

# Workshop with cognitively impaired persons evaluating a website redesign using a clickable mock-up

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**Abstract**—For the redesign of a website targeting persons with any kind of disability, we worked with a group of people with cognitive disabilities. The goal was to test proposed enhancements to the menu of the website, simplifying the user experience but keeping the modifications small, so that users don't have to relearn how to use the website. We prepared a clickable prototype and had it evaluated by the test persons. The project confirmed that clickable prototypes are a useful tool for such evaluations. It shed light on the way how such persons find their way around a website. They preferred a graphical menu over a textual one. But contrary to our expectations, they ignored moving elements that were thought to focus attention on important content. We also found that a navigation is difficult to be evaluated if the website content is not provided in an easy-to-understand language, because non-easy language content of pages navigated to is not recognized as the desired information. The conclusion contains recommendations about the design of clickable prototypes and about priorities on the website (re)design in general.

**Keywords**—accessibility, cognitive impairment, websites, user centered design, mock-up, clickable prototype

## I. INTRODUCTION

In Switzerland there is an umbrella organization consisting of around 40 organizations from the fields of self-help, counselling, and specialist assistance for people with disabilities. The aim of the umbrella organization is to enable people with disabilities to lead a self-determined and equal life in an inclusive society in all areas of life. Therefore, the umbrella organisation runs an internet-based service aimed equally at people with disabilities as well as their relatives and carers. The service website must therefore be accessible to everyone. The previous service was already barrier-free in many areas (e.g. offering a choice of larger fonts, higher contrasts, read-aloud function, etc.). However, people with cognitive impairments still had problems. Previous work and workshops organized by the umbrella organisation had shown that these visitors often do not find what they are looking for on the website. Sometimes a search does find the right article, but because the article begins with a complex title, people do not recognize it as a relevant result. In addition, the visual design of the website was confusing for the target group of people with cognitive disabilities (PwCDs), and its structure, i.e. its menus and submenus, was not clear. There were also the requirements that the use of the service/website should be motivating and be a joy.

This goal of "joy of use" could not be confirmed from the results of an earlier survey. As far as the content was concerned, the website texts were generally too complicated. A project was set up with the goal of enhancing the joy of use. As a complete revision of the texts would have gone beyond

the scope of the project, the project focused on improving navigability: we developed a clickable prototype and used it to obtain and analyse feedback in a further workshop.

## II. WEB CONTENT ACCESSIBILITY

### A. Web Content Accessibility Guidelines

Gartland [1] gives an overview over the existing official recommendations and guidelines about accessibility. There are two main guidelines. The first are the "Web Content Accessibility Guidelines" (WCAG, [2]) that list acceptance criteria in three levels (A, AA, and AAA). Its current version is from 2023 and has been adopted by the European Commission in the form of the EN 301 549 V3.2.1 standard [3]. The scope of the EN standard is much broader than the WCAG, because the EN 301 549 specifies the functional accessibility requirements applicable not only to websites, but to ICT products and services in general within Europe and is intended to be used with web-based technologies, non-web technologies, and hybrids that use both. It covers both software and hardware as well as services. Where websites are concerned, the EN 301 549 links to the WCAG and contains clarifying notes to the WCAG clauses.

Many studies on website design for people with special needs have been carried out in the field of "design for the elderly" [4], or for visually impaired persons. For PwCDs, however, these findings can only be applied to a limited extent.

With a view to people with cognitive, linguistic, or learning disabilities, the mentioned guidelines describe the characteristics of a web service in such a way that the displays and presentations must be simpler, easier to understand and easier to use. It is important to understand that the WCAG guidelines is no cookbook that simply can be followed to achieve a perfect website. On the contrary, chapter 9.5 of [3] contains:

*NOTE: The W3C states that "It is not recommended that Level AAA conformance be required as a general policy for entire sites because it is not possible to satisfy all Level AAA Success Criteria for some content".*

According to [1], the WCAG provides some guidance about plain language, use of icons and images, but fails to deliver clear techniques for "simplified structures and process" that may be required for those with cognitive disabilities.

A website designer must therefore select which criteria are to be optimized, depending on the targeted audience. Concerning websites which target persons with cognitive impairments, the following four aspects are important ([3], chapter 4.2.10):

- Note 1: Adjustable timings, error indications and suggestions, and logical focus order are examples of design features that can help fulfil this clause.
- Note 2: Providing an audio output of the text is an example of support for people with limited reading abilities.
- Note 3: The provision of a spelling aid and word prediction of the text is an example of support for people with limited writing abilities.
- Note 4: Interacting with the content can be easier and less error-prone if tasks are presented in easy-to-follow steps.

### B. Status of the website under review

For the project focusing on the redesign of the service website, we found that service website already fulfilled Notes 1 to 3 largely. However, the last “Note 4” is particularly important, as the website clearly had room for improvement within this aspect of the interaction. So, the project team decided to improve the service primarily via the following sub-aspects:

- Multiple Ways (WCAG 2.1 [2] Success Criterion “2.4.5 Multiple Ways”)
- Headings and Labels (WCAG 2.1 [2] Success Criterion “2.4.6 Headings and Labels”)
- Focus visible (WCAG 2.1 [2] Success Criterion “2.4.7 Focus Visible”)

When analysing the existing service, we found that there is still great potential for improvement in terms of simplifying the website’s content. As this would require not only a re-formulation but also a complete revision of the content, was not a goal to be achieved within the project. If this revision were carried out for optimization purposes, the other aspects of Chapter 9 of EN 301 549 [3] should also be considered.

Another aim of the project was to improve the hedonistic quality of the service. This determines whether using the service of the service is enjoyable. In other words, a service must touch the user emotionally. A service must therefore also have something like a soul that tells a kind of story. This creates character traits, which manage to inspire users and motivate them to use the service again and again. The basics of hedonistic quality are described in [5] under the term “user experience”.

## III. METHODS USED

Usability testing was conducted in combination with observational and group discussion methods as part of the qualitative research approach chosen for the workshop. It was one element in an overarching user centred design approach [6] for redesigning the website. With the limited number of participants available to us, qualitative studies were of greater relevance. For the workshop we prepared a clickable mock-up with an alternative navigation for the website. We worked in groups of two testers and one observer and gave them tasks like what they had to find on the “website” on the laptop. All observers had the same list of criteria about what to look for

during the tasks. They also had a list of questions for a semi-structured interview after the tasks had been fulfilled. At the end, we discussed the observations with the whole group.

### A. The testers

We conducted a workshop with 8 PwCDs. These persons belong to a group who had organized themselves as specialists for technology reviews. They are between age 30 and 50, cognitively impaired to varying degrees (from mild to moderate) and use the internet regularly. An employee of the umbrella organization had become aware of the group and had asked if they would help to improve the website. Their acceptance, based on an informed decision, created an ideal situation, because with this, we met three of the four proposed best practices given by [1] (chapter 5.3.2):

- People: The PwCDs were involved as co-designers rather than subjects being tested or evaluated.
- Space: The space was friendly and welcoming (see C, The workshop).
- Process: The testers were adults participating by their own initiative, so their consent was given.

### B. The prototype

To create a clickable prototype, we used the tool “Figma” [7]. It allows to design screens that look like real websites, containing using images, texts, and screenshot elements, and to define clickable elements that lead to a different screen. Very useful are “intelligent transitions” that animate the transition from one screen to the next one: elements that do not change remain still while elements that change are smoothly animated from one state into the next one.

We first created hand sketches of possible pages and discussed them with the project partners / website owners. After deciding what to implement, we took screenshots from parts of the original website and combined them with new elements to create a realistic-looking prototype.

The main feature was the creation of a graphical menu: The original service website had an illustration that showed a person surrounded by circles or “bubbles” bearing names of topics that could be of interest. But this image was a purely illustrative, passive element. We enhanced it to have all the menu points as clickable circles surrounding the person. To emphasize that the circles are clickable, we wanted to draw attention to them. We designed an element highlighting one of the circles and moving slowly to the next circle (Fig. 1 and Fig. 2). Although [8] recommends in the checklist on table 1 to “Ensure Controls and Content Do Not Move Unexpectedly”, we considered the moving circle neither as content nor as control element, and that it therefore does not violate the recommendation. To ensure that its movement is also not unexpected, we made it very slow and predictable: The green circle stayed in the background of one of the menu circles for 10 seconds and then moved to the next menu circle during 2 seconds (which is quite slow given the short distance it has to travel).

In addition, to explain what can be found in the submenu of the highlighted bubble, a box in the lower left of the image displayed a short sentence describing the contents of the currently highlighted menu point. This box also offered arrows that could be used to actively move the highlight circle to the previous or next topic (Fig. 1). Success Criterion 2.2.2 of [2] states that there must be “Pause, Stop and Hide

functions” when a web page initiates animation, but pause and stop could not be used here because it makes no sense to pause the focus circle while it is in transition between menu items. Therefore, we decided to make the focus circle controllable, which seemed to be a better solution for this success criterion. We intentionally did not offer a “hide” function because we wanted to find what the test persons do with this feature. Overall, these features should support the success criterion “focus visible” ([2] 2.4.7) as well as “headings and labels” ([2] 2.4.6).



Fig. 1. Main page, when menu point "Berner Modell" is highlighted



Fig. 2. Main page, with green focus circle moving from menu point "Berner Modell" to "Unterstützung"

The original service website had submenus for each of the menu points. We did not implement all of them, but to support the tasks we wanted to give our test persons, we implemented two content pages in two different branches of the main menu. Consequently, two of the main menu circles led to submenu pages. These pages had a submenu which was designed similarly as the main menu, having the sub-menupoints in circles. However, there was no green highlight circle wandering around on this screen, we only highlighted the one circle that had content (Fig. 3).

We wanted to intervene only slightly in the design of the existing website so as not to overwhelm the target group with too many changes. So, we adhered to the original overall layout of the pages. On the two content pages, we kept the original text. In the top left we put a miniature version of the start page image, which would lead back to the start page when clicked (Fig. 4).

Also the layout of the top bar (featuring the logo, a search bar and the menu) was left unchanged, with the menu as a second way of navigation, supporting the criterion “multiple

ways”. In line with the criterion “focus visible” ([2] 2.4.7), we enhanced the menu such that it would dim the rest of the screen when the menu was clicked, to focus the attention on the menu (Fig. 5).

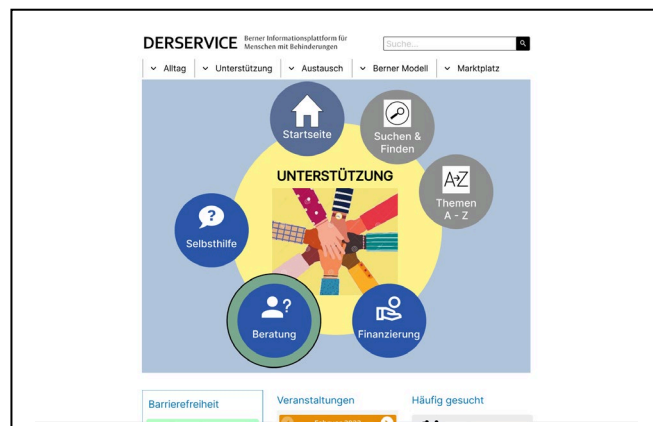


Fig. 3. Submenu of menu point “Unterstützung”, with green focus circle not moving



Fig. 4. Content page for “Beratung” (solution of the task “find information about organizations that can help you”)

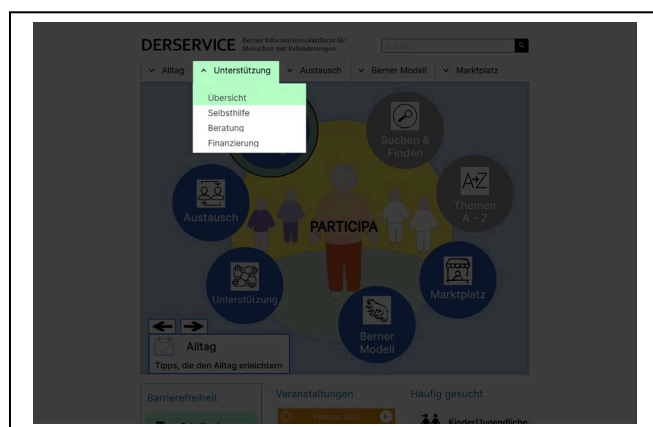


Fig. 5. Text menu, with remaining website content dimmed

### C. The workshop

The workshop was conducted on an afternoon, in a large meeting room. We prepared a circle of chairs in the middle of the room and several tables with laptops spread out in the corners of the room. After the arrival, a round of introductions created an informal and relaxed atmosphere. Then we split into three groups, each with an observer and two or three PwCDs. The testers had a laptop with mouse and the Figma

mock-up in front of them, the observer sat a bit to the side. The observer gave a first search request and asked them to solve the task while describing what they do and why. Observations were done according to a list of criteria, but were also open to note other impressions like mimics etc.

The two search requests were:

1. Find information about training courses, we gave the specific German key word «Weiterbildung».
2. Find information about organizations that can help you (no specific key word given).

After the testers had found the first page, and without returning to the start page, the observer gave the second search request. Both pages were in different branches of the site tree, both on level two (i.e. reachable not from the main menu, but from a submenu). The two content pages contained the same text and layout as on the original website, except on the top left we had added a miniature version of the start page image that would lead back to the start page (Fig. 4).

After all groups had solved their tasks, we gathered in front of a screen with the prototype projected onto the wall. We asked about remarks in general to the prototype. Then, we started a discussion about other means of navigation, e.g. chatbots (results of that discussion are not in the focus of this paper but mentioned briefly in the discussion section).

#### IV. RESULTS

From our preparatory discussions with the service website owners, we knew that PwCDs most often find information using Google as general search engine, and in general do not use menus on a website or a search on the website. We wanted to find how the test persons handle the navigation through the website, so we intentionally did not implement a search feature. When the testers were presented with the task to find a certain information, most of them really tried the search field first. We had to tell them that the search does not work on the prototype and explained that they should find the information by other means.

After this, they found the click possibility in the main menu. For some of them this was clear, for others it was merely a "hope" that it would lead somewhere. However, when this approach worked and led them to the submenu, they used without hesitation the same approach to navigate further into the next level with content pages. Doing so, all of them found the first of the requested content page quite quickly.

But then, most of them were not able to return to the main page because they did not understand that a click on the image on the top left would lead them back there. We had to give the hint that this image is clickable. None of the testers wanted to go back "one level", they all wanted to start over on the main page. Then they also found the second of the searched pages. Some were unsure if this is the correct page because the text on the page was too difficult.

When they wanted to "look around" more on the prototype, it was confusing and frustrating to them that not all menu points had sub-menus and that there was not more content.

None of them used the menu bar to find the requested information.

In the general discussion afterwards, the test persons also talked about the icons we had used, and that some of them were unclear, ambiguous, or even misleading. Concerning the image leading back to the start page, some testers recommended to add a caption to the image: "back to main page". Most of the testers appreciated the information about the content of the submenu in the lower left box. They pointed out that they like to be informed where a click would lead them before clicking it. Some expressed this even as a fear of not knowing how to get back after a click, and thus getting lost on the website.

#### V. DISCUSSION

##### A. Navigation and finding information

Although this would have to be confirmed by further investigations, we suspect that the general tendency of the target audience to prefer search engines over menu usage is probably caused by their earlier frustrating experiences with navigation on websites. So, the task of creating a website navigation that they will use was a challenging one. As expected, they wanted to apply the proven strategy also in the prototype and used other means of navigation only when forced to. We conclude that a website navigation only has a chance of being adopted by PwCDs if it is very attractive and clearly easier to use than a general search.

We had hoped to achieve a clear and attractive navigation with the moving green circle that highlighted the menu items. To our big surprise, none of the test persons mentioned the green moving circle. When asked directly about it, it transpired that most did not notice the green moving circle at all. They said that they had not paid attention to it, and that, when they look at it, they find it rather confusing. Since movement generally rather attracts attention, the question is where this ignoring comes from. One hypothesis is that on today's websites, advertising and other non-relevant content tends to try to attract attention through moving elements, and that users have learned that moving elements are therefore not interesting and to be ignored. It still needs to be investigated whether it can be concluded from this that moving elements should generally be avoided, or how they should be designed so that they can be used in a way that is helpful for PwCDs.

As said, a general search is usually the first strategy of the persons in the test group, but when forced use other means of navigation, they all used the image. None of them used the menu bar to find the requested information. It seems that graphical elements are preferred over text by PwCDs. For visually impaired people who use screen readers, clearly a navigation with a text menu is preferable. So, to be accessible to the widest possible audience, a website must offer several navigation options.

Once the testers had found out how to work with the circle menu, they used without hesitation the same approach to navigate further into the next level with content pages. It can be concluded that for a navigation to be easily understandable, it must be very consistent and work the same way throughout the whole site.

However, we observed that after having found the first content page and confronted with a second find task, none of them wanted to go back "one level", they all wanted to start over on the main page. They needed the hint that a click on the top left image would lead them to the start page. We hypothesise from this that the test subjects do not have a

structural model of the website in their minds, i.e. they do not know where they are in the website structure, in which submenu on which level. They always start from the beginning and move linearly to the page they are looking for. Websites should take this into account when structuring their content. It remains to be investigated whether a good “breadcrumb” navigation (a screen element that shows the path and current position on the website) really would help, or if it just would add one more confusing and not-so-easy to understand element to the website.

The observation that PwCDs tend not to have a clear “sitemap” in their minds when surfing a website is also supported by their statement that they want to know where a link would lead them, and even more so by their fear of getting lost. Websites with a lot of content must find a way to organize their content with structure neither too deep nor too wide. Buettner [9] investigated the relationship between visual complexity and mental workload and found that designers should use a balanced combination of submenus (navigation complexity) and text (more information complexity) because this leads to the least mental workload. It remains to be investigated whether this also applies to PwCDs. In general, a very clear site organization helps most users to find their way around. Despite this, there will always be a part of users who are not able to understand the site structure, so the question remains how to organize large amounts of information such that it remains manoeuvrable for PwCDs. Guessing from the strategy of our testers, a good search function on the site itself could help.

The positive result that the page they were looking for was found clashes sharply with the observation that some of the testers were unsure whether the page found was really the one they were looking for. The reason was that the pages were still with the original text, as we did not make text changes in our prototype. However, it was very clear from the beginning that the texts on the whole website were generally too complicated and that the one single measure that would make the website more accessible for PwCDs would be to rewrite all content. This had been clear even before the start of the project, and a part of the original website’s pages already contained a button that would display an “Easy Language” version of that page. Our new insight is that it should not be an optional function for some pages, but should be implemented across the whole website, as a default. The language to choose would be Easy Language, in German “Leichte Sprache”. Baumert [10] states that “Leichte Sprache” is currently the only tool for communicating content to people with neuronal impairments. We conclude that even an easy-to-use navigation would not make a website more accessible to PwCDs if the content is not reworked as well, and preferably written in Easy Language. It is to be noted that the rules and usage of “Easy Language” is different in the different languages, [11] gives an overview for Easy Languages in Europe.

### B. Clickable Prototypes

Looking at our approach, we can confirm that a clickable prototype is very suitable for obtaining feedback from users with cognitive impairments. But when the testers wanted to “look around” more on the prototype, it was confusing and frustrating to them that not all menu points had sub-menus. We conclude that a prototype must be very close to the actual result. It is confusing if pages are missing, or links lead nowhere or to a common page like “here would be content”.

Also, the icons used must be very clear. Placeholders or ill-fitting standard images in a prototype seem to be worse than no icons at all. We observed that some persons tended to ignore the text when there was an icon, so an icon must convey the real meaning, and icon selection or creation should not be under-estimated, even for a prototype. However, we also had persons stating that they prefer to read the text, as they consider themselves as being not good in guessing meaning from icons. Again, there is no “one solution fits all”, and having both titles and icons strongly supports the success criterion “multiple ways” ([2] 2.4.5).

### C. Other ideas and limitations

The difficulty of finding content could also be mitigated by using alternative technologies. For example, the website could offer a chatbot that helps with finding content. We tried to discuss this topic in a plenary discussion. Some participants of the workshop considered this possibility as interesting, but for others the discussion about the hypothesis “if the website were offering a chatbot to help you” was too abstract. Using a chatbot on a travel agency website as an example, we could talk about the chatbot, but the testers could not make the abstract connection that such a chatbot could also be used to help them on the services website’s content – they rather discussed the possibility that the service website would also offer travels. We conclude that over whatever technology feedback is desired, an example of it must be implemented as genuinely as possible so that it is tangible for the test subjects.

## VI. CONCLUSION

### A. Recommendations

As a conclusion, we recommend for websites that target PwCDs and for working with PwCDs for evaluation of websites:

- The consistent use of “Easy Language” takes precedence over all other points. We emphasize this point because even a perfectly designed menu or a very easy to use search function is of no use when the persons using the website are insecure about what is the content of the pages they have found. Special attention should be paid to titles that are displayed in search results so that the content found is recognized as a hit.
- There is no “one solution fits all” - the website should offer different presentation and navigation modes to fit different impairments.
- When icons are used, their meaning must be clear and unambiguous.
- When a mock-up is created to test a potential new function with PwCDs, it must be able to be operated as realistically as possible. Omitted links or links to a standard page “there would be content here” are very confusing.

### B. Outlook

We see more research is required in the following topics:

- Moving elements: Should moving elements generally be avoided on websites for PwCDs, or how they should be designed to be helpful?

- “Breadcrumb navigation” – is it helpful or does it just add cognitive and visual complexity to the website?
- Icons: How to find icons that are intuitively clear? How about their internationality, colour, level of abstraction etc.?

In this study, emphasis was placed on qualitative statements. In a future research project with a larger group of participants, quantitative surveys could be carried out.

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