

Supporting the Web Experience of Young People with Learning Disabilities

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Abstract. The paper describes a test setup to survey the needs of young people with learning disabilities with regard to additional functions that could support their use of the web. Via an HTML mock-up, different iconic representations of buttons to invoke these additional functions as well as different placements of the buttons were explored. Results with N=34 indicate that study participants preferred button locations on the right side of web pages and prefer icons with associative symbols and analogy symbols for text sizing functions and low-iconic images, associative symbols and arbitrary symbols for text reading functions.

Keywords: Learning disabilities, special educational needs, SEN, button design, button placement.

1 Introduction

1.1 Access for People with Learning Disabilities

It is widely acknowledged that information and communication technology (ICT) can play a major role in empowering disadvantaged groups towards better participation in society. However, people with learning disabilities are rarely benefitting from ICT. For many years accessibility issues have been dealt with in numerous projects, activities and large-scale initiatives, but the centre of gravity has been on providing access to ICT for motor or sensor impaired users. Guidelines for designing accessible ICT still become vague, when the target group of people with learning disabilities is addressed. Although usability aspects have migrated slowly into common guidelines for accessibility, they have been often dealt with as “optional”. But for people with learning disabilities poor usability can inhibit the use of ICT, while other user groups might find ways of working around usability flaws. Good usability, hence, needs to be upgraded to a high-priority accessibility requirement for people with learning disabilities.

1.2 Research Activities in the Field of ICT Accessibility

A multiplicity of projects and initiatives has focused on accessibility of ICT for people with disabilities in the previous 15 to 20 years. In Europe, the Telematics

Applications programme as part of the 4th Framework Programme (1994 – 1998), e.g., included the ‘Technology / Telematics for the Integration of Disabled and Elderly people’ initiative. Later, accessibility and the inclusion of the requirements of people with disabilities in ICT research and development projects were highlighted as obligatory for all projects to be funded.

There are only few resources available that provide empirical evidence on guidelines issued by experts to support the web experience of people with learning disabilities. Key problem issues that need to be addressed were identified in a project that tested an interactive multimedia learning environment with the target group [1] and came up with the following areas: accessibility, navigation, pedagogic structure, aesthetics, games and screen properties. Authors also claim that there is still a need for a more holistic approach to maximizing the role of the Web in enabling disabled people to access information, services and experiences including those with learning disabilities [2].

Some projects of interest to this area are for example ON-LINE [3], a European learning project to offer new ways of access to multi-media learning for people with special educational needs (SEN), the ECDL for people with disabilities [4] that aimed at adapting this ECDL certificate to the needs of people with disabilities, and ACCESSIBLE [5] that started 2008 and aims at researching and developing an assessment simulation module in order to fully support and incorporate accessibility approaches for the design and development of accessible new applications.

1.3 Target Group

Problematic with regard to the comparison of results of different activities is that there is still no internationally agreed disability terminology available. Hence, statistically comparable data are also missing to estimate the dimension of the target group. And because national definitions are often broad and not well-defined, the group of people with learning disabilities, who will be in the focus of the study, needs some further explanation. The target group comprises of people with learning / cognitive disabilities (IQ lower than 70) including people with autism, or deaf and blind people with cognitive problems, yet without people who are mentally ill. Spoken in terms of the WHO’s ICD-10, the target group encompasses people with moderate mental retardation (IQ 35 – 49) and mild mental retardation (IQ 50 – 69). (The IQ, however, is not necessarily a reliable measure, as many of people’s abilities and strengths do not show up well in IQ assessments. In fact, levels of learning disability are points on a spectrum, without clear dividing lines between them [6]). Within the study we aim at reaching people, who are able to communicate by spoken language, but their cognitive ability like attention, cognition, perception, conclusion, memory, abstraction or logic is limited by the disability.

2 Methodology

When surveying the needs of people with learning disabilities and of people with motor or sensor impairments, the knowledge base with regard to ICT accessibility

seems to be disproportionate compared to the number of people who belong to these groups. While there is a multitude of experiences, tools, surveys and research outcomes available in the field of visually and motor impaired ICT users, users with learning disabilities are hardly covered. Most often, easy to understand language as well as clear navigation is recommended. Within this study, it is aimed to go a step further and to explore *how* and *where* additional functions should be made available for web browser users with learning disabilities.

For target group specific reasons, only a limited number of additional functions will be explored in the study. Often, people with learning disabilities have a limited span of attention. The introduction of too many new functions could be confusing and tiring to them. Therefore, two functions (*increase/decrease text size, start/stop reading aloud*) will be explored, and other functionality will be tested in additional studies later on.

As a lack of suitable content resources for the target group has been reported all over, the first step for setting up the study was to make available an information resource that both is interesting to the target group as well as is offered in easy to read. This information resource provided an easy to read version of the UN Convention on the Rights of Persons with Disabilities in German, implemented with an additional focus on the ease of navigation and use (see conference contribution by Erle & Bergmann). The pre-test scenario to check, whether the UN Convention is written as well as implemented in an understandable and fully accessible form, has been extended to address the study questions.

The target group to participate in this study was in the role of user experts. In advance to their participation, they received information on the project and on the purpose of their potential participation in understandable language, and at any stage of the project they could decide not to participate (anymore), without any negative consequences for the user.

3 Research and Development Work

From observations it was assumed that people with learning disabilities use the same web browsers like anybody else. The two most widely used web browsers in Germany are Mozilla Firefox (60%) and Internet Explorer (27%). Consequently, the navigation bar of the Mozilla Firefox web browser had been replicated in HTML to allow easy addition and modification of buttons, and the navigation bar of the browser engine underneath was hidden such that only the simulated bar remained.

Study participants were asked about their perceived level of own ICT experience (e.g. tools / applications they use when they are online) and about their knowledge of menus and navigation buttons. For each of the new functions (i.e. *increase font size, decrease font size, start reading aloud, stop reading aloud*) they were asked to select one icon from a set of 12 icons that best represent the function to the study participant. While Figure 1 groups these icons according to their level of graphical abstraction, the participants were offered a mix of 12 icons per function.













| | | | |
|---------------------|---|---|---|
| High-iconic images |  |  |  |
| Low-iconic images |  |  |  |
| Associative symbols |  |  |  |
| Arbitrary symbols |  |  |  |

Fig. 1. Classification of icons (here: *stop reading aloud*) by level of graphical abstraction

After the selection of one of the presented icons, each new function was represented by a button that used this icon. Yet, the same button was placed at three different locations at the same time (see Figures 2 and 3). The first location was the top of the page menu which often is located left-hand side. The assumption for this location was that the main menu attracts a lot of attention, so the new function's location would be in the focus of the user's attention. The second location was at the far right-hand side in an area free of content. A vertical menu with functions like *print*, *sitemap* and *contact* was extended by the new button(s). The underlying assumption was that a button placed there does not need to 'compete' with other information for the user's attention. Finally, a position in the browser's navigation bar, just between the icons and the address bar was chosen. The assumption was that the browser's navigation bar always stays visible even on long pages where users might need to scroll down.

The aim was to observe where study participants naturally expect a new function to appear, and to monitor which of the three locations was selected when users were asked to use the new functions. As to minimize the influence of other factors, the icon / button selection area was placed equidistant to the three locations, and the size of the browser's navigation bar was slightly increased such that navigation buttons matched the size of the buttons for the new functions.

4 Results

The study was performed March 2010 with 34 young participants (20 male, 14 female) aged between 11 and 23 years in four different educational institutions. Three of these institutions were secondary schools, while the fourth was a pre-vocational institution. All participants were informed about the study and its purpose and agreed to contribute.

More than 60% of the study participants do have a computer at home, and more than 56% have internet access at home as well. Accordingly, the participants scored their own IT experience above average (3.5 on a scale from 1 'not at all' to 5 'very good'). Being asked of how often per week they go online the participants responded with 3.2 times per week in average. Preferred activities online were: watching videos (65%), listening to music (53%), gaming (47%), chatting (29%), writing / reading e-mails (29%), reading (18%) and searching for photos (15%).

4.1 Icon Design Preferences

To elicit the participants' icon design preferences, a web-based search for "real-world" examples for the four functions (*increase / decrease font size* and *start / stop reading aloud*) was performed. The rationale for searching icons instead of designing completely new ones was that real exemplars have some likelihood that users might encounter them while browsing the web.

In general, icons can be grouped into categories of high-iconic images, low-iconic images, associative symbols, ideomorphic symbols, isomorphic symbols and arbitrary symbols. However, for the functions *increase* and *decrease font size* no suitable high-iconic images could be found, while no suitable analogy symbols could be found for the functions *start* and *stop reading aloud*. Per icon category 3 icons were chosen, resulting in 12 icons presented to the participants per function.

Table 1 and Table 2 summarize the results of the study with regard to icon design preferences. The data imply that associative symbols and analogy symbols are quite well known and appreciated as self-explanatory enough to represent the two functions *increase / decrease font size* (see Table 1). For *start reading* low-iconic images and associative symbols seem to be preferred, while for *stop reading* the preferences are spread quite similar over the three categories low-iconic images, associative symbols and arbitrary symbols (see Table 2).

Table 1. Proportion of users who selected an icon considered most self-explanatory for the respective function (*increase / decrease font size*) from 4 different icon categories (N=34)

| | Increase font size | Decrease font size |
|---------------------|--------------------|--------------------|
| Low-iconic images | 18 % | 12 % |
| Associative symbols | 33 % | 21 % |
| Analogy symbols | 33 % | 48 % |
| Arbitrary symbols | 15 % | 18 % |

Table 2. Proportion of users who selected an icon considered most self-explanatory for the respective function (*start / stop reading aloud*) from 4 different icon categories (N=34)

| | Start reading aloud | Stop reading aloud |
|---------------------|---------------------|--------------------|
| High-iconic images | 13 % | 16 % |
| Low-iconic images | 34 % | 29 % |
| Associative symbols | 38 % | 26 % |
| Arbitrary symbols | 16 % | 29 % |

4.2 Button Location Preferences

After each icon selection, buttons were automatically generated using the icons as its graphical representation. Three copies of the same button were placed on the web site as described in section 3. The functions *increase* and *decrease font size* were included in a side menu on the right side of each page, in the left main menu and in the navigation bar (see Figure 2). 68% of the users selected the button placed right, 24% the button on the left, and no user the button placed in the navigation bar. 8% of the users did not find any of the three buttons.

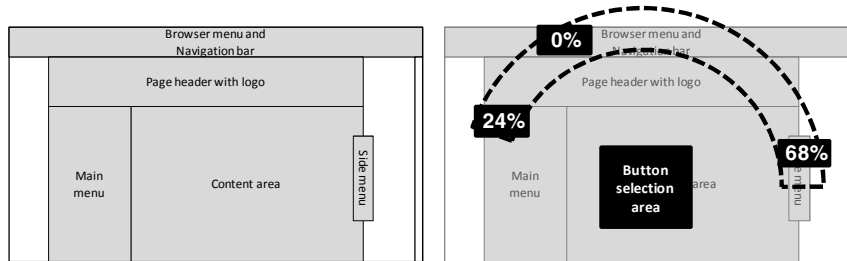


Fig. 2. *Left:* Basic structure of web page; *Right:* placement of buttons equidistant from the button selection area and percentage of users who selected each respective location. 8 % of users did not succeed in finding any of the buttons (N=34).

The test for the *start* and *stop reading aloud* function was quite similar. Yet, it was observed that on many web pages the button to invoke this function was placed behind the headline of the content area. In consequence, the button position formerly located in the right side menu was shifted slightly top-left to respond to this observation. The results are displayed in Figure 3. While 3 participants did not find any of the buttons for the other two functions, now 4 participants did not succeed (12%). This means that one participant who found the *increase / decrease font size* buttons on the right did not find the *start / stop reading aloud* buttons any more. In total, 62% of the participants used the buttons on the right, 26% the buttons on the left, and again no participant used the buttons in the navigation bar.

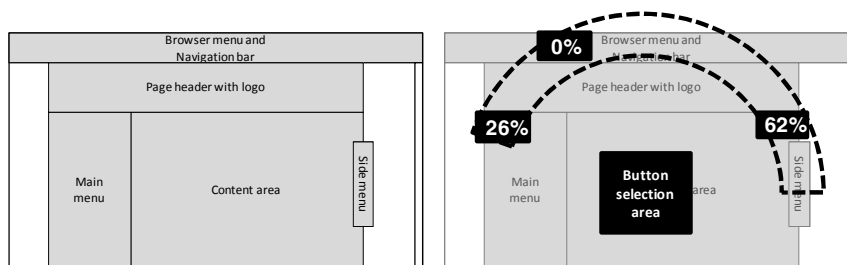


Fig. 3. *Left:* Basic structure of web page; *Right:* placement of buttons equidistant from the button selection area and percentage of users who selected each respective location. 12 % of users did not succeed in finding any of the buttons (N=34).

As to get further information on why the navigation bar location was the least favored, all participants were also asked about their knowledge of menu items and navigation bar functions. While 50% of the users knew at least one menu item under the *File* entry, only few knew other functions under other menu items (see Figure 4). 65% of the participants knew the *Back* button, 56% the *Forward* button, 6% the *Reload* button and 9% the *Home* button.



Fig. 4. *Left:* Browser menu and navigation bar; *Right:* Percentage of users who knew at least one of the functions of menu items or of the respective navigation bar icons (N=34)

5 Discussion


First of all, the group of study participants was in no way representative for the target group. The study aimed at younger volunteering participants as those are more likely to have web experiences. Second, the selection of icons used within the study was based on subjective grounds. The perceived frequency of occurrence triggered the decision to use an icon in the study. In general, high-iconic images would benefit from larger presentations than buttons provide. The study researched existing icon designs but did not explore own designs yet. However, the study results provide some insights which icon category seems to be suitable to be selected in future design.

An interesting issue was observed during the study. The web page contained a search field whose search button showed a magnifying glass. However, 52% of the participants selected an icon with a magnifying glass to represent the function *increase font size*, and 33% used an icon with a magnifying glass to represent the *decrease* function. Accordingly, only 23% of the participants found the search field without help. Obviously, this points out an area of potential conflicts.

Assumptions about the right placement of buttons on a web page were based on typical design decisions when setting up new web sites. As a new idea, a button location within the navigation bar was explored as well. This aimed at including the web browser into the discussion of ‘practical usability’, as users experience the combination of interactive elements in the web pages and of the web browser, which might create an overall complexity, resulting in barriers for the target group.

The results, however, show that users with learning disabilities, although quite web-experienced, prefer a location for additional functions which is not addressed accordingly by web designers yet. Buttons in the navigation bar were obviously placed in areas of low interest and presumably low attention accordingly. Study participants were also asked whether they could guess the functionality behind some additional buttons: 94% would expect a printing function behind a button with a simplified printer as an associative symbol, 50% would expect a mailing function behind a button labeled with a simplified letter, but only 14% expected a help function behind a button labeled with a question mark. Buttons that contained their function in writing (e.g. the “send” button) were recognized by all study participants. Research by Davies et al. [7] who modified web browsers supports these findings. Their modifications resulted in significantly improved performance data and user satisfaction levels. Sevilla et al. [8] consequently eliminated the menu in a modified browser and used only simplified buttons such as *Back* and *Home*.

The meaning of arbitrary symbols needs to be learnt, as it cannot be derived from its visual presentation (e.g. currency symbols). From the study’s target group it was expected to have participants with limited cognitive abilities in the area of memory (for recognition of symbols) or in the area of conclusion and logic (for inferring that if a symbol works in one situation it could have the same function in another situation).

Surprisingly, arbitrary symbols ranked high to represent the function *stop reading aloud*. The symbol used for that is one often found on remote controls or music players ('pause', ) , so it can be assumed that study participants were familiar with those interaction elements. This outcome highlights the relevance of training aspects and calls for a standardization of key interaction elements to support learnability of new applications as well as of explorability of web sites for the target group.

Study data suggest that the users hardly pay any attention to the navigation bar and thus are not aware of changes that take place within that area. This is possibly a strategy to cope with complexity, or to focus on areas that are useful to them. In fact, most web pages can be operated without the need to use navigation bar items. It could be worth exploring whether the location for buttons in the navigation bar will attract more attention if the other functions provided there are really useful for the users.

Future activities resulting from these outcomes include studies with people with learning disabilities aged 25 or older to cross-check whether age or ICT experience has an impact on the results, exploring the redesign of the browser standard buttons and layout to see whether user interaction improves, and discussing how web page content including navigation and browser design could be synchronised such that overall complexity can be prevented or at least reduced.

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