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Article

Survey of the linguistic accessibility of websites designed for people with intellectual disability

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Abstract

Internet usage is high amongst the general population but access problems persist for adults with intellectual disability. A descriptive study was conducted to survey the linguistic accessibility of websites designed for this user group. The purposive sample comprised fifteen UK-based websites associated with the self-advocacy organization People First, plus a matched, mainstream website for comparison. Linguistic measures at lexical and sentence levels were applied to text samples from each website. Readability scores ranged from 4.4 to 23.6 with only three websites achieving below the recommended standard for universal accessibility. Word variability scores ranged from 54 to 80 with many websites employing diverse vocabularies. Most of the websites achieved word frequency mean values within the 5 to 800,000 range. Only one website achieved scores indicative of positive accessibility value on all three measures. Mainstream website scores were unremarkable compared to the People First websites. Linguistic accessibility of websites designed for people with intellectual disability appears to be highly variable. The limitations of the study are discussed. A review of text authoring principles is called for as well as consideration of a mediating role for significant others providing support.

Keywords: website text; linguistic analysis; accessibility; readability; intellectual disability

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1 Introduction

Over six years ago, a UK national newspaper printed a commentary on a Google survey reporting on the increased amounts of time UK citizens spent online compared with watching television (Johnson 2006: 6). Many daily activities are now web-based and include online bank services, distance learning and high street shopping. The popularity of social networking sites has grown, with reportedly over 400 million Facebook users worldwide (Naughton 2010: 23) and over 30 million in the UK alone (Burcher 2011). Growing usage of the internet by people with disabilities has also been reported (Bevan 2003), although only 36% of the population with intellectual disability have access to the internet (Low 2003: 9), in stark contrast to the 77% of UK homes with access in the general population (Office for National Statistics 2011).

1.1 Accessibility

Despite the ubiquity of computer technology and the World Wide Web, it is recognized that problems of access and participation persist amongst people who experience difficulties in the domains of communication, cognition and social development (Karreman et al. 2007). The World Wide Web Consortium (W3C) promotes accessibility through its Web Accessibility Initiative, which includes a set of Web Content Accessibility Guidelines (WCAG 2.0 2008). Clustered around the four key principles, the guidelines state that websites must be perceivable, operable, understandable and robust. However, they are largely concentrated on the needs of individuals with visual and physical impairments under the 'perceivable' principle, with many components related to cognitive difficulties being listed as lower priorities (Williams and Nicholas 2006; Friedman and Bryen 2007). The guidelines of particular relevance to the user group with intellectual disability relate to the 'understandable' principle. For example, the criterion for monitoring the text reading level is to keep it below 'lower secondary education' (WCAG 2008: 14-16). However, the guideline is somewhat vague and no examples are given for how this might be achieved. Certificates of website accessibility are sometimes displayed. The 'Bobby' seal of approval is given by the Centre for Applied Special Technology (CAST 1998) and indicates compliance with the W3C website guidelines. Alternatively, presence of the actual W3C logo is also used sometimes. As a result of its formal investigation of web accessibility in the UK, the Disability Rights Commission (DRC) reported that 81% of websites surveyed failed to uphold the most basic W3C accessibility guidelines and specifications (DRC 2004: 9). In 2006, the British Standards Institution in consultation with the Disability Rights Commission produced a PAS (publicly available specification) document on web accessibility, PAS 78 (BSI 2006). The main purpose is to provide guidance to commissioners (those

who procure web design services) on best practice with regard to accessible websites. The document refers extensively to the WAI guidelines.

The current study aims to explore the linguistic accessibility value of websites designed for the user group with intellectual disability. The main research question is as follows: what variation exists among the websites with regard to the complexity of linguistic content? A subsidiary question is: how does a matched, mainstream comparator perform on measures of linguistic accessibility in comparison to the websites designed for use by people with intellectual disability?

1.2 Challenges for people with intellectual disability

People with intellectual disability present some particular challenges for website accessibility, not least of which is the high prevalence of severe language and communication impairments (Emerson et al. 2001). There is little recent research published in this area, although estimates reported earlier range from 50% (Enderby and Davies 1989) to 81% (Law and Lester 1991). Despite variance in prevalence figures, it is acknowledged generally that there is an increased risk of communication difficulties in people with intellectual disability compared with the general population (Kerr et al. 1996; McLean et al. 1996). Communication difficulties are frequently accompanied by poor or non-existent literacy skills (Lyon 1996; Erickson 2005; Jones et al. 2006; Verhoeven and Vermeer 2006), although there is limited information regarding prevalence in the population with intellectual disability (Young *et al.* 2004). Failure to acquire reading and writing skills has been attributed to underlying impairments affecting cognitive processes (Foley 1993) and limited educational experience (Lacey et al. 2007; McNaughton and Tawney 1993; Basil and Reves 2003), although there appears to be the potential for continued development of literacy skills into adulthood (Bochner et al. 2001; Moni and Jobling 2001; Pershey and Gilbert 2002). The decoding of the written word has been referred to as the 'technical aspect of reading literacy' (Verhoeven and Vermeer 2006: 726), whereby the child initially develops a sight and say vocabulary, and learns letter to sound rules enabling address of unfamiliar words (Byrne et al. 1995). The links between language acquisition and reading ability have been well established. Nathan, Stackhouse, Goulandris and Snowling (2004) found that oral language proficiency at age four was strongly predictive of reading and spelling ability at age six. Links between the structural aspects of language and the development of reading, semantic abilities and reading comprehension have also been reported (Roth et al. 2002). People with intellectual disability experience particular difficulties with lexical decoding and reading comprehension (Conners 2003). Receptive and expressive vocabularies are

often smaller than would be predicted from mental age, and are dominated by concrete, basic category terms (Tager-Flusberg and Sullivan 1998). There are exceptions, such as the discrete group of people with Down syndrome where relative strengths in literacy development have been reported (Appleton *et al.* 2002) despite the presence of limited language skills (see Abbeduto *et al.* 2007). However, weak phonological skills have also been associated with variable reading levels (see Snowling *et al.* 2008).

Given the prevalence of communication and literacy difficulties, it is not surprising that problems in accessing web-based information and engaging in computer-based tasks have been reported by a number of researchers (Williams 2006; Williams and Nicholas 2006; Karreman et al. 2007). Among the reading errors reported by Karreman et al. (2007) were the pronunciation of long words or words from a different language, and distinguishing between visually similar words such as 'difficult' and 'different', which was observed to have a detrimental effect on comprehension. Williams (2006) identified a need for development work in the area of page layout that considers text size, position and the use of icons. The Office of Communications (Ofcom 2008: 16-19) reported that very few of the 35 participants with intellectual disability in their survey had an e-mail address because of low levels of literacy. Those who did have e-mail often relied on others to check their accounts. Johnson and Hegarty (2003) identified some of the problems encountered by participants with intellectual disability engaged in web-based learning, which included locating desired information, performing download actions and importing chosen images into documents. The population with intellectual disability includes the full range of impairment and therefore variation across sub-groups is likely. Williams and Hanson-Baldauf (2010) found that people with mild intellectual disability can be proficient at using the internet, even when working independently with mainstream websites such as YouTube; however, comprehension of website content was limited unless preceded with an introduction to the focal topic. Despite reported difficulties, many new opportunities and advantages have also been identified. Personal Home Pages were found to support adults with Down Syndrome in developing and maintaining friendships and telling their own stories (Seale and Pockeny 2002). Other studies have similarly found that the internet has the potential to support communication and empowerment, and have a positive influence on self-concept (Bunning et al. 2009).

1.3 Accessibility options

The pervasive nature of literacy difficulties means that the text content of websites is challenging for many users with intellectual disability. Text-to-speech support is an option and a range of helper packages are available for this purpose,

e.g. BrowseAloud. Well designed graphics and multimedia can be positive aids to the use and understanding of website content and a range of symbol sets and image banks are on offer, e.g. Change Picture Bank; Picture Communication Symbols (PCS). Indeed, use of pictures, graphics, icons and symbols was one of the top recommendations of web design guidelines surveyed by Friedman and Bryen (2007). However, the use of colourful images and audio support for text is not a guarantee of accessibility (Hoppestad 2007). Language accessibility in whatever form it is presented, e.g. speech or text, is another consideration. The WCAG (W3C, 2) recommends the use of 'the clearest and simplest language appropriate for a site's content' (Karreman et al. 2007: 510). Guidelines for the production of easy-to-read documents have been devised by the European Commission (Freyoff et al. 1998), which includes covering only one idea per sentence, use of active rather than passive verbs, and avoidance of abstract concepts. A comparable set of guidelines has been published by Mencap, the UK's national charity for people with intellectual disabilities and their carers (Mencap 2000). Karreman et al. (2007) found that website changes informed by a guideline improved the level of access gained by users with intellectual disability when compared to the non-adapted version of the site.

2 Methods

2.1 Design, ethics and sample

A descriptive study was conducted that involved survey of the linguistic content of websites used by people with intellectual disability. A mainstream equivalent website was also included as an informal comparator. Ethical approval was granted by the university ethics committee. Although there were no human participants, website anonymity was established by assigning each one to a letter of the alphabet. A purposive sample of websites designed for use by people with intellectual disability was established using snowballing techniques. It was decided to focus on websites associated with People First, a national organization concerned with self-advocacy, because they are specifically designed for this user group. Initial identification was carried out via 'The Big Tree' portal where a list of UK-based People First websites is provided. Each website was accessed and links followed to extend sample recruitment. Websites were included if they were fully operational and not under construction during the project period. Fifteen People First websites met the inclusion criteria for the study. The mainstream comparator was the official website of the Citizen's Advice Bureau, a registered charity, which provides an information and advisory service for people residing in the UK. In common with People First, it is concerned with rights and responsibilities.

2.2 Text sampling and analysis

The content pages of each website were reviewed. Entire pages or parts of pages were excluded from the data if they provided contact details, issued invitations to register, presented online forums and chatrooms, or contained personal and fictional narratives. The remaining pages in each website were then randomly assigned to a numbered order from '1' upwards, depending on the number of pages included. The text was sampled following the randomized order of pages and in correspondence with the requirements established for each measure stated below. Exclusions were made at this stage if they were proper nouns (names of people and places) or numbers expressed in digit form, e.g. '4', appeared on button titles, hyperlinks or pictures. Hyphenated words were counted as one word e.g. self-advocacy.

Measures of linguistic content were either at the sentence or at the lexical (word) level. Developed as a formula for evaluating text readability (Gunning 1952), the Gunning Fog Index was used as a sentence level measure. A score is generated, based on such characteristics as statistical average word length (counted in syllables), the number of complex words comprising three syllables or more, and sentence length. The resulting number is an estimate of the number of years of formal education that a person requires in order to understand the text on a first reading. Texts that are designed for a wide audience generally require a Fog index of less than 12. Texts that require a closeto-universal understanding generally require an index of less than 8. Whilst providing a relatively swift indication of text complexity, the Fog Index has two main limitations. The first concerns the fact that poly-syllabicity does not necessarily equate with reading complexity. For example, the word 'anything' has three syllables, but would not be considered by many to be 'complex'. Conversely, a short word that has more than one meaning, e.g. 'mine', may provide a decoding challenge. The second limitation concerns the issue of technical jargon. For example, the word 'advocacy' comprises four syllables and is counted as a 'complex word' by the Fog Index; however, it is likely to be followed by the specialist audience of People First with little difficulty. Cognizant of these potential difficulties, two sets of 100 words were sampled. The randomized page order was followed until the first 100 words were reached. Using the same procedure, the second 100 words were also sampled.

There were two measures at the lexical (word) level: (i) word variability; and (ii) word frequency. Word variability (i), also referred to as type-token ratio (TTR), is a measure of vocabulary diversity within a piece of text or a person's speech. The number of different words (type) occurring in a piece of text are compared with the total number of words (tokens) (see Williamson 2009). Thus a TTR of 0.5 or 50%, based on 200 types in a text of 400 words, would imply greater lexical diversity than a TTR of 0.1 or 10%, based on 40 types in a text of

identical length. Increased lexical variation in a text, as determined by a high TTR score, implies it is more difficult to read. A low TTR score shows there has been word repetition within a text making it more accessible. This provides information regarding the lexical demands placed on the users of People First websites, who are likely to have language difficulties associated with intellectual disability. No 'ideal' scores are provided for TTRs of written text, but typically it is higher than for speech (Williamson 2009). Fletcher (1985) found an average of around 50% in the speech samples of children aged 3;00 to 8;00, which is consistent with the reported results of a much earlier study by Templin (1957). Westin (2002) used TTR in researching language complexity and diversity in upmarket editorials between 1900 and 1993. The average score for The Times, Guardian and Daily Telegraph was 57.67%. Generally, the bigger the text sample, the more likely that the TTR scores will be lower because of the increased likelihood of word repetitions occurring. Thus Baayen's (2001) review of the entire book of Alice in Wonderland by Lewis Carroll (over 26,000 words) arrived at a TTR of 10%. For the current study, calculation was carried out manually on the same samples used for the Fog Index, i.e. two samples of 100 words and then the combined sample of 200 words per website. It was expected that the combined sample of 200 words would have a lower TTR value than for each of the separate 100 word samples. By controlling the number of words sampled from each website, the problem of comparability between different sample sizes was addressed. However, the potential influence of crossing topic boundaries by sampling words across a number of pages remained. The introduction of a new topic would possibly give rise to new vocabulary items and affect the overall TTR score for the sample.

The second measure was word frequency (ii), defined as commonality of usage. A total of 30 words were randomly sampled using an electronic randomizer (available at: http://www.randomizer.org) from each of the first and second 100 word sets established earlier. This is the frequency with which a word occurs within the English language. For this purpose, the British National Corpus was used, which contains a collection of 100 million words. These are samples of written and spoken language from a wide range of sources, designed to represent a wide cross-section of British English from the latter part of the 20th century. It was recognized that the very nature of the People First websites and their mutual theme on self-advocacy might dictate specialized content and therefore lower word frequency values. The calculation was conducted by copying and pasting each word in the random sample into a window on the website of the BNC for allocation of its word frequency value.

The data were entered into Excel spreadsheets for initial summary of content features. Exploratory analysis was conducted using the Statistical Package for Social Sciences (computer software used for statistical analysis).

3 Results

3.1 Sample features

Initial survey of the websites in the sample revealed varied characteristics as shown in Table 1. Only three websites had certificates of W3C validation and one had Bobby approval. The number of content pages per website ranged from 5 to 27 plus. Many of the websites contained additional links to documents, e.g. reports, reviews and guidance, displayed as PDF files. These were not included in the current study. The home page of each website was a combination of pictorial images, text and colour providing links to other pages in the website or to other websites. Displays varied broadly from top to bottom, left to right or else centred in tabular format. All the websites used pictures of some sort to supplement the text content. The People First websites used some graphics variously sourced by Change Picture Bank (n=6), Photo-symbols (n=6), Widgit symbols (n=1) and MS Clipart (n=4). In addition, the majority of the websites, including the mainstream equivalent, used photographic images and other pictures of undeterminable source (People First: n = 10). Only three People First websites offered text to speech options to the user and six provided text in different sizes (usually regular or small).

3.2 Readability scores using Fog index

The data, as illustrated in Figure 1, revealed variable readability scores, ranging from 4.4 to 23.6. The mean scores for samples 1 and 2 for the People First websites were 11.03 (SD=.6) and 12.24 (SD=3.6), respectively, which compare favourably with the higher score of the mainstream website Z^* (n = 16.4 and 19.7). The scores for most of the People First websites tended to cluster around 15 and below (26 scores across 15 websites). Only two websites achieved Fog indices below 8, the score for universal readability (E: n = 5.6, 7.2; N: n = 5.8, 4.4). The two highest scoring websites were the mainstream equivalent (Z^*) and website O (n=20.5 and 20.1), the latter being the highest of the two. With the exception of website O, all the People First websites achieved at least one score within seven points of the recommended bar, i.e. eight, four of which were within two points. Although only slight differences were observed between the two text samples for each website, there were some notable exceptions. Websites D and K each achieved Fog indices within five points of the recommended bar (8) on the first sample of 100 words, whilst their second samples were over 20.

3.3 Lexical variety

Higher scores on word variability indicate greater diversity of vocabulary. Figure 2 shows the TTR scores for each website derived from two text samples

Website	Symbols of	No. of	Access to other pages via home page			Use of gr	raphics			Format	options
	Approval	pages		Change	Photo-syms	Widgit	MS Clipart	Photos	Other	Text size	Audio
A	Bobby	m	Text display links for access					Yes			
В		4	Text buttons down left	Yes				Yes	Yes	Yes	
U		6	lcons on buttons using symbols	Yes	Yes	Yes		Yes	Yes	Yes	Yes
D		4	Grid displaying text & pictures	Yes	Yes		Yes	Yes	Yes		
ш		10	Photo pictures on buttons		Yes		Yes				
ц		4	Clipart pictures on button links down left				Yes	Yes		Yes	
IJ	W3C	11	Photo images on buttons in table in centre						Yes	Yes	Yes
н	W3C	10	Text & photo images in table		Yes						
_		5	Brief text & links listed down left side					Yes	Yes		
–		6	Text with icons	Yes					Yes		
¥		4	Text on buttons with pictures					Yes	Yes	Yes	Yes
_	W3C	7	Text on button on left & bottom of page	Yes	Yes		Yes	Yes	Yes		
Z		7	lcon buttons on left	Yes					Yes		
z		5	Text links on bar		Yes			Yes	Yes		
0		7	Buttons on left fwith text & pictures					Yes		Yes	
Z*		8	Text & pictures in table format					Yes	Yes		

Table 1: Summary of website characteristics (Z^* = mainstream website)



Figure 1: Leaf and stem plots showing Fog indices for first and second 100 word samples for each website with midway point shown (horizontal line indicates universal value of 8)



Figure 2: Leaf and stem plot showing word variability (TTR) scores (%) for each website – median and interquartile range indicated



Figure 3: Leaf and stem plots showing word frequency mean scores for each website sample (expressed in 100,000's) with midway points shown

of 100 words each and the score for the combined 200 text sample. Scores across all the word samples (the first two 100 word samples and the combined sample of 200 words) ranged from 46 to 80. Mean scores for each 100 word sample were 64.6 (SD = 6.44) and 66.53 (SD = 7.0) and for the 200 word sample, 55.5 (SD = 5.0). For the larger sample, variability decreased, producing a lower range: 46 to 62.5. The mainstream website Z* achieved scores of 61, 73 and 57 on the three text samples. The difference between the mean scores from samples 1 and 2 and the mean score on a 200 word sample was 9.3 (SD = 2.92), indicating that the longer the text from which words are sampled, the lower the word variability. Some of the websites showed extreme variation between the two scores on the 100 word samples, e.g. websites C (80-62), G (61-75), J (54-73) and Z* (61-73). Three websites (D, E and O) achieved the same scores for both samples indicating some internal consistency. Website N, one of two websites with the lowest Fog indices, also achieved the lowest range of scores on word variability (n = 58; 54; 46).

3.4 Word frequency

Word frequency scores were derived from the BNC (2010) to show the extent of usage in the English Language. The higher word frequency score is indicative of vocabulary that is more commonly used, and therefore likely to be more

familiar. As illustrated in Figure 3, values produced across both samples for the People First websites ranged from 3 to 12 (100,000's) with a combined mean of 6.8 (SD = 1.56). The two websites achieving the highest mean scores were websites N (n = 10) and O (n = 10), indicating greater commonality in word usage. The word frequency scores of the mainstream comparator Z^* were fairly unremarkable (n=7; 10).

4 Discussion

Websites designed for use by people with intellectual disability under the selfadvocacy banner of People First showed variation with regard to front page access points, utilization of graphic displays and number of content pages. In terms of readability as measured by the Fog index, only two websites achieved a score below the recommended value for universal accessibility. The majority of the scores were clustered between 5-10 points above. The mainstream comparator was one of four websites achieving the highest Fog indices, although the top three scores were achieved by People First websites. Word variability in the two 100 word samples revealed seven websites, of which the mainstream comparator (Z*) was one, with at least one score above 70% indicating diverse vocabulary in use. The majority of these scores ranged from 60-75% with only four websites achieving a score below 60%. Four of the websites, including website Z^* , had differences of more than 10% between the two scores on the 100 word samples. Word variability of the combined 200 word sample for each website showed a decrease across the board with three websites (A, D & N) achieving scores below 50%. Mean values for the word frequency measure across the two samples ranged from 300,000 to 1 million. Four websites had at least one value above 1 million. Across all three measures (readability, word variability and frequency), the People First website N achieved scores reflecting a greater accessibility value, with the lowest Fog indices and word variability scores, and the shared highest word frequency score. The performance of website Z*, the mainstream comparator, was fairly unremarkable compared with the majority of the People First websites.

4.1 Sentence level

Readability of website text as measured by the Fog Index varied across the websites. Only two websites achieved a level below the recommended bar of '8' for universal readability (University of Minnesota 2006). This is a disappointing result, given that the reading comprehension of people with intellectual disability is likely to be lower than that of the general population (Lyon 1996; Erickson 2005; Jones *et al.* 2006). The Fog Index is derived from the number of long sentences and polysyllabic words within a piece of text, the processing of

which relies heavily on the working memory, often an area of difficulty for this population (Emerson et al. 2001). Poor readers struggle to decode multisyllabic words (Archer et al. 2003) and long words can impact on comprehension levels (Karreman et al. 2007). If, as suggested in Leong, Ewing and Pitt (2002), 20-25 words per sentence is equal to the skills of an advanced degree level reader, then the majority of the websites are likely to present readability challenges for users with intellectual disability (Lyon 1996; Erickson 2005; Jones et al. 2006; Verhoeven and Vermeer 2006). It is possible that a structure strategy, such as use of a bullet point list, has caused an increase in sentence length in some websites, which may in fact aid readability (Meyer 2003). Most of the People First websites, as well as the mainstream comparator, contained graphics, which may have aided reading comprehension for website users through the cueing of key meanings represented in text (Johnson and Hegarty 2003). However, the mere presence of graphics is not a guarantee of readability and demands a strategic correspondence between meaning in text and meaning conveyed in pictures (Hoppestad 2007). The mainstream website attained one of the four highest mean scores for readability, indicating a higher level of word and sentence complexity than the remaining twelve websites. It would appear that linguistic complexity may have been considered in the authoring of People First texts, although there is still work to be done if a lower score in keeping with universal standard of eight is to be achieved.

4.2 Lexical variety

The word variability (TTR) scores revealed an uneven profile across the People First websites, ranging from 54 to 80. Ten of the websites, including the mainstream comparator, had mean scores above 65%, four of which were above 70%. Compared with similar measures taken from upmarket daily newspapers (Westin 2002), the scores revealed greater lexical variety. Lexical variation is not explicitly addressed in the production of 'easy to read' material (Freyhoff et al. 1998; Mencap 2008), although use of a narrower lexicon is considered to make for less challenging content (Williamson 2009). This would be in keeping with the reduced mental lexicon of individuals with intellectual disability (Tager-Flusberg and Sullivan 1998). The reduction in word variability as the text sample increased in the combined 200 word sample, however, is consistent with the findings of others (see, for example, Baayen 2001; Westin 2002). The disparities between different 100 word samples from the same website may reflect the way subject matter is allocated or indicate a lack of consistency in the website's authorship. Given that the pages of a website tend to be viewed as independent content rather than consecutive pages in a fictional narrative, it may be useful to view word variability within one page rather than across pages.

4.3 Word frequency

The vocabulary used in People First websites may have contributed to some of the lower word frequency scores. Words such as 'advocacy', 'disability' and 'volunteer' were amongst words commonly seen across many of the People First websites, which is in keeping with the overall subject matter. The word 'advocacy' may not be commonly found within a cross section of texts aimed at the *general* population (e.g. BNC), but it is a relevant and widely used term in the community with intellectual disability, particularly amongst the People First membership. Thus individuals may acquire some complex vocabulary specific to their lifestyle needs. It is noteworthy that website N not only achieved the lowest readability index and word variability scores, but also the highest word frequency average, indicating a more consistent approach to text accessibility.

People with intellectual disability are a heterogeneous group with a range of literacy and communication abilities. It would therefore be impossible to compose a 'text' that would be linguistically accessible to all. For some individuals with more severe to profound and multiple intellectual disability, written text is simply inappropriate (Lyon 1996). However, exclusion from the potential benefits of web-based information and communication such as empowerment (Seale and Pockeny 2002; Renblad 2003), development of selfconcept (Bunning *et al.* 2009) and educational advancement (Bevan 2003), is not an option. Text dominated websites prove the biggest barrier to accessibility (Johnson and Hegarty 2003; Harryson *et al.* 2004) amongst users with poor literacy skills. Alternatively, there is a potential role for significant others in mediating user access to website content and negotiating the construction of meaning (Johnson and Hegarty 2003).

4.4 Limitations

The scope of the three measures used in this descriptive study were restricted to surface level linguistic accessibility, but the ultimate test would have been to evaluate reading comprehension amongst a sample of website users with intellectual disability. The Fog Index is relatively quick to calculate, but does not consider slang, style and syntax, existing contextual knowledge and personal interest in the subject matter (Schutten and McFarland 2009). Furthermore, it does not consider the coherence of paragraph structure that might support accessibility. Future research should include measurement of text cohesion variables such as noun and argument overlap; stem overlap; ellipsis and connectives. The TTR provided a useful indication of lexical variety; however, the topic-based structure of websites meant that application to individual pages would have been more useful than to the numbered samples that went across pages in some cases. Word frequency, whilst giving higher values to words in common usage, did not accommodate the specialized vocabulary of the

People First audience. Furthermore, the factor of word imageability, e.g. the extent to which a word is associated with the senses, was not considered. For example, the word 'the' was assigned a high frequency score above six million, compared to the more concrete word 'people' at a value of 127,711 (Gleason and Ratner 1998). Future research should consider word frequency in tandem with word imageability.

4.5 Summary and implications

The internet offers some new possibilities for the giving and receiving of information, for communication and personal empowerment. Website design and linguistic content would benefit from consideration of factors such as text readability, lexical variety and frequency if the inclusion of people with intellectual disability is to be secured. However, the real test of a website's accessibility must involve the user group in comprehension tasks based on recall and conceptual understanding. Research and development in this area might be served by the discipline of linguistics in conjunction with expertise from the fields of intellectual disability and assistive technology. Ultimately, population heterogeneity probably means that accessibility of web design and linguistic content will never be sufficient to include all individuals with intellectual disability. Future research might consider not only the linguistic accessibility as measured by reading comprehension demonstrated by users, but also the potential relevance of human mediation as the bridging point between the user and the website.

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