
Designing for specific users: Context mapping study

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Citation: Pots, E.; Lubbers, N.;
Kulakova, P.; Setiawan, S. Title. *The
Designing for Specific Users Journal*.
2023, 1. <https://doi.org/10.3390/xxxxx>

Academic Editor: Jelle van Dijk

Publisher's Note: University of
Twente stays neutral with regard to
jurisdictional claims in published
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Abstract: The “Design for Specific Users” project proposes a model for learning environments that draws from designing technologies based on specific user experiences and environments. This Context Mapping Study presents the first experience of the research phase, which also constituted a face-to-face meeting with the assigned specific user as the goal is to design an assistive device that is tailored to them. While the majority of the collaboration will be done with our specific user, the idea is to first concretely look at one use case example and to analyze their contexts and its implications and then, further along the process, target the design towards a broader group with similar needs.

The main framework of this project is the idea that "co-design" is the most powerful tool for the success of the designed assistive technologies in the use environments. Rather than viewing the user as a single static snapshot, the co-design method should encompass a more continuous collaboration and evaluation of the adoption process of the design with the user throughout several phases in time.

The purpose of this study is to investigate the following: (i) societal trends and perspectives on disability: what are at present, the biggest societal challenges with support and care of people with disabilities; (ii) introduction to assistive technologies; (iii) human centered design; (iv) introduction to our specific user; (v) market research on existing products in the market; (vi) co-design. Concluding, further research perspectives and challenges are discussed.

In general, this paper starts with introducing key theories, concepts and topics relevant to the project and the challenges and common pitfalls associated with it, and then zooms in on the specific user and their wants and needs. Thus, based on the findings and insights of this study, we will end up with a formulation of our main design challenge.

Keywords: Co-design; Assistive technology abandonment; Assistive technology appropriation Specific user; Context mapping.

1. Introduction

A context mapping study is a technique used in the beginning 'exploratory' phase of a project. It is trying to identify relevant questions and (unmet) needs that are suitable for innovation. It provides a clear framework for research that may guide us towards a main design challenge. This study is very useful as it creates a shared understanding and language between client and designer through structural contact and exchanges which will lead towards more relevant and empathetic design in relation to the use contexts. Through involvement of users from the beginning, the innovative ideas will better match a user need, decreasing the chance of failure in our design.

For our project, it is a necessary starting point to gain background information and perspectives as inclusion decisions require a firm understanding of disabilities, the demand of activity contexts, and types of disabilities.

2. Societal trends and changing perspectives on disabilities

In general, there is a tendency for segments in society to form an in-group and out-group dichotomy where people would view others as belonging to either a familiar in-group or a less familiar out-group (Hatemi et al., 2013).

This group formation or biases may lead to social exclusion for members of the out-groups, whether intentional or not as these biases can be triggered by explicit mentioning of in-group norms and stereotypic expectations that may evoke feelings of estrangement amongst the 'out-groups' (Blanchard et al., 1994).

It can be said that individuals with disabilities may fall under a special case of out-group because in today's society there is awareness and initiative to be inclusive. However, these efforts have potential to fall short of their purpose or even have a counteractive effect if not carefully thought out.

2.1. Societal challenges in care and support of people with disabilities

Perception of disability can vary depending on the moral compass of the society. As mentioned previously, there is awareness about the importance of being inclusive; thus the problem becomes less common of peer rejection but rather of out-group exclusion.

In many cases people tend to have a very positive and empowering attitude towards individuals with disabilities to avoid their social exclusion and isolation. However, too much of anything is never good and by treating individuals with disabilities as very special or as personal sources of inspiration can fall under unintentional exclusion (TEDx Talks, 2014). However, that is not to say that we must limit ourselves from acting encouragingly towards people with disabilities as individuals' self-esteem is important and defines the extent to which an individual approves of, likes, and values oneself (Blascovich et al., 1991). It then becomes the case of striking a balance of positive treatment without inappropriate over-praising.

According to the “contact hypothesis” (Allport, 1954), prejudice often stems from incomplete or inaccurate information about out-groups, leading to stereotyping and overgeneralization. Thus positive contact and familiarity with perspective taking and empathy can advance understanding of individuals. Such contact is also bidirectional as it may benefit individuals with disabilities to feel social acceptance.

2.2. Participation and empowerment

According to Merriam Webster dictionary (1847), participation and empowerment are defined as “the state or action of being actively involved in something” and “the granting of the power, right, or authority to perform various acts or duties,” respectively. In the case of our specific user, the use of assistive technologies such as rubber mounts that cover gaps around her glasses help in reducing the eye dryness and the discomfort that came from her eye disease. This device will make participation in her activities more comfortable and thus, ‘granting the power’ to perform tasks more efficiently.

3. Introduction to assistive technologies

Assistive technologies (ATs) are products, equipment, and systems that enhance learning, working, and daily living for persons with disabilities (What is AT? - Assistive Technology Industry Association, z.d.). Examples may range from high technology ATs such as special purpose communication programs to more common technologies such as braces, educational software, electronic devices etc..

In this project, the specific user perspective, their clinical needs and social context are crucial for the design process and decisions. It is then necessary that active interaction between designer and intended user is maintained as the end product is designed to assist them with certain difficulties based on their experience and lifestyle. The collaboration must therefore be bidirectional with frequent as possible exchange of information, testing, evaluation, and iterative improvement. In this way, users are the ‘directors’ behind the research and as designers we transfer these needs into real-world solutions.

To be successful, we must acknowledge ethical issues of technology acceptance, dependence, access, and safety during and throughout the design process and not when it is too far along in the development stage.

3.1. Technology abandonment and appropriation

In fact, poor, ineffective, or inappropriate design is a key cause of device abandonment. There is a vast pool of causes that may lead to discontinuance of assistive technologies and the effects of it can be very large scale. As an example, according to Petrie et al. (2018) abandonment rates for hearing aids have reached up to 78%. Critical to the success of our product we must assess the possible causes to technology abandonment.

Some reasons may be as follows:

- Solution does not work as desired;
- Over complex design that is difficult to handle;
- Mismatch between users’ needs/ expectations and the designed solution (If the AT does not enable the performance of the tasks, or all the tasks, that the user wants to do);
- If something is to be worn (e.g. hearing aid, wheelchair) and it is not comfortable for long term use.

From the above list, close and consistent user involvement in the design process remains key to successful outcomes. However, there are also subjective reasons in the medical realm that are beyond the control of the technology provider. Studies have stated that changes in the needs of users are an important predictor for abandonment (Petrie et al.,

2018). Such changes can be permanent (e.g. a progressively worsening sight or an operation that cures near blindness), temporary or fluctuating (e.g. altered medication.) As designers, we can address these changes with technology that is easily adjustable to the users'/ situation's changing needs, however there is the risk of designing something over complex that will often lead to abandonment.

Technology appropriation is a means of repurposing existing technologies in terms of recombination, with an emphasis on the strategy of habilitation., as proposed by Likavčan and Scholz-Wäckerle (2016). In simpler terms, it is the effort users make in order to adapt or alter the technology in a way that it becomes suitable within their own contexts.

It is a common pitfall to treat the research focus mostly on the phase before development of the technology. It is equally crucial to study behavior patterns in use of the prototype and how users will integrate these technologies into their daily social and environmental contexts. Thus, to ensure usability and suitability of ATs for the use context, the importance of involving users in the design process, e.g., participatory design (PD) or prototyping methods must be stressed in order to minimize chances of technology appropriation.

4. Human centered design

Human centered is a problem-solving technique that puts users at the center of the design and development process to create products and services that resonate and are tailored to the audience's needs (What is human-centered design? | HBS Online, 2020). The goal in designing in this way is to keep users' in mind during each stage of the process resulting in more intuitive products that customers have already vetted the need for.

4.1. Implications for our design vision and design ethics

As we are designing for a very specific individual with a rare problem, there are some serious ethical considerations at play when it comes to financing this project. We must weigh whether or not it is ethical to spend a fortune designing something for one individual or use that money towards a larger cause.

Currently, our design vision is to create an attachable covering for eyeglasses to prevent eye dryness which is the issue for our user. However, similar-function products already exist the market and in the case of our specific user she is able to come up with (albeit imperfect) homemade solutions for this problem thus, it goes to question whether or not ample financing must be placed towards this problem or rather towards a problem that is suffered by a wider range/ group of people. The concept of helping one individual versus financing for helping many has been discussed by Peter Singer in a Ted Talk and in 'Practical Ethics' (2011) in which he gave the example of spending 40,000 dollars on training a single dog to guide a blind person versus spending that money to cure many people of blindness in another country.

5. Introduction to our specific user

The specific user for whom and with whom a product will be designed is Agnes Janses. She lives in Deventer with her husband, son, daughter and 2 dogs. She also works as a social psychological supervisor Special Educational Needs at a secondary school.

In April 2021, Agnes became ill with Graves' autoimmune thyroid eye disease. Last June, the disease became so severe that she had a 90% chance of going blind and only 10% vision left. To prevent this, she had an orbita operation in September 2022. The risk of going blind is now gone, but she still has many other practical problems.

Graves' autoimmune thyroid eye disease is the most common eye disease. The disease results from an immune reaction against the thyroid gland and, in some cases, the eye

socket tissue. The disease comes in many different degrees; for example, some people get all the symptoms and others only one or a few (Oogziekte Van Graves - UMC Utrecht, n.d.). Agnes, unfortunately, has a very severe form of the disease and therefore has had all the symptoms there are and still suffers from some symptoms now.

The symptoms of Graves' disease are watery eyes, redness of the eyes and/or eyelids, light sensitivity, double vision, pressure behind the eyes and dryness of the cornea. In addition, eye movements can hurt, and looking straight ahead can also be painful. Another symptom of Graves' disease is reduced vision, due to an ulcer on the cornea or pressure on the optic nerve (Oogziekte Van Graves - UMC Utrecht, n.d.) (Graves' Eye Disease | National Eye Institute, 2022) (Thyroid Eye Disease (TED or Graves Eye Disease) | Kellogg Eye Center | Michigan Medicine, n.d.).

Research shows that Graves' autoimmune thyroid eye disease (TED) clearly influences the quality of life (QOF) of patients. The more active the disease is and the more symptoms the patient has, the more the QOL is affected. In many TED patients, appearance and also visual function remain affected in the long term, due to the symptoms of TED. Therefore, even when the disease stabilizes and becomes less chronic, the QOL of many patients is still clearly affected by the disease. (Cockerham et al., 2021)

Agnes also has many things in her daily life that she can no longer do or that become more difficult because of her illness. For example, she can no longer drive a car or ride a normal bicycle. She also can no longer walk her dogs in the evening. Looking down is difficult, so she cannot read properly or cut things on the kitchen counter. This makes it difficult for her to see thresholds or steps and to tell the difference between them. The double vision also makes it difficult for Agnes to know what reality is, which also makes participating in traffic a lot more difficult. In addition, there are many practical things that are made more difficult by the disease, all of which affect her quality of life.

Right now, Agnes still has very dry eyes and in addition, she cannot close her eyelids properly, threatening the cornea. She also suffers from double vision and her vision is reduced. Because there are few people who have the disease in such a severe way as Agnes, there is no market to make products or tools. There are some products and tools on the market, but these products only help with improving or solving 1 of the symptoms.

The tools Agnes currently uses are plastic eye caps for when she goes outside, with her glasses that have prisms stuck on them over them. She also has another pair of glasses that she has to put on top of that when she wants to see better up close. She also has 2 other pairs of glasses that have different functions or that she uses at different times of the day. None of these are ideal solutions, but for now they are the best products and tools available.

6. Market research

6.1. Existing products on the market

Another part of 'Context Mapping' is marketing research. The Marketing Research investigates which existing products are currently on the market against Graves' eye disease. This research consists of making a Comparative Table (Table 1) and Positioning Matrix (Diagram 1).

Existing products:

1. Plastic eye caps;
2. Prism correction;
3. Glasses with caps;
4. Eyepatch;

5. Artificial tears;
6. Prednison.

6.1.1. Plastic eye caps

The first product on the market for Graves eye disease is plastic eye caps as seen in Figure 1. Our Co-Designer uses this product because she has dry eyes and her eyelids cannot close properly. These plastic eye caps are not commercial and from the conversation with the Co-designer it turned out that it took 3 months before she received these eye caps from the health insurance. So these products are very scarce.



Figure 1. Plastic eye cap.

6.1.2. Prism correction

Another product that the codesigner is currently using are glued correction prisms on her glasses as shown in Figure 2. These correction prisms are there to create single visions while someone suffers from double vision. Such a correction prism consists of horizontal or vertical lines etched into the glasses or just one glass. These lines change how the light arrives at your eye and improves vision. These prisms are available from opticians.



Figure 2. Prism correction.

6.1.3. Glasses with caps

These glasses with caps as seen in Figure 3 have the same function as an eye patch, namely to protect the eyes against light and dryness. These glasses have to be specially made to measure and this only happens in 4 stores in the Netherlands. This product is therefore not commercial at all and for a narrow target group.



Figure 3. Glasses with caps.

6.1.4. Eye patch

Another product as seen in Figure 4 is an eye patch, which is very similar to a pirate eye patch. Normally, this product should be hung over the most dominant eye so

that the weaker eye can strengthen. For Graves' eye disease, it works exactly the other way around. This product is available in many online webshops and party stores.



Figure 4. Eye patch.

6.1.5. Artificial tears

With Graves' disease, the eyelids cannot close properly and this causes dry eyes. A product that can be used for this are artificial tears, Figure 5, that reduce the dryness of the eyes. This product is available in stores such as Kruidvat and Etos, but also in pharmacies.



Figure 5. Artificial tears.

6.1.6. Prednison

Anti-inflammatories are important in the active phase of Graves' eye disease. The tissue around the eye socket is inflamed in the active phase and this can be treated with prednison (the anti-inflammatory). Prednison as in Figure 6 is heavy medication, that's why it is only available in pharmacies.



Figure 6. Prednison.

Table 1. Comparative table







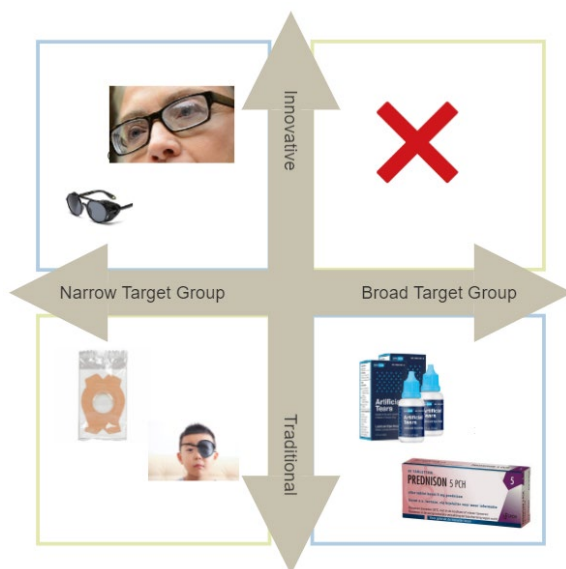
Product						
Commercial	No	No	No	Yes	Yes	No
Price	-	€235-€470	€2500	€8	€13	-
Where to buy?	Health Insurance	Optician	4 specific shops/opticians in the Netherlands	Multiple Online Web shops, Party Stores	Kruidvat, Etos, Pharmacy, Online Web shops	Pharmacy

Diagram 1. Positioning matrix



7. Co-design/ Participatory design

Co-design is a type of design process which includes the affected stakeholders. This ensures that the end product satisfies them in all possible ways. For instance, when designing for people with disabilities, a representative(s) from this demographic becomes a co-designer. Thus, they can guide and give feedback to a designer throughout the process, resulting in delivering the most suitable product for this specific group of people (Co-design and participatory design: a solid process primer, 2015b).

Co-design plays an important role when designing for a specific user group, with their specific needs. A designer does not always have an awareness about the issue they are designing for and in order to avoid solutions which are detached from real life situations having end-users involved in a design process can enhance the usability of the final product. This issue was addressed by the Design Council in the RED paper (2004), where it was mentioned that the approaches without co-designing have limitations which are making them unsuitable for a variety of projects, especially those related to Public services. After this, the new “co-creation” (similar to co-designing) approach was introduced. Another advantage of participatory design is facilitation of collaborative solutions. It allows for different perspectives of people with different backgrounds to be combined in the same process. According to Szebeko’s essay (2010), co-designing can be

useful for tackling complex problems because of its “capacity to respond with holistic and collaborative solutions”.

7.1. Implementing existing methods, tools and materials

To learn from the existing experience on methodology of co-designing, three academic papers will be analyzed and their potential application for the current project will be discussed. Two of the studies focus on working with the people with visual impairment in the design process. The other study is a review on 28 different co-design projects focusing on older adults which discusses the outcomes of these projects.

There are different ways of how end-users may be included in design practices and different depths of their involvement. An article from “Gerontologist” identified several stages of the design process and discussed possible methods and tools used in each step (Table 2). The depth of co-designer involvement depends on their participation in each stage (Sumner, J. A.).

Table 2. Design stage and corresponding co-designing methods According to

Design stage	Co-designing methods	Goals
Needs and Ideation	Frequently used: Workshops, focus groups, interviews, direct observations. Less frequently used: participant diaries, sketching, photographs/videos, priming (398).	An assessment of needs and idea generation (398).
Prototyping	Different types of prototypes showed to co-designers: fully functional, partially functional, nonfunctional(399). Evaluation of the prototype in a real-world setting.	Facilitate discussion, build knowledge, raise awareness, testing and refining the functionality (399).
Pilot testing	Evaluation of a product in a real-world setting, living lab (399-400)	Health and well-being outcomes of the final product. (399)

While this paper provides a general approach towards participatory design, other studies involve more relevant target groups with case-specific methodology. The study which was focused on designing for children with visual impairment, emphasized the importance of involving experts in the design process. For instance, while co-designing with children provided a lot of insights on their behavior and struggles, there was a lack of expertise. Thus, the participatory design also focused on involving the educational services as well as adults with visual impairment (Pires et al., 2021d). The other study stated that participatory design did not only enhance the final results, but also supported a more effective designing process by generating more interest in collaboration. Tools such as tactile models and prototypes helped a lot in communication with their co-designers and improved their understanding of the project (Andréa et al.,2021).

After reviewing the variety of the co-design methods introduced in the academic papers discussed above, it can be concluded that that it would be the most beneficial to work with the ones related to working with people with visual impairments. Thus, it is important to utilize a variety of tactile tools, which can ease the process for co-designers and help them to better understand the product. In addition to that, verbal discussion can enhance the understanding of the co-designer of the product and encourage the intensity of the brainstorming. The output of the co-design sessions will mostly be notes from discussions, sketches and rapid prototypes. The co-designers will have the most influence on the product in the beginning of the project, however closer to the end, it is necessary to have more technical input resulting in mostly involvement of the project participants. However, consistent consulting with the co-design is essential.

8. Discussion and conclusions

Literature study in combination with the practical part of the project suggest the conclusion that the current 'disability' of the co-designer is concerned with the lack of products on the market that tackle several complex symptomatic problems at once. This causes multiple issues that the co-designer has to deal with in their daily life. Some of them are more prominent; such as impracticality of carrying and wearing multiple spectacles at once, and financial stress related to costs of the temporary medical solutions. The others, less prominent ones, are more psychological, for instance social alienation which is caused by the visual appearance of some existing products.

9. Design challenge

Based on the conclusions drawn from this study we have formulated the design challenge which will focus on designing a more universal product, specifically, one pair of glasses that can be customized, so it can be adjusted to help with different symptoms and be suitable for different circumstances.

Author Contributions: The literature study was completed with the participation of the whole group. Sashya worked on the parts of societal trends and the changing perspective on disability, Introduction to Assistive Technologies and Human Centered Design. Ellemijn worked on the introduction of the disability/condition of the 'specific user'. Niek worked on the market research on existing products and Polina worked on the Co-design / Participatory Design.

The practical work contains an interview with the co-designer and a presentation. The contents of the presentation: a persona, storyboard and a person journey, were completed by Niek, Polina and Ellemijn respectively. The presentation was given by Ellemijn and Polina.

Informed Consent Statement: "Informed consent was obtained from all subjects involved in the study."

Acknowledgments: The completion of this paper would not be possible without the support of the co-designer, who shared valuable information related to their personal experience.

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