A PICTURE IS WORTH 1,000 WORDS: DEPICTING WEB PAGE MENU ENTRIES USING IMAGES FOR PEOPLE WITH LEARNING DISABILITIES

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Abstract: The use of images, symbols and other pictorial representation in websites is both common practice and urged in the literature on web design, particularly with regard to people with learning disabilities. However, there is a paucity of literature on the efficacy of using images in this way, and on what might be the most effective pictorial representation of various topics related to 'transition' – the change from the protective environment of school to the adult world of supported employment and more independent living. The aim of the study was to determine which were the most effective depictions of transition-related topics – such as leisure, health and education - with regard to three types of photographic and artistic representation – photos, icons and Widgits. The study was undertaken in two stages. A qualitative stage explored the meanings given to various photos and icons, selected from appropriate websites and literature. Stage two consisted of an online exercise, in which participants are presented with various photos or other representations and select which category the belong to (health, work etc.) Results suggested 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 representation. More concrete topics such as Friends, are easier to represent pictorially than concepts such as Support or Safety. The most effective representations were photographic, with Widgits being the least effective. A strong case could be made from these results for audio rendition of labels.

Keywords: Pictorial representation. Web site design. Learning disabilities.

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UMA IMAGEM VALE MIL PALAVRAS: REPRESENTANDO LISTAS DE PÁGINAS DA WEB USANDO IMAGENS PARA PESSOAS COM DEFICIÊNCIAS DE APRENDIZAGEM

Resumo: O uso de imagens, símbolos e outras representações gráficas em sites é uma prática comum e é aconselhável na literatura sobre design web, particularmente no que diz respeito a pessoas com dificuldades de aprendizagem. No entanto, há uma escassez de literatura sobre a eficácia de usar imagens dessa maneira e sobre o que poderia ser a representação pictórica mais eficaz de vários tópicos relacionados à "transição" - a mudança do ambiente protetor da escola para o mundo adulto de empregos apoiados e uma vida mais independente. O objetivo do estudo foi determinar quais foram as representações mais efetivas de temas relacionados à transição - como lazer, saúde e educação - em relação a três tipos de representação fotográfica e artística - fotos, ícones e Widgits. O estudo foi realizado em duas etapas. Uma etapa qualitativa explorou os significados dados a várias fotos e ícones, selecionados de sites e literatura apropriados. O estágio dois consistiu em um exercício on-line, no qual os participantes são apresentados com várias fotos ou outras representações e selecione a qual categoria pertence (saúde, trabalho etc.). Os resultados sugeriram que, embora insistivamente sensato, o uso da representação gráfica não pode realmente ajudar a compreensão do conteúdo, devido às dificuldades inerentes à tentativa de encapsular conceitos dentro de uma única representação. Tópicos mais concretos, como Amigos, são mais fáceis de representar de forma gráfica do que conceitos como Suporte ou Segurança. As representações mais efetivas foram fotográficas, sendo Widgits o menos efetivo. Um caso forte poderia ser feito a partir desses resultados para renderização de áudio de rótulos.

Palavras-chave: Representação gráfica. Design do site. Deficiencias de aprendizagem.

UNA IMAGEN VALE MÁS QUE 1.000 PALABRAS: REPRESENTA LAS ENTRADAS DEL MENÚ DE LA PÁGINA WEB CON IMÁGENES PARA PERSONAS CON DISCAPACIDADES DE APRENDIZAJE

Resumen: El uso de imágenes, símbolos y otras representaciones pictóricas en los sitios web es una práctica común e insiste en la literatura sobre diseño web, particularmente con respecto a las personas con discapacidades de aprendizaje. Sin embargo, hay una escasez de literatura sobre la eficacia del uso de imágenes de esta manera, y sobre lo que podría ser la representación pictórica más efectiva de varios temas relacionados con la "transición": el cambio del entorno protector del mundo escolar al mundo de los adultos. empleo apoyado y más vida independiente. El objetivo del estudio fue determinar cuáles fueron las representaciones más efectivas de los temas relacionados con la transición, como el ocio, la salud y la educación, con respecto a tres tipos de representación fotográfica y artística: fotos, iconos y Widgits. El estudio se llevó a cabo en dos etapas. Una etapa cualitativa exploró los significados dados a varias fotos e íconos, seleccionados de sitios web y literatura apropiados. La segunda etapa consistió en un ejercicio en línea, en el que los participantes se

presentan con varias fotos u otras representaciones y seleccionan a qué categoría pertenecen (salud, trabajo, etc.). Los resultados sugirieron que, si bien intuitivamente es sensato, el uso de la representación pictórica puede no ayudar realmente a la comprensión del contenido, debido a las dificultades inherentes al intento de encapsular conceptos dentro de una única representación. Temas más concretos como Amigos, son más fáciles de representar pictóricamente que conceptos tales como Soporte o Seguridad. Las representaciones más efectivas fueron fotográficas, siendo Widgits la menos efectiva. A partir de estos resultados, podría obtenerse un buen argumento para la reproducción de audio de las etiquetas.

Palabras clave: Representación pictórica. Diseño de sitio web. Dificultades de aprendizaje.

Introduction

A popular saying in the English language claims that 'A picture is worth 1000 words[2]', suggesting that one image can convey as much meaning as would require a large amount of descriptive text. However, although not an intended meaning for the saying, one could argue that a picture may also have 1,000 different interpretations. In semiotics, for example, one 'sign' (photo, icon or other representation) may signify a large number of concepts. Thus, a portrait of Marylyn Munro could signify glamour, sexuality, beauty, depression, youth, drug-taking, wealth, etc. (CHANDLER, 2017). Thus, attempting to encapsulate one specific concept as an image for a web site menu entry is fraught with difficulty. For example, what could the picture of a policeman represent, if one were not literate enough to read the accompanying verbal entry 'Safety'? 'work', perhaps? Or 'authority'?

An examination of this issue is important, as the use of images, symbols and other pictorial representation in websites is both common practice and urged in the literature on web design (SINGH; GEDEON; RHO, 1998; HUDSON; WEAKLEY; FIRMINGER, 2004), particularly with regard to people with learning disabilities (SEVILLA et al., 2007; BOHMAN, 2013a). In addition to their use in the body of web pages, to replace or accompany verbal content, images, in the form of photos, icons or other pictorial representation also accompany hyperlinks, most notably in contents or menu lists.

[2] Attributable to Frederick R. Barnard, who published a piece commending the effectiveness of graphics in advertising with the title "One look is worth a thousand words" *Printer's Ink*, December 1921 (see: https://www.phrases.org.uk/meanings/a-picture-is-worth-a-thousand-words.html)

However, in addition to there being a paucity of literature on the efficacy of using imagery in understanding content, there is even less on the understanding of images themselves and what they are designed or chosen to represent. Clearly, as an information medium, images are worthless if they fail to convey the meaning intended.

This paper report on a study that explored this issue by working with people with learning disabilities who examined and interpretted the meaning of a number of photographs, icons and Widgit Symbols relatd to the topic of transition.

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.

Literature review

Jones, Long and Finlay (2007, p. 546) note that '*T*he 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 explain: 'stimuli, including words and symbols, can be substituted for each other in a particular context without meaning being substantially altered'. The concept 'fruit', for example, being represented orally, in writing and by a drawing having the same meaning, if one knows the conventions, and therefore being mutually substitutable.

Poncelas and Murphy (2007, p. 466) 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' (PONCELAS; MURPHY, 2007, p. 467). Jones, Long and Finlay (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 at least 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)' (PONCELAS; MURPHY, 2007, p. 466). Participants were randomly assigned to two groups, each receiving one of the versions, and asked a series of questions on it, immediately after exposure and again a short time afterwards.

Neither version was well understood. The text-with-symbols group showed no better understanding than the text-only one. This was true whatever the level of understanding. For example, those with better language comprehension scores and/or reading skills tended to show a higher understanding – but in both conditions equally. The conclusion of the study overall was that 'the addition of symbols to simple texts does not necessarily improve people's understanding of it' (PONCELAS; MURPHY, 2007, p. 466).

Jones, Long and Finlay (2007) had the similar aim of testing whether adding symbols to text improved its comprehensibility for adults with Learning Disabilities. Their results, however, were markedly different. They worked with 19 adults with 'mild or borderline' Learning Disabilities, whom they asked to read four short passages of text, two of which had Widgit symbols added (Widgit 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]). Following their reading of each passage, they were asked four comprehension questions.

Participants scored significantly better on the comprehension tests on the symbolised text condition than on the plain text one. 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' (JONES; LONG; FINLAY, 2007, p. 545).

The stark contrast in these results might be due to the choice of materials used: passages from a low-graded reading test by Jones, Long and Finlay (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', 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, Long and Finlay (2007, p. 547) 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 symbolize abstract concepts.

Hannus and Hyona (1999) studied the effects of illustrations on learning 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 the two media. Results suggest that learning is heavily driven by the text and that children inspect illustrations only minimally. In fact, 'illustrations may [...] be harmful for poorer learners [who spent] more time away from the task ... 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, p. 119) that pictures distract low-ability learners'

attention away from the actual learning task and [...] may, in fact, be a hindrance to learning'.

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. 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.

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, p. 180). 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. Findings suggested that pictures with text – in all formats - enhanced comprehension.

The groups using booklets with illustrations scored higher on a test than the non-illustrated book group. This was most marked with the matchstick and cartoon groups. Moll (1986) suggests 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 et al., 2006).

Methodology

Setting

The qualitative phase of the fieldwork was carried out at two campuses of a Further Education (FE)College in Hertfordshire, England, in the familiar setting of the participants' classroom. In each case, the groups were attending the same course and participated during one of their classes. Other institutions and organisations participated in stage two.

Sample

The population for phase one of the study were all classes as having 'mild' learning disabilities. As such, they had a reading age of around 8 years, had some difficulty expressing themselves (although their receptive language was good). Both those at the college of FE and at other insititions (Day Centres; Voluntary groups etc.) were being taught, either formally or informally, aspects of 'skills for life' including handling money, coping with employment and basic IT skills. For the qualitative phase of the project, an initial sample of six learners, from the FE college, 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

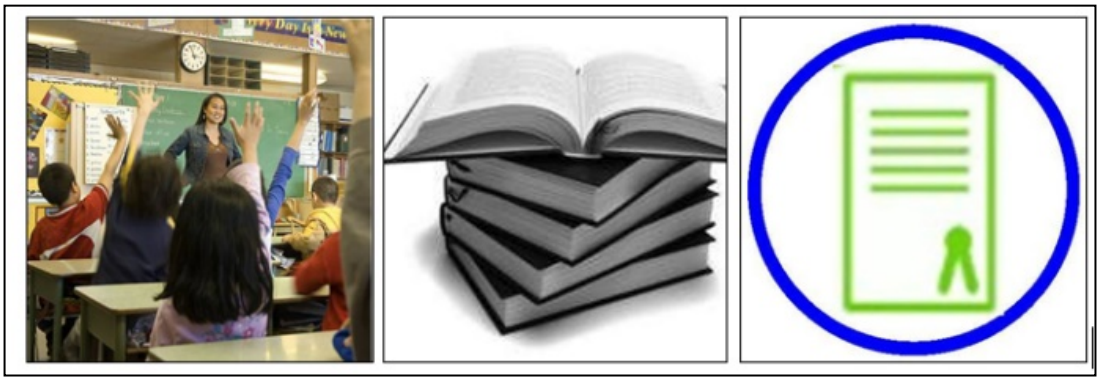
From prior work by both the present author (e.g. WILLIAMS, 2008; MINNION et al., 2008); other literature on information needs and transition (TOWNSLEY, 2004; TARLETON, 2004; WARD et al., 2003; MORRIS, 2001, 2002) and resources available (e.g. Mencap[3]; Friendly Resources[4]; Movingonup[5]), several categories of information topics were drawn up. These were: Education; Health; Leisure; Independent Living; Relationships; Safety; Support; Work.

Three representations of each topic were found or created. These were, Education as an example (Figure 1):

- As direct a photographic representation as possible (a photo of a teacher with her class)
- A less direct photograph (a photo of a set of books)
- 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 in the context of the containing page.

Figure 1 - 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 study reported here.

[3] www.mencap.org.uk
[4] www.friendlyresources.org.uk/
[5] www.movingonup.info

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 each category.

Stage two consisted of an online exercise, undertaken using a web page written in JavaScript (see Figure 2). Participants were presented with a pictorial representation of one of the topics, with a list of topics across the top of the screen. They select the appropriate topic by clicking. The screen is refreshed with another representation.

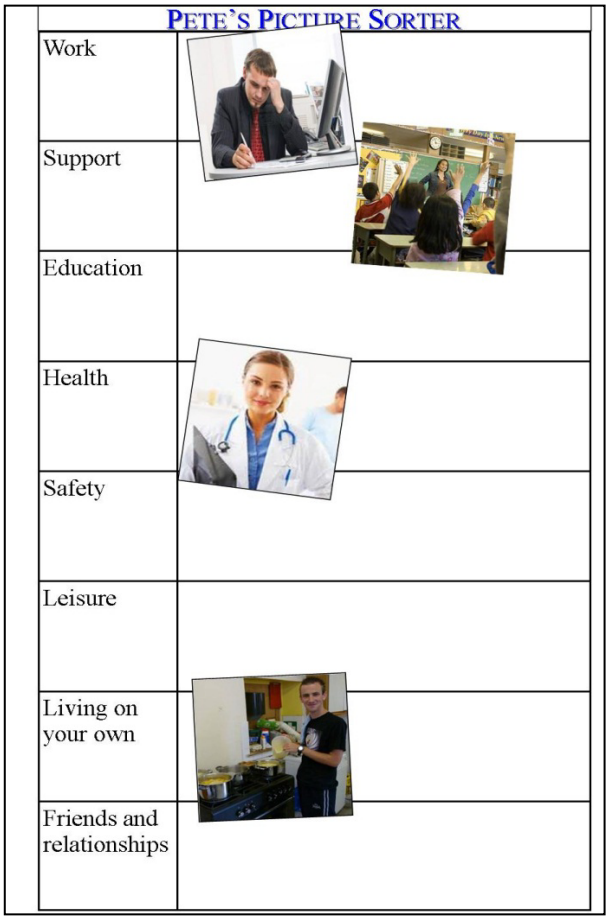
Figure 2 - Icon recognition interface

A session consisted of 24 iterations, after which participants were prompted to hit a 'Finish' button. This submitted the data for capture. Data gathered were the representation selected, the original image designation and 'success or fail'. 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 to explain the project and the participants' roles in it. 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 3 - 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 part of the research, 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.

Data Analysis

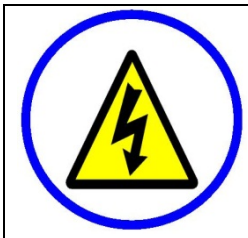
Each picture was placed in a category by the researcher and professionals working in the field. This categorisation was compared to those chosen by participants, in order to study the overall variation from the pre-classifications, and the extent to which each class of representation varied from this.

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 1.

Figure 1 - Pictorial representations ('icons' in the text) of the transition topics

			
Safety	Work	Leisure	Friends
			
Support	Health	Living On Your Own	Education

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 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 5) was chosen by the researcher, however, to represent Health.

Figure 5 - 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; BOOTH, 1994; 1996; FINLAY; WALTON; ANTAKI, 2008).

Providing alternative interpretations of the photos containing animals: two photos featured animals (see Figure 6). 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 6 - 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.

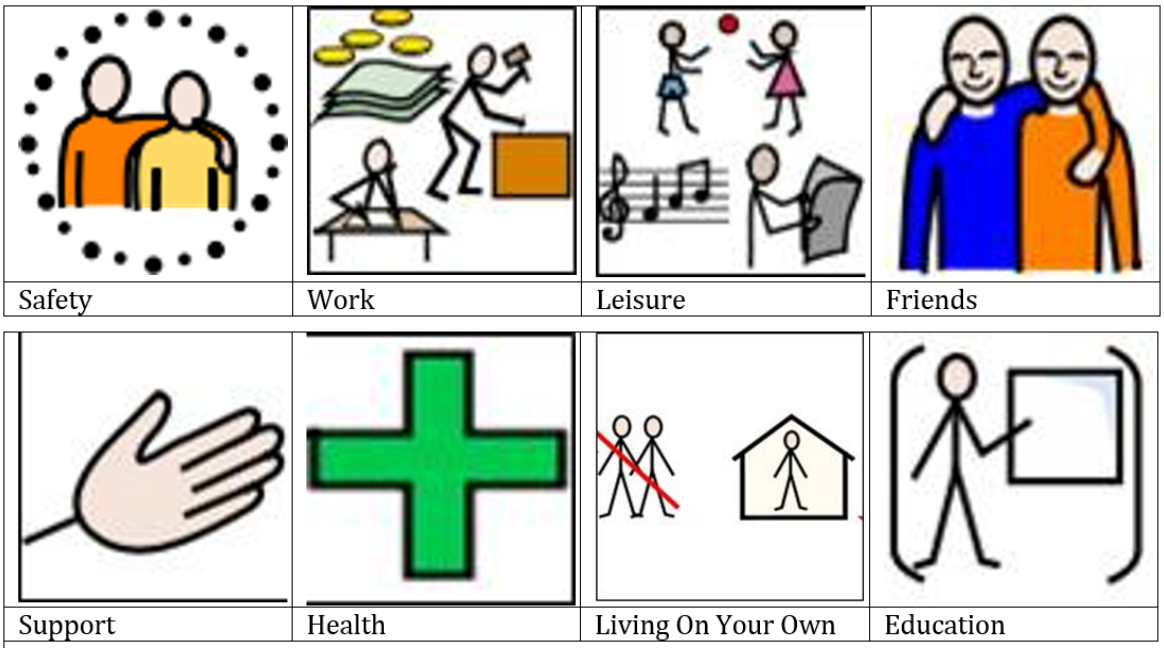
Making well thought-out alternative categorisations: The test showed several other examples where participants placed images in categories other than those for which they were chosen by the researcher. However, these could hardly be called mistakes, but demonstrated just how many photos could be placed quite logically in alternative categories. Examples were:

- Books (Work instead of Education);
- Coach trip (Education instead of Leisure);
- 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 'Widgit' symbols used for this study are shown in Figure 7, below.

Figure 7 - 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) or a sport (possible overlap with Leisure) It was decided to replace the nurse with someone in a yoga pose, which although could be classed as Leisure, may suggest Health more strongly. A second depiction was a photo of a woman apparently with a headache (Figure 8). 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 8 - 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 9). 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 9 - Safety photographs

Leisure: The only problem here was the image of a group of young people looking out of a bus or train carriage. 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 1). 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, 2017), performed the least well, with only around half of the times one of its symbols was presented to participants being correctly categorised.

Table 1 - Study Six: online test: 'success' rate, by representation type

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)		

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 2 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.

Table 2 - Study Six: online test: 'success rate' by topic

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 3 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 **Erro! Fonte de referência não encontrada.** and Figure 1). 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.

Table 3 - Study Six: online test: results in percentages by topic and representation type

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)

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 (Error! Reference source not found.), 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.

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 (Figure 10), 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 2 - 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 (**Erro! Fonte de referência não encontrada.**). Surprisingly, another photograph, of someone cooking alone, was seen on only 13 out of 27 (48%) of its presentations as representing this topic.

Figure 3 - 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: U*nusually, the icon (the electric danger sign, as shown in Figure 1) 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 (**Erro! Fonte de referência não encontrada.**) 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 (

Figure **4**), 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 4 - Going out photograph

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 1), 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 Figure 5). This far exceeded any other photo or iconic depiction.

Figure 5 - 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 6 - 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 (

Figure 6). 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, this practice is universally recommended by organisations and individuals concerned with accessible information provision (e.g. W3C, 2017; BOHMAN, 2013b; PEARSON; KOPI, 2003). The present study 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 2). 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, clearly familiar to the participants. 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. It may be that the combination of picture and audio label are more effective than that of picture or text label – a topic for further research.

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