

Investigating ways of redesigning information systems for people with reading difficulties

DM2624 Project Report 2022

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1 Introduction and Background

Dyslexia is a reading or writing disability that affects a lot of people to some degree. One place where this can be a big hindrance is in museums. Most museums use text-heavy plaques to inform visitors about the different displays. This presents an accessibility issue for those with reading disabilities.

This project aimed at answering the question: *How can user experience for people with dyslexia be improved with redesigned information screens at the Play Beyond Play exhibition at Tekniska Museet?*

To answer the question we have considered criteria and design guidelines regarding web accessibility and dyslexia to come up with an alternative design to the existing screens. Both the new and the original designs were tested to evaluate improvements regarding usability.

Although the main target group for the project was people with dyslexia, the redesigns were expected to improve accessibility for most visitors, in line with the design-for-all principle (see section 1.1.2.).

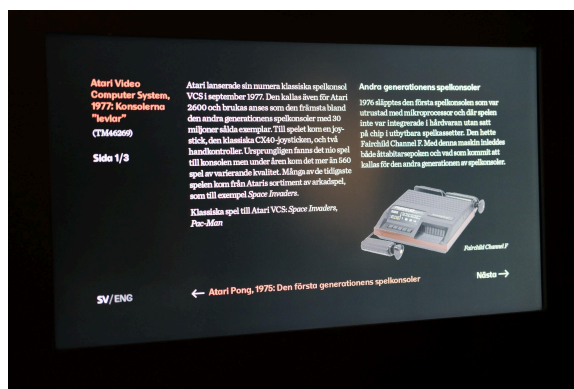


Figure 1: The original design

1.1 Background

1.1.1 Dyslexia

According to The Swedish Dyslexia Association, approximately one in five children experience some kind of reading or writing disability [1]. A subgroup to these disabilities are people with dyslexia. The number of people affected varies in the literature, but is estimated to be around 5-8 percent of the Swedish

population [1]. Dyslexia is also said to have an occurrence of between 10-20 percent for the world population [2]. Its effects can be eased by using information technology and counseling, among other things. Dyslexia is said to be congenital and life-long in its effects [3]. Dyslexia is not strictly defined from other reading and writing disabilities, which is why the number of affected people varies based on the research.

In their paper from 2012, de Santana et al. describes how the difficulty in learning to decode and to spell is at the core of dyslexia [2]. In their paper, they also present state of the art research on dyslexia and web accessibility. Based on this, they present a comprehensive set of guidelines for use in designing web pages with dyslexia in mind. These guidelines laid the foundation for how the information screens at the Tekniska Museet exhibition were redesigned.

1.1.2 Design-for-all

Design-for-all is a design principle that aims to create designs that are accessible for all, without the need for specialized solutions for people with disabilities. The principle is human centered and tries to address the full range of human capabilities [4]. Some examples of design-for-all are automatic doors, text with good readability, and good indexing of websites.

1.1.3 ICT in museums

Information and communication technology in museums is something that has been appearing more and more during the recent years. The museum subject of this project, Tekniska Museet, has quite a bit of modern ICT solutions for making the museum more accessible. The exhibition Mega Mind, for example, utilizes specialized information screens that have been designed with several different disabilities in mind. Another example of a museum incorporating ICT solutions is Hallwylska Museet that have made their museum available online using 3D scans of the different exhibits. This way the museum is more accessible to people that might have trouble making it there.

1.2 Ethical considerations

Disability can be a sensitive topic. Something to have in mind is that people with hidden disabilities might not want to share it. In consideration for the

participants, all identities were kept anonymous and no names were recorded in the results section.

There is also risk for stigmatization among people using assistive technology [5] which we took into consideration by not creating a different version of the system for people with dyslexia, but instead making the original system better for all - in line with the design-for-all principle.

Bagga-Gupta et al. argues that one should "go beyond the dichotomised binaries that mark understandings of functionality, ability-disability and other identity positioning" [6]. We took these words into consideration when analyzing the results of our study. It is important to not group users as either dyslectics or non-dyslectics and expect these groups to have the same experiences of using the system. Dyslexia can come in many different forms and what is a problem for someone cannot be generalized to everyone. We tried to see if we could find a design that may not be perfect for everyone, but which works for as many people as possible.

1.3 Contributions

The project was mostly conducted in group meetings either physically or over zoom, where all of the present group members worked simultaneously on a part of the project. Everyone worked on the preparation and literature search, as well as coming together to write and construct guidelines. Designing the prototype was done in parts, with different constellations of the group members joining out of availability. As for user testing, not all group members were present for each interview but everyone contributed in some way by either finding participants or conducting the interviews. Overall, the division of work has been made on the spot while we work and the assignments of work have been interchangeable between the group members.

2 Method

The design guidelines used in this project were inspired by the 41 guidelines regarding web accessibility for dyslexia mentioned in Santana et al.'s paper [2], but adjusted to fit in the context of information screens instead of the web. This resulted in 20 guidelines (see appendix).

Using these adjusted guidelines, the current screens were evaluated by looking at pictures of them and pointing out things that could be improved, added or removed. Based on these observations, a plan was made for the new interface design.

After this initial step, a brainstorming session was carried out, where the project group suggested and sketched out ideas for the design of the different pages of the new interface. From the results of this session, a few finalized sketches of the design were made which the final prototype was then based on. The final prototype was created using Google Presentation, where the buttons were given functionality by linking them to different pages of the presentation, mimicking a functional information screen.

After the prototype had been finished the usability evaluations were conducted in two parts. The first part consisted of usability testing where a think-aloud protocol was used to gather data on the user's experience of interacting with the new and the original design. The users were prompted when needed in order for them to explore the entire functionality of the designs. The second part then involved semi-structured interviews where the user's thoughts about the design were gathered by asking questions about the experience and by asking them to make comparisons between the two designs.

Participants were recruited from the networks of group members. The aim of the project, and the fact that the user testing phase wanted to involve people with dyslexia, was presented to them to establish interest. By doing so, they could themselves offer to participate. All participants expressed that they had dyslexia or reading difficulties. 1 out of 4 user evaluations was carried out in place at Tekniska Museet, where the participant could physically interact with one of the old screens as well as our prototype. The remaining interviews had to be carried out remotely over Zoom, where another interactive Google Slides presentation using pictures of the current information screens was used.

3 Results and Analysis

3.1 The new design

The screensaver was redesigned so that the title of the exhibition is static and the start button is bigger and more visible.

To comply with the first design criterion (see appendix), two static elements were added for navigation. One was a screen reader function that complies with the fifteenth criterion. The other was a settings-button which allows the user to access a settings panel. The option to swap between languages was moved into settings where options to

change font size and background color were added to abide by the nineteenth criterion. To fit the sixth criterion the articles were clearly numbered on the menu, but these numbers are also visible in the articles. In accordance with the ninth design criterion the font size was made bigger and for the fourteenth the line spacing was made wider than the original design. The font was also swapped to one without serif, in accordance with the tenth criterion.

Once an article is chosen a static menu button is visible on all pages until the user is back at the menu. In the articles the titles were moved to the top of the page and the page numbers were moved to the bottom of the page to fit the third design criterion. The columns were separated further and the text was split into more pages to not cram everything together and complies with the sixteenth criterion.

3.2 User evaluations

Recurring feedback

All four users mentioned that navigation to the overview-page was easier in the new design thanks to the dedicated menu button. All participants were confused when navigating to the menu in the original design. It also took them longer to do so compared to the original design, since they had to use the go-back-button multiple times.

All users also mentioned that the new design was easier to read compared to the previous design, but different reasons for their opinion were stated. Two people said that it was due to the generous line spacing, among which one also mentioned the spacing between columns. Two mentioned the advantage of having larger sized text for the readability. One person also described the text of the original design as cluttered.

Three users mentioned that the title of the articles felt misplaced in the first design, where it was placed in the upper left corner. One referred to the title as “the third column of text”, stating that it was difficult to distinguish it from the body text.

Two users mentioned that the possibilities for interaction with the elements on screen were unclear. One of them suggested that the clickable articles on the menu page should be made more button-like, using 3D-shadowing.

Two participants liked the presence of icons in the new design, and one mentioned that the icon size of the new design was good.

Two participants also argued that it was convenient to be able to change language without having to go

through the settings-menu, which was only possible in the original design.

Inconsistency in feedback

The users' opinions on screen resolution and color-contrast were inconsistent. One preferred the low resolution and contrasts of the original screen while another preferred the other screen for the opposite reasons.

3.3 Takeaways/analysis

From the feedback we concluded that providing the user with more navigational tools and better labels while following the conventions for placement and size of buttons, led to a more intuitive navigation experience. We also found that increasing the whitespace in the text in combination to switching to a sans-serif font had a big impact on the readability of the texts.

4 Discussion

Finding, defining, using and carefully choosing design principles and goals for your purpose is a good way to make sure that you do not forget some aspect of your design and that your design is inclusive.

This is the individual part. Write here a discussion of the project work/results, based on your main goals for what you wanted to learn in the course. This part should be of sufficient academic quality; from [1] (and this is recommended reading!):

The Discussion is the hardest section of a scientific article to write, as cognitive skills must be used to properly contextualize the findings of a study. In this article, we guide scientific writers, particularly unexperienced ones, on how to structure a Discussion section based on an article by Docherty and Smith (1999). According to these authors, a discussion should be prepared by organizing information in the following order: (a) statement of principal findings; (b) strengths and weaknesses of the study; (c) strengths and weaknesses in relation to other studies, discussing particularly any differences in results; (d) meaning of the study: possible mechanisms and implications; and (e) unanswered questions and future research. Each component of this sequence is discussed in detail with examples drawn from the literature.

- Benefits for other types of users (children, elders, people who are new to the Swedish language)
- Not very reliable result since we didn't test on a lot of people with dyslexia
- How possible/realistic is this system actually to implement?
- What further research would be needed?
- All people with dyslexia do not have difficulties with the same thing. It can be more reading or more writing.

5 Conclusion

This should be a conclusion that reflects the results and the discussion. A conclusion is usually short. You can include possible future directions (i.e., from a personal perspective: not all in the group have the same interests).

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Appendix - Design criteria

1. Navigation should be consistent and visible at all times
2. Images for navigation should have significant alternative text that describes their function.
3. The pages should be numbered in a clear way
4. All capital letters and italics should be avoided, unless it is an acronym. If highlighting is needed, use bold and bigger text size.
5. Link labels should be easy to understand and use simple language
6. If lists are used, use ordered lists.
7. The pages should not be cluttered and should instead use plenty of whitespace.
8. The design should avoid using pure white as the background color. Patterns and background images should also be avoided.
9. The smallest text size should be between 12 to 14px.
10. Monospaced fonts without serif should be used.
11. Justified text alignment should be avoided
12. Double negatives and complicated language should be avoided.
13. Short paragraphs containing direct sentences with small amounts of information should be used. If a long sentence contains more than one idea it should be divided into two.
14. Paragraphs should be separated with a spacing line and use 1.5 to 2 lines of spacing between lines.
15. A text to speech should be available. The option should exist for the content to be read out loud.
16. A limited quantity of information should be presented, avoiding scrolling and memory overload.
17. Large columns of text should be avoided and default width for columns should be from 60 to 70 characters long.
18. Images, charts, and graphics should be used when appropriate to complement textual information and illustrate complex ideas.
19. Features that allow users to configure background color, text color, font type, and text size should be included.
20. Video or audio should only be provided under users' requests.