35	1.145	.194
Pair 2	text_S	6.43	35	1.036	.175
	text_L	7.04	35	1.007	.170
Pair 3	images_yes	6.80	35	.901	.152
	images_no	6.73	35	1.184	.200
Paired Samples Statistics: higher group					
		t	df	Sig. (2-tailed)	
Pair 1	menu_V - menu_H	2.239	29	.033	
Pair 2	text_S - text_L	-.225	29	.823	
Pair 3	images_yes - images_no	.526	29	.603	
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	menu_V	6.48	30	.963	.176
	menu_H	6.03	30	.797	.146
Pair 2	text_S	6.19	30	.964	.176
	text_L	6.24	30	.958	.175
Pair 3	images_yes	6.30	30	.842	.154
	images_no	6.18	30	1.037	.189

Table 48: Study Seven: paired samples t-test – 2-tailed significance tests (SPSS output)

Regression: Lower literacy group: correlations (N=271)					
		Sqrt_tasktime	MenuHorV	ImagesYorN	textSorL
Pearson Correlation	Sqrt_tasktime	1.000	.079	.011	.178
	MenuHorV	.079	1.000	.003	.011
	ImagesYorN	.011	.003	1.000	.033
	textSorL	.178	.011	.033	1.000
Sig. (1-tailed)	Sqrt_tasktime	.	.097	.431	.002
	MenuHorV	.097	.	.477	.428
	ImagesYorN	.431	.477	.	.293
	textSorL	.002	.428	.293	.

Regression: Higher literacy group: Correlations					
		Sqrt_tasktime	ImagesYorN	textSorL	MenuHorV
Pearson Correlation	Sqrt_tasktime	1.000	.034	.029	.115
	ImagesYorN	.034	1.000	.009	-.018
	textSorL	.029	.009	1.000	.000
	MenuHorV	.115	-.018	.000	1.000
Sig. (1-tailed)	Sqrt_tasktime	.	.310	.334	.045
	ImagesYorN	.310	.	.446	.395
	textSorL	.334	.446	.	.499
	MenuHorV	.045	.395	.499	.
N	Sqrt_tasktime	218	218	218	218
	ImagesYorN	218	218	218	218
	textSorL	218	218	218	218
	MenuHorV	218	218	218	218

Table 49: Study seven: multiple regression: Correlations by literacy level (SPSS output)

Linear regression: Coefficients[a] lower literacy group						
		Unstandardised Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.219	.215		28.891	.000
	ImagesYorN	.016	.219	.004	.075	.941
	textSorL	.647	.219	.177	2.951	.003
	MenuHorV	.282	.219	.077	1.285	.200
a. Dependent Variable: Sqrt_tasktime						

Linear regression: Coefficientsa higher group						
		Unstandardised Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	5.913	.237		24.899	.000
	ImagesYorN	.125	.238	.036	.524	.601
	textSorL	.101	.238	.029	.426	.670
	MenuHorV	.407	.238	.116	1.711	.089
a. Dependent Variable: Sqrt_tasktime						

Table 50: Study Seven: multiple regression coefficients, lower and higher literacy groups

Group Statistics: horizontal menu					
	Lower_higher_lit	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Lower	137	6.5483	1.88545	.16108
	Higher	111	6.0278	1.84865	.17547

Independent Samples Test: horizontal menu				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sqrt_tasktime	Equal variances assumed	.030	.52050	.23869

Table 51: Study Seven: independent samples t-test: Horizontal menu comparison

Group Statistics: vertical menu					
	Lower_higher_lit	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Lower	134	6.8372	1.76419	.15240
	Higher	107	6.4328	1.64324	.15886

Independent Samples Test: vertical menu				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sqrt_tasktime	Equal variances assumed	.070	.40434	.22190

Table 52: Study Seven: independent samples t-test: Vertical menu comparison

Group Statistics: no-images					
	Lower_higher_lit	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Lower	138	6.6720	1.88499	.16046
	Higher	108	6.1668	1.75556	.16893

Independent Samples Test: no-images				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sqrt_tasktime	Equal variances assumed	.033	.50519	.23503

Table 53: Study Seven: independent samples t-test: no-image comparison

Group Statistics: with-images					
	Lower_higher_lit	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Lower	134	6.7308	1.78391	.15411
	Higher	110	6.2852	1.76758	.16853

Independent Samples Test: with-images				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sqrt_tasktime	Equal variances assumed	.052	.44561	.22858

Table 54: Study Seven: independent samples t-test: with-images comparison

Group Statistics: small-text					
	Lower_higher_lit	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Lower	135	6.3645	1.79885	.15482
	Higher	110	6.1758	1.78566	.17026

Independent Samples Test: small-text				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sqrt_tasktime	Equal variances assumed	.413	.18869	.23030

Table 55: Study Seven: independent samples t-test: small-text comparison

Group Statistics: large-text					
	Lower_higher_lit	N	Mean	Std. Deviation	Std. Error Mean
Sqrt_tasktime	Lower	137	7.0326	1.81155	.15477
	Higher	108	6.2783	1.73734	.16718

Independent Samples Test: large-text				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Sqrt_tasktime	Equal variances assumed	.001	.75431	.22895

Table 56: Study Seven: independent samples t-test:large-text comparisons