

# Disabled Design Quest

Using design justice and crip hacking to design  
a 3D printing toolkit to increase  
creative confidence of disabled people

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Lastly, I want to thank my family and friends, who always tried to understand my research and talk with me about it, I hope this thesis will provide you with some more information about disability and crip hacking so we can talk about it a bit more easily.

## Abstract

The goal of this thesis project was to increase the creative confidence in making and hacking of disabled people so they could partake in the maker movement and create their own custom assistive technology (AT). Two participant activities were conducted: 1. An exploratory hacking activity by disabled people to design for justice where the participants hacked small household appliances. 2. A creative learning activity where disabled people used the Disabled Design Quest (DDQ) prototype, with a pre- and post-use interview and diary study. The results from Activity 1 were used to ideate a toolkit made of a disabled community-led platform to learn about different types of making, and this was then further conceptualized and prototyped into the DDQ website. The impact of the use of this DDQ prototype on the creative confidence of disabled people was then evaluated in Activity 2, which showed a self-reported increase in the creative confidence of all participants who completed the activity. The interview transcripts and diary were further analysed using thematic analysis, which resulted in 18 themes which were used to answer the research questions. Results include participants going through a learning process with feelings of excitement, overwhelm and satisfaction, pride and assurance to be able to 3D print something and adapt/hack a product to better fit their needs; they had to overcome some barriers and solve problems. They were able to play with 3D printing in a safe environment with community support, led by the DDQ website that, according to the participants, was clear, interesting and educational. The participants were eager to use the gained skills and knowledge about the possibilities of 3D printing in the future. Recommendations for future research include developing the prototype further and conducting an accessibility evaluation in a dedicated study with experts by experience as well as (web)accessibility experts. Limitations of this project include the analysis and interview being conducted by the same person, which can be influenced by bias from my personal disabled experience, as well as constraints both in the cost of the study and the duration of this entire thesis project. The problem space addressed in this thesis cannot be solved in its entirety with a website. Nonetheless, this work aims to be a step in the direction of enabling disabled people to take back agency over their AT, but systematic change is still needed.

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## Glossary

This thesis uses field-specific terms from disability studies, design and technology, or diversity, equity, and inclusion. I describe and define these terms below as I understand and use them.

**Ableism** – The discrimination of people with disabilities in favour of non-disabled individuals. This term and its related literature will be introduced extensively in Chapter 1.

**Access needs** – The needs of any human (not just disabled people) of what they need to be able to do or access certain things. For non-disabled people, these needs are often automatically fulfilled by standard design practices, e.g. stairs to get from one floor to the next, a toilet that is accessible to them, or using a bike, car or public transport for distances that would take them too much time or effort to do walking. The access needs of disabled people are often not fulfilled by standard designs. This creates the idea that disabled people are the only ones who have these access needs (and therefore sometimes referred to as “special needs”) even though every person has them. It’s just that non-disabled people’s needs are often fulfilled, and disabled people’s are not. Access needs are further discussed in Chapter 1 under the Accessibility heading.

**Assistive technology (AT)** – Often, definitions of this term from the engineering/technical world refer to the increase in function or productivity achieved by using these pieces of technology. However, these can be taken as attempts to use technology to optimize/normalize the disabled bodymind (which means to see the body and mind as one integrated unit) to be more like non-disabled people, also known as techno-ableism (Shew, 2023). ‘Assistive technologies seek to approximate typical human behaviour, which reveals an underlying orientation towards a certain type of bodymind’ (Pimentel & Monteleone, 2019, p. 72). ‘Disabled bodies are commonly regarded as ‘original cyborgs’ in transhumanist futuring, outfitted with bionic limbs and intelligent canes in the hopes that they will be optimised – or, at the very least, normalised. Assistive technologies thus operate under a productivist ethos which conflates a working body with a valuable one’ (Spektor & Fox, 2020, p. 350), and by posing an individual solution, it frames disability as an individual (medical) problem instead of a systemic one (Pimentel & Monteleone, 2019). The World Health Organisation (WHO) proposes a broader definition that includes participation in social settings and inclusivity in general (*Assistive Technology*, 2024). In this thesis, I will refer to AT as: technology (high or low tech) that can improve a (disabled) person’s life in whatever context they choose, including education, health, participation, inclusion, comfort, self-care, communication, etc. This term is further discussed in Chapter 1.

**Criptastic hacking/crip-hacking** – Crip(tastic)-hacking is the practices disabled people partake in by adapting products or their environment or using products in a different context than intended to make products and their environment better suited to their needs. There is an activist part of this practice, but this is not necessarily what I focus on in this thesis, although supporting this practice could already be seen as activist. The term crip hacking/criptastic hacking is not widely used or known. People will often call it disability hacks, DIY chronic illness hacks, or in the literature, when talking about this practice more generally, it is often referred to as hacking. It is in the same domain as democratizing innovation in which reappropriation of technology has a similar definition to crip(tastic) hacking but for all people, not only disabled people. I do find it important still to use the term crip(tastic) hacking because not only did it come from disabled people, it also uses the

reclaiming of the word cripple, an important part in disability history, and I think the term should get more attention than it does.

The use of *crip* in *crip hacking* comes from the word *cripple*, a word most people know to be a derogatory word. However, many in the disabled community have been reclaiming the word. It was used by the Disability Visibility Project (*Crip The Vote*, 2021), and many disabled social media creators use it in hashtags #cripfashion, #cripskills, #crippride etc. *Crip* is also used in the *crip technoscience* manifesto. In this paper, technoscience and the provocative concept of ‘ “crip,” the non-compliant, anti-assimilationist position that disability is a desirable part of the world’ (Hamraie & Fritsch, 2019, p. 2) are brought together in *crip technoscience*. *Crip* theory centres disability as the resistance against ‘compulsory ablebodiedness’ (McRuer, 2006, p. 1).

**Crip technoscience** - *Crip technoscience*, as defined in the manifesto, is the practice of critique, alteration, and reinvention of our material-discursive world. ‘We contrast *crip technoscience* with mainstream “disability technoscience” as a field of traditional expert relations and practices concerned with designing for disabled people rather than with or by disabled people’ (Hamraie & Fritsch, 2019, pp. 3-4). *Crip technoscience* is also harnessed politically for ‘refusing to comply with demands to cure, fix or eliminate disability. Attentive to intersectional workings of power and privilege, we agitate against independence and productivity as requirements for existence’ (Hamraie & Fritsch, 2019, p. 2).

**Cyborg/cripborg** - To me, *cyborg* means my intimate relationship as a disabled person with the technology I use, which sometimes becomes an extension of myself. This specific type of *cyborg* is sometimes also called *cripborg*.

*‘Cripborg(noun): (1) Crippled cyborg; (2) a disabled person who selects technologies whilst anticipating the world they will encounter; (3) crips who will not be resisted: you too will be assimilated. From the prefix “crip-”, taken proudly and reclaimed from the word cripple, once a name for disabled people + cyborg, originally meaning cybernetic organism, the confluence of what is natural or organic with what is artificial or technological. Coined, perhaps separately, for a videogame (thanks, Google: Bloodborg vs.Cripborg), but done for a different context here by Bethany Stevens. Origins: cheeky’ (Nelson et al., 2019, pp. 2-3).*

Disabled people who ascribe to the *cyborg* concept also use the term “Current *Cyborg*” or “Common *Cyborg*” against “Future *Cyborg*.” Current *cyborg* refers to disabled people (or any person, for that matter) who have an intimate relationship with various types of technology, whether strapped to the body, implanted in the body, or becoming an extension of the body. Future *cyborg* refers to the fantasy/sci-fi ideas of *cyborgs* (Earle, 2019).

*The cyborg is the engineer’s dream. The engineer steers and manipulates the human to greater performance. As a common cyborg, I subvert that dream. I do not want to sell any of their shit for them. I am not impressed with their tech, which they call 3C98-3, and which I am wearing, a leg that whirs and clicks, a socket that will not fit unless I stay in the weight range of 100-105 pounds. I am 88 per cent charged in basic mode and I have taken 638,402 steps on this leg. The last one they gave me was a lemon. Maybe this feeling of trial-and-error, repetition and glitch, is part of the cyborg condition and, by extension, the disabled condition.*  
(Weise, 2018, para. 8)

**Design Justice** - Design Justice is a framework of principles that creates a more equitable design process for people of minorities. This thesis will investigate it with a specific focus on disabled people. The framework is introduced and further discussed in Chapter 2.

**Design Lab** - 'DesignLab is an eco-system facilitating creative collaboration and knowledge transfer between researchers, societal organisations, students, and citizens. We value plural perspectives and expertise from individuals as well as organisations – nurturing collaborative projects that transcend disciplinary and professional domains' (*DesignLab | DesignLab | University of Twente*, n.d., para. 1). The Design Lab has several different facilities, an ideation space, a lounge, a conceptualization space, a prototyping space, a mechanical workshop, a textile workshop, an electronics workshop, a digital workshop, several classrooms and spaces for group work (*DesignLab Facilities*, n.d.).

**Disability** – Disability as a term is explained in Chapter 1, including the disability models. Here, I want to explain why the term disability is used, why I refer to disabled people as disabled people and why I don't use another term. This heavily relates to my positionality from experiencing disability first-hand and having discussions about disability with others in the disability community and reading works about this from disabled writers and/or activists (e.g. Rebekkah Taussig, Ashley Shew, Alice Wong, Sins Invalid, Harriet McBryde Johnson (2020), Leah Lakshmi Piepzna-Samarasinha, Nina Tame, Jessica Kellgren-Fozard, Imani Barbarin, Shane Burcaw, Christel Verbogt, Lauri Giepmans, Feminists Against Ableism, Ableism Is Trash (@ableismistrash), Syanne Centeno, Jo Beckwith, Eli (@rolling\_in\_multicolour), Lucy Trieshmann (@disabledinjustice), Merel Muller and many more). First and foremost, disability is not a bad word; it's a neutral one. Disability might be stigmatized, and there is discrimination, but not using the term disability because you think the term has a negative connotation can reinforce this stigma and this negative connotation by treating it as such. Let's treat the word disability like it is, a neutral, it describes a way of being and moving through the world that might be different than we are used to, but just that, different, not inherently better or worse than a non-disabled life. Just like life, disability is neither all good nor all bad. There are positive sides, like building or finding a community of amazing people and seeing the resilience and disabled joy and feeling access intimacy, and there are negative sides, like pain, fatigue or difficulty executing the tasks you want to do. But that is the same for any person. Life is neither all good nor all bad. Of course, there are ableism and inaccessibility to deal with. Still, those are not inherent to disability but inherent to an ableist society that doesn't prioritize the needs of all its citizens. I use identity-first language (disabled person) most of the time because my disability shapes every part of my life and is inextricably linked to me; I'm no longer ashamed to say I'm disabled, and therefore, I use Disabled to describe myself. I, however, respect any way any disabled person decides to describe themselves. I will be using disabled people when speaking about the larger group.

**Feminist theory** – I use a feminist lens in this research. Feminism and feminist theory can be defined and used in many different ways; here, I use and define feminist theory as paying close attention to the intersections of different power structures, biases and discrimination based on gender, race, class, disability, sexuality, religion, etc. Feminism is creating more space; it evolves, expands and is growing in richness; it is becoming less about the opposing men and women and more about disrupting established power structures and the matrix of domination, becoming more intersectional. The newer feminist theory asks who has power and who does not, where that comes from, and how we can disrupt the disparity between the powerful and the powerless. We often rally behind claims of "all women" because that sends a

stronger message, but what if we see the nuance there? Everyone is different, but we still deserve a place at the table. That nuance is harder to rally behind but sturdier and more sustainable (Taussig, 2021; Costanza-Chock, 2020). ‘A feminist approach informs not only what work is done and how, but also calls on researchers to be accountable for their positionality, privilege and point of view’ (Winkle et al., 2023, p. 73). My positionality can be found in Chapter 2.

**Inspiration porn** - Inspiration porn is all the stories, images or videos being created around a disabled person’s experience with “This wheelchair user can lift weights, what’s your excuse?!” and “This disabled person is not letting their disability stop them” or “The only disability in life is a bad attitude” all for the pleasure and inspiration of non-disabled people at the expense of disabled people.

*Yet as disabled people, we know that one of our biggest gifts is the Mad, sick, disabled, Deaf dreams we are always dreaming and have always been dreaming, way beyond what we are allowed to dream. Not in the inspiration-porn way that’s the only way many abled people can imagine that disabled-people dream of “not letting disability stop us!” Wanting to walk or see or be “normal” above all costs, being a supercrip or an inspiration but never human. (Piepzna-Samarasinha, 2020, p. 253)*

These stories, images or videos of inspiration porn reinforce ableist narratives that everyone should want to be normal and that as a disabled person, you have to prove your worth, either by being sad so non-disabled people can save you or be inspirational.

**Neurodivergent** – Someone is neurodivergent when their brain works differently than a neurotypical’s brain. The term is not loved by all neurodivergent people because it implies divergence from normal, which does not exist. There is no normal way a brain works, but it could be argued that it is more like divergence from socially acceptable functioning, a neurodivergent individual often struggles to function in a society designed for neurotypical bodyminds (Renzulli & Gelbar, 2023).

Some neurodivergent people use other terms like neuro-spicy, neurofizzy or referring to the specific condition(s) they have been diagnosed with (*Are There Other Terms You Call Yourself or Others as Neurodivergent?*, 2023).

**Neurodiversity** - Neurodiversity is the notion that there is great diversity and variety in neurocognitive functioning in our society. This includes neurotypical people as well as neurodivergent people. One cannot “have neurodiversity;” it describes the variety in a group of people. Neurodiversity does not reside in one person; however, a person can be neurodivergent.

**Neurodiversity paradigm** - The neurodiversity paradigm argues that there is a great variety in neurocognitive functioning, and rather than medicalize these, they are a normal variation and should be respected like any other human difference like gender or sexuality, and societal change should be at the root of the solution not medical treatment of the individual, but some argue that this view is limited because it excludes those who would like treatment like ADHD medication (Nelson, 2021).

**Technoableism** - Technoableism is the notion or expectation that technology will cure, fix, or eradicate disability (Shew, 2023). This is further explained in the Disability pride vs. Cure



mentality header in Chapter 1. Technoableism is rooted in ableism. Although many disabled people have a close relationship with technology, it is not the solution to disability, nor should we be looking for one.

**The matrix of domination** – A concept thought up by black feminists whereby each kind of oppression, be it gender, age, sexual orientation, race, disability, etc., is part of one overarching structure of domination (Collins, 2000). The term is closely related to intersectionality, but where intersectionality mostly speaks about how these forms of oppression intersect, how people can be oppressed in more than one way and how these interrelate, the matrix of domination is more about how all of these types of domination all fall in the same structure of domination and how this is organized (Collins, 2000).

**Toolkit** - A toolkit is a collection of tools brought together for a specific purpose, such as benefiting the design process. Dalsgaard (2017) describes these tools as ‘instruments of inquiry’, and according to Freach, they are helpful for catalysing interactions, building relationships, and enabling diverse communities to take action and innovate creatively (2018). Therefore, it can be interesting to combine several tools in a toolkit to achieve these benefits.



1.

## Introduction

Disability is among the largest minority groups (Factsheet on Persons with Disabilities | United Nations Enable, n.d.). ‘An estimated 1.3 billion people – or 16% of the global population – experience a significant disability today. This number is growing because of increased noncommunicable diseases and people living longer’ (*Disability*, 2023, key facts section). Some countries have a higher percentage of disabled people, like the US, about 27% (Centers for Disease Control and Prevention, 2023) and in others, like the Netherlands, the number is a little lower, with 2,5 million disabled people in c.a. 18 million citizens, about 14% of the population of the country (*Nederlands Keurmerk voor Toegankelijkheid*, n.d.). Although these are estimations and based on the people known to the government, since there is no disability registration system in the Netherlands, the real number might be higher. We can say that disabled people represent a significant part of society. However, ‘we [disabled people] are usually left out of the conversations around tech for disability. There are ongoing calls for universal design, but this design employs and imagines our bodies (often as the basis for professional certification) while rarely (if ever) simply asking us what we need’ (Shew, 2023, p. 8). Even though disabled people are often at the front lines of new technology, being the first users of exoskeletons, Closed Captions, automatic door openers, text-to-speech and voice-to-text, and more, technological interventions that are eventually picked up by the majority user (Shew, 2023). Disabled people could be seen as lead users for a large variety of types of technology. Disabled people are placed in the “extreme user” (Liikkanen, 2009) category in User-Centred Design (UCD) and Human-Centred Computing (HCC), which has many characteristics in common with lead users.

Design can mean different things to different people and has many definitions. Scholars in the scientific community and design practitioners outside of it still don’t agree on one exact definition. It can be seen as a professional term, a job or part of a job, something you would need to have an education in (Hoffman et al., 2004), but this has not always been the case. According to design scholars Robert Hoffman, Axel Roesler, and Brian Moon, the designer, as a specific kind of person or as a profession, emerged with the Industrial Revolution. Until then, knowledge about creating, using, and maintaining specialized tools was transmitted via craft guilds (Hoffman et al., 2004; Costanza-Chock, 2020). Design could also be seen with a broader view as a part of everyone’s life: design your own life, your environment, your career, your clothing style, your home interior design – it’s all design, but some people get paid to do it and others don’t (Costanza-Chock, 2020).

Disabled people are a great example of being designers in everyday contexts: disabled people often have to adapt their surroundings to be functional and accessible for them because the built environment is often not designed with them in mind. Therefore, they adapt, making the environment and products more usable. This is also known as *crip-hacking* or *technology appropriation* (Yergeau, n.d.; Hamraie & Fritsch, 2019; Eglash et al., 2004; Bar et al., 2016). ‘Appropriation is the process through which technology users go beyond mere adoption to make technology their own and to embed it within their social, economic, and political practices’ (Bar et al., 2016, p. 1). Disabled people start using products other than intended, make adaptations to the shape and colours, add textures/grips, and make products uniquely theirs; we could call these people *informal designers* when compared to professional designers; in design, this group is often referred to as *lead users*. Ron Eglash et al. (2004) and Bar, Weber, and Pisani (2016) research technology appropriation, and they have shown

that the practices of hacking, modifying, remixing, and, in other ways, making technologies work for the user's own needs are used quite commonly in a variety of contexts.

Disabled people are nonetheless treated as the target group of many types of technology, e.g. assistive technology, assistive robotics and medical technology. However, 'technology for disabled people is often developed by non-disabled populations, producing an environment where the perspectives of disabled researchers – particularly when they clash with normative ways of approaching accessible technology – are denigrated, dismissed or treated as invalid' (Ymous et al., 2020, p. 1). ' "Engineering for good" labs design prosthetic hands without ever talking to hand amputees. The public is always ready to ask us why we don't have whatever hot device has recently been hyped in a feel-good news story' (Shew, 2023, p. 8) even though these products weren't designed with the disabled end users and often do not work for them. This can lead to a disconnection between what the professional designer thinks the target group wants or needs and what the target group actually wants or needs. This disconnection and lack of contact with the target group can cause low adoption rates of AT because the process is not transparent, and future users have a low sense of ownership over the designed products (Martí Carrillo et al., 2018).

Philips and Zhao have discovered several predictors of AT abandonment. 'Four factors were significantly related to abandonment - lack of consideration of user opinion in selection, easy device procurement, poor device performance, and change in user needs or priorities. These findings suggest that technology-related policies and services need to emphasize consumer involvement and the long-term needs of consumers to reduce device abandonment and enhance consumer satisfaction' (Phillips & Zhao, 1993, p. 36). 'If we do not make consulting persons with disabilities a priority, we will not meet the demands of the end user, history will repeat itself, and the technology will be abandoned' (Cowan et al., 2012, p. 7). The involvement of users can improve the match between users' needs and available technology, which could lead to improved AT. 'Some users of AT have not felt that the motivations of designers have been aligned with their own when developing AT' (Harris, 2006 as cited in Williamson et al., 2015, pp. 258-259). However, disabled people are expected to adopt the new technology designed for them and not with them. Even if this technology doesn't fit their needs or is not their style (Williamson et al., 2015).

Some may think of disability simulations as the solution to this. Using a wheelchair for a day, splinting or restricting sensory input with earplugs or sight-limiting devices is thought to imitate the experience of disability. The technique has been discredited by a meta-analysis by Ashley Flower et al. (2007) and negatively regarded by disabled people (*I Won't Pretend That Disability Simulation Works*, 2014) for the reinforcement of the ableism it tries to dismantle and often has unintended consequences (Nario-Redmond et al., 2017). Disability simulations show a very specific kind of disability and only superficially (French, 1992), which cannot cover the entire disabled experience. Eventually, we can state that disability simulations cannot replace the involvement of disabled people in research.

Disabled people should be part of the design process when developing technology, especially when this technology under development regards them because 'disabled people are experts and designers of everyday life' (Hamraie & Fritsch, 2019, p. 1). 'Those whose needs have long been marginalized within the matrix of domination have a strong information advantage when it comes to articulating those needs and developing possible solutions' (Costanza-Chock, 2020, p. 111). 'We need a shift from deficit to asset-based approaches to design scoping; we

also need community leadership in design processes during scoping and “challenge” definition phases of a design cycle, not only during the “gathering ideas” or “testing our solutions” phases’ (Costanza-Chock, 2020 p. 27).

*‘Disabled people are often excellent innovators and have lots of ideas. In the short term the involvement of disabled people in design processes can help to deliver better products and services for everyone: an easy-to-read plaque on a postbox, a big button phone or a shower with a better dial. In the long run, asking disabled people to be at the heart of the design process could help to revolutionise our whole system of public services and of business. Disabled people can teach us to listen to users first, second and last so that the people who matter create solutions, tell us what really works and everyone reaps the benefits’ (Miller et al., 2004, p. 60).*

Disabled people should be involved in the design, research, and development of disability technology. Not just as part of a group giving feedback when the design is already conceptualized, but at the start, as part of the research team, they should have power and control over the process, in whatever shape or form.

*I think that science is for everyone. It belongs to the people, and it has to be available to everyone, because we are all natural explorers. I think that if we limit people with disabilities from participating in science, we’ll sever our links with history and with society. I dream of a level scientific playing field, where people encourage respect and respect each other, where people exchange strategies and discover together. If people with disabilities are allowed into the scientific field, an explosion, a huge titanic burst of knowledge will take place, I am sure. (Díaz-Merced, 2020, pp. 172-173).*

Technology is also sometimes seen as the solution to disability. Non-disabled people believe and expect disabled people to believe that technology will save them in the future. This perception of technology does not often match the realities of disability. Concerns around technology, like poor design, bad planning, maintenance, purchasing costs, and lack of social support, are disregarded (Shew, 2023).

*While our lives are deeply entangled with technologies of all kinds (not just fancy ones, left-handed scissors or walkers or hearing aids are all disability technologies), disabled people are almost never included in discussions about what technology means and how it integrates into daily life, what it means to be human in our modern world. (Shew, 2023, pp. 8-9)*

*‘Innovations that places disabled people at the heart of a process that will improve everyone’s quality of life also does something more: it starts to get rid of the ‘them and us’ distinction, which is at the root of the discrimination still faced by disabled people. This happens at both ends of the design process: ‘upstream inclusion’ of disabled people from the outset reflects and builds an appreciation of their contribution; and the ability of everyone to use the final product or service allows disabled people to be part of the ‘mainstream’ (Miller et al., 2004, p. 60).*

Disabled people are often excluded from creativity research, either explicitly, implicitly or by the choice of methodology (Jones, 2022). Creativity is something that most have heard of, but it has a variety of definitions. Some claim that creativity is exceptional, a talent only afforded to some and not all humans (Sternberg, 2006; Mumford, 2003). Others see creativity as an

inherent capability and need of the human species, benefitting individuals and the larger culture (Rudowicz, 2003). 'Cultural models describe creativity in terms of groups sharing values, experiences, and resources' (Jones, 2022, p. 491). Even though disabled people are often left out of creativity research, disabled people have valuable and unique experiences to contribute to creativity (Jones, 2022). 'Phenomenologically, wheelchair users know how gravity, centrifugal force, and uneven surfaces shape the experience of space, not only aesthetically but also emotionally (Sánchez Criado, 2018, p. 91). When we look at creativity as a cultural phenomenon whereby creativity results from one's immersion into their culture, then disabled people should not be disqualified from creativity research because they are immersed in their own culture: disability culture and therefore are just as much as anyone else capable of creativity.

*Disabled people should be a welcomed part of every part of society, we should all do our best to make this world the most accessible to them.*

*'Inclusive "kindness" isn't just a favor extended to disabled people; including disabled people is a kindness for all of us. Because listening to voices that are typically silenced brings to the table nuance, endurance, creativity, beauty, innovation, and power' (Taussig, 2021, p. 197).*



## 2. Positionality

Positionality is the practice of a researcher explaining their position related to the study, showing how this position might influence the study, and clarifying how personal experiences could influence the research and biases that could be present (Qin, 2016).

I am a disabled white cis-gendered woman in my late twenties with a bachelor's degree and I am currently pursuing a master's degree in industrial design engineering. I have strong beliefs when it comes to disability justice and use lenses of feminist theory and crip technoscience. I am both disabled and a designer. I have moved through the world, passing as a non-disabled person for most of the time and then becoming a lot more visibly disabled. This puts me in a special position where I can easily compare how I was treated when I passed as non-disabled and when I did not and the injustices that come from being visibly disabled. I am immersed in the disabled community and have learned a lot from other community members. Some experiences are almost universal among disabled people, like ableism, but others are more divisive. Because of these experiences, I have developed a bias towards disabled people. And I don't think this has to be a problem. A bias towards a marginalized group is the way to course correct. To stay "neutral" is not actually neutral. This often means standing by and letting the current path continue to repress and discriminate against minorities. You cannot be "neutral"; neutral justifies exclusion, and neutral is being tolerant of intolerance (Shew, 2023).

This thesis is grounded in scientific practice and scientific objectivity. During the thesis project, I had to be conscious of this bias and make my thesis research-led. At the end of the first few chapters, I added my opinions and reflections under Reflexivity.

Forlano described beautifully how I feel; 'like my own cyborg body, the narrative that follows – at times intimate and personal and sometimes abstract and theoretical – is hybrid' (Forlano, 2016, p. 1) I couldn't have said it better myself. Through this kind of hybrid scholarship, I hope to contribute to developing a deeper understanding of the role that disabled people can play in design.

Crip-hacking is very personally relevant and important to me because it brings together design and disability in a beautiful way that can often fill the gap left by professional designers. To give you some insight into how I have crip-hacked things in my own life, the best example of this is using an Ikea towel bar on my front door to close the door behind me (figure 1). I had to crip hack a solution because I couldn't find a suitable solution for my door and my budget (the T-pull Door closer product made for this problem was out of budget (T-Pull Door Closer, *n.d.*)) and the towel bar was the perfect solution without making permanent changes.

## Figure 1

*Ikea towel bar added to the front door*

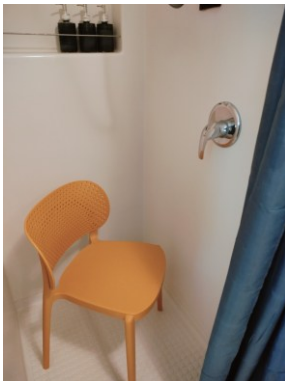


*Note.* Photograph taken by author. Alt-text: A front door that is slightly ajar, the inside of the house is slightly visible, and there is a white towel bar halfway down the door in a horizontal position secured with suction cups.

Another example of a crip-hacked solution is my shower chair. I have a beautifully bright yellow sturdy plastic garden chair (figure 2) with an ergonomically curved back that works better, fits better in my style, and is more comfortable than any shower chair I've seen before.

## Figure 2

*Yellow garden chair used as a shower chair*



*Note.* Photograph taken by author. Alt-text: A white shower stall with a blue shower curtain, a yellow garden chair placed in the middle, a shower faucet, and a shelf within arm's reach.

There is also a lot of other assistive technology that I use, both high and low tech: glass jar lid opener, arm support for my desk, lap desk, wheelchair and handbike, electric kitchen tools for grating and chopping, a combination tool with a shoehorn and grabber, ergonomic computer mouse, smaller keyboard for more ergonomic shoulder position, crutches, walking canes, a stand and board for jigsaw puzzles, silver finger splints, Dragon Naturally Speaking software, speech-to-text software, text-to-speech Daisy reader/Kurzweil, Voice assist on my iPad for turning e-book pages, an iPad holder arm, iPad for digital drawing, metal with silicone reusable drinking straws, a Joseph Joseph strainer spatula (*Scoop™ Plus Colander - Grey | Joseph Joseph*, n.d.) for straining pasta without having to lift the heavy pot, and a foldable bar stool with backrest for cooking. Most of these I have come across randomly and saw the usefulness for me, or other disabled people or occupational therapists recommended it.

I have probably missed some in this list, but there are lots of tools that make it possible for me to be able to do the things I want/have to do each day. They differ depending on the

symptoms I experience each day, and therefore, I have a variety of assistive technology that sometimes is meant for a similar purpose, but for different severity of symptoms. I would like to own much more assistive technology that I think can be beneficial for me; either the costs are prohibitive, or it doesn't fit well into the rest of my life, which are some of the problems I see in AT.

Overall, my position as a disabled person gives me a unique lens through which I approach this thesis project. I recognized the need to maintain awareness of this positionality throughout and separate my personal opinions from scientific research as much as possible. I believe this lens can contribute to a more inclusive understanding of the topics of this thesis.

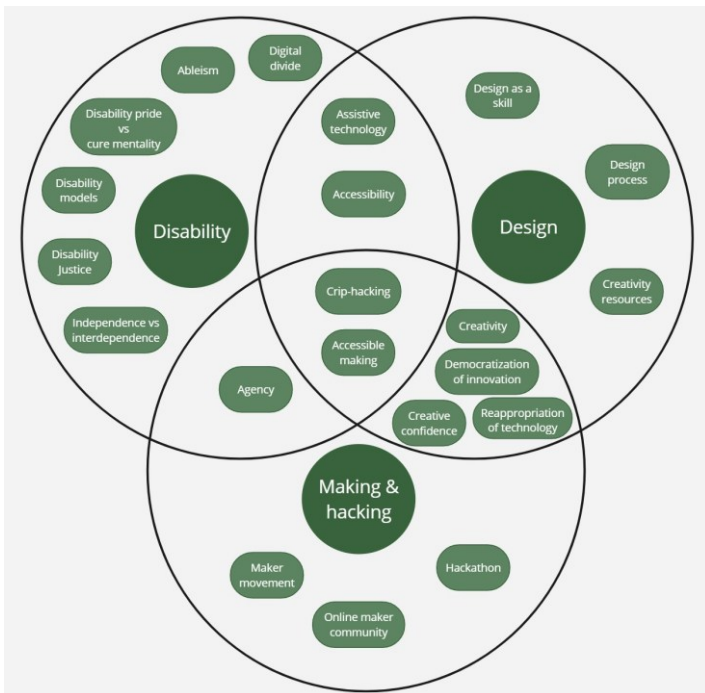


# 3. Background

This chapter will introduce and explain concepts and theories, with relevant literature, that will help with understanding the context of this thesis. Several topics will be discussed, including disability, design, and making & hacking. In the figure (3) below, these concepts can be seen and how they relate to each other.

Figure 3

Visual overview of the background topics



Note. Alt-text: a Venn diagram within the main circle's disability, design and making & hacking. In the disability circle are these words: digital divide, ableism, disability pride vs cure mentality, disability justice, independence vs interdependence. Intersecting with the design circle is: assistive technology, accessibility. In the design circle: design as a skill, design process, creativity research. Intersecting with the making & hacking circle: creativity, democratization of innovation, creative confidence, reappropriation of technology. In the making & hacking circle: maker movement, online maker community, hackathon. Intersecting with the disability circle: agency. In the segment in the middle within all 3 circles: crip-hacking and accessible making.

## Disability

Disability is part of being human. Almost everyone will either temporarily or permanently experience disability at some point in their life. It is quite a unique minority as it is one of the only ones one can be born into or join at any time (Disability, n.d.; Bogart et al., 2019). An estimated 1.3 billion people – about 16% of the global population – currently experience significant disability. This number will increase due to an ageing population and an increase in the prevalence of non-communicable diseases, but also because we have become better at treating diseases; therefore, people are less likely to die from diseases, but a part of that group will live with chronic symptoms. For example, with fatigue after cancer treatment (Jones et al., 2016; Disability, n.d) or survivors of critical illness (with ICU stay) who could now be living with a disability (Hodgson et al., 2017) or stroke survivors for which a quarter to half of the population is disabled after (Carmo et al., 2015). Disability is at the intersection of individuals with health conditions and personal and environmental factors like negative attitudes and inaccessibility (Disability, n.d.; Bogart & Dunn, 2019). Disability is also often multi-faceted, intersecting with other social identities (e.g., gender, race, sexual orientation,

etc.), disabled people could face multiple different forms of discrimination (Bogart & Dunn, 2019).

'We can learn from the past in terms of how disability has been politically framed, understood, and weaponized and see how our current systems perpetuate long-standing ableist biases' (Shew, 2023, p. 88). Efforts related to the social model and universal design can make the environment more accessible; real long-term diversity, equity and inclusion of disabled people need more than just that; laws, beliefs and policies need to be changed, and there needs to be a real change to correct injustices. The road is long towards structural changes; disabled people also need practical change now; small changes in the form of design can have more impact down the road.

*Disabled people have always existed, whether the word disability is used or not. To me disability is not a monolith, nor is it a clear-cut binary of disabled and non-disabled. Disability is mutable and ever-evolving. Disability is both apparent and nonapparent. Disability is pain, struggle, brilliance, abundance, and joy. Disability is sociopolitical, cultural, and biological. Being visible and claiming a disabled identity brings risks as much as it brings joy. (Wong, 2020, p. xxii)*

## Disability models

There are two most commonly used ways to see disability, also known as the disability models, two lenses that see the same scene in different ways; the most used and known in the global west are the medical and the social models. The medical model, or clinical model, is the default, the way we typically look at disability and how we have looked at disability for a long time. It is focussed on problems with the individual, which is very medically heavy, and focussed on diseases or conditions that person has that limit their lives. It could also be described as the deficit-based model. The social model, however, sees this differently. It is a more holistic view of disability where a condition or medical issue is recognised. Still, the focus is on the experience of disability, the context of disability and the environments creating disabling moments, the systemic problems that are most limiting to the person, the way we have designed the world, which is often not designed with disabled people in mind (Taussig, 2021; Olkin et al., 2019; Swain & French, 2000; Shakespeare, 1996). Non-disabled people do understand the social model of disability, albeit superficially and as a basic conceptual model. They understand that stairs are disabling for wheelchair users, and the barriers in the environment are disabling the person. However, they do not have the same understanding when a disabled person is proud to be the person they are (Swain & French, 2000).

'When people posit disability as a problem, they look for solutions' (Shew, 2023, p. 4). Disabled people can and do have problems, sometimes pain and dysfunction, but mainly social, structural, and practical problems that stem from an ableist society, where the disabled body and mind are seen as fundamentally flawed, unworthy of inclusion, broken, or inadequate. This reduces the disabled experience to a stereotype (Shew, 2023; Taussig, 2021; Olkin et al., 2019; Bogart et al., 2019).

*The technologized disabled body – the re-enabled body, “triumphant” over its own conditions – is a lie. Technology cannot transcend the meat sack; the body is still there, still felt, still handled, enduring. But technology – and the normative ideas of what it means to have the correct body or mind – increasingly separates our selves from the bodies with which we encounter the world. (Shew, 2023, p. 74)*

In the representation of disability and technology, there are expectations encoded, expectations that disabled bodyminds need fixing. In this expectation, the non-disabled saviour is centred on their impression of what disabled people need. The experiences and desires of disabled people are rarely considered (Shew, 2023; Taussig, 2021). 'Most disabled people certainly don't hate technology, but many of us resent the tropey-sappy depictions of technology that center abled saviors and their impressions of what we need' (Shew, 2023, p. 33).

*New technologies raise questions about the sorts of people we want to be and the sort of society we want to live in. This is true for many types of technology, not just disability-related technologies, and some communities are more intentional about critical considerations, periods of assessment, and decisions about adoption.*

*Rarely do we see disability technologies involve the kind of reflection raised by other technologies – even though these are often technologies we wear closer to our bodies, often in everyday use, ones that need maintenance and repair. (Shew, 2023, p. 75)*

An arm prosthesis should answer to the needs of the wearer, but often, the reality is that it answers to the needs of the starrer. It should look “normal,” even when “normal”-looking prostheses don't have the best functionality (Shew, 2023).

Swain & French argue that a new model of disability is emerging within the literature by disabled people and within disability culture, expressed most clearly by the Disability Arts Movement. Swain & French name this the affirmative model in their paper. A model that sees disability as non-tragic and encompasses positive social identities, both individual and collective and is grounded in the benefits of lifestyle and life experience of being disabled. It builds on the social model, but where the social model of disability is still about the problem. The affirmative model celebrates disability and focuses on the positives and benefits of disability (Swain & French, 2000).

### Disability pride vs cure mentality

In everyday life and the media, disability is often seen as a sad thing, a problem, a marker of limitations, but what about the disabled joy, the strength to deal with an ableist world every day? What if disabled people are proud to call themselves disabled? You don't see that very often. Do not mistake pride with only being positive, though; disability is hard, but so is life in general; they are neutral; you can be proud for achieving something both despite and because of your disability (Wong, 2020).

*Are you better yet? Get well soon. Race for a cure. Pray for a cure. There is a persistent belief amongst abled people that a cure is what disabled people should want. To abandon our disabled selves and bodies and assimilate into a perhaps unachievable abled skin. Pushback to this idea often comes in the form of the social model of disability, which states that we are disabled by society and a lack of access rather than by our bodies. For many, the social model can be liberating by locating the cause of our problems outside our bodies, we can begin to love ourselves again. (Moore, 2020, pp. 75-76)*

If you believe the media narrative, you would think that all paralyzed people share one goal: to walk. Walking is the gold standard for normalcy (Shew, 2023). Many people in Deaf and autistic communities do not want a cure. They are proud of their disability and see it as an

intrinsic part of themselves and their culture. The same can be said for people with other disabilities (Moore, 2020).

*Are they an intrinsic part of who we are? Or are they an identity that comes with the side of agony we should gladly give up? How do we feel when able people start advocating for “cures” - Which may come in the form of eliminating our people entirely rather than when the desire for a cure comes from disabled advocates?  
(Moore, 2020, pp. 75-76)*

‘Eventually, everyone becomes disabled if they live long enough; like death and taxes, ageing is inevitable. We should always be planning with disability in mind because disability is an inherent part of having squishy meat bodies’ (Shew, 2023, p. 52). Accommodations for disabled people are not “special.” At least, it is no more special than the world of accommodations surrounding us. Non-disabled people’s needs are already met, so they seem normal; non-disabled people do not even really see them as needs or accommodations; it is always there, expected (Taussig, 2021). ‘Typically, those who already have access haven’t had to think about who is still waiting to be included’ (Taussig, 2021, p. 212).

## Accessibility

To many disabled people, access is so much more than just coming across a ramp. ‘Access is a way of life, a relationship between you and the world around you; it’s a posture, a belief about your role in your community, about the value of your presence’ (Taussig, 2021, pp. 213-214). There is a fundamental difference between moving through a space that meets all your access needs and taking it for granted or needing to fight for every bit of access. Little moments of barriers, of inaccessibility, they add up.

*When I take a beat and look around, I don’t know where my personal insecurities end, and ableism picks up. Who would I even be if my body were allowed seamless access to my city, my community, my friend’s houses? I mean - really - what would happen if I stumbled onto some alternate universe made perfectly accessible to me? It’s hard to imagine such an unfamiliar flow of confidence, self-assuredness, and ease. (Taussig, 2021, pp. 215-216)*

It is hard for non-disabled people to see the inaccessibility because the world was mainly built with them in mind. The experience of inaccessibility for disabled people is cumulative; it consists of feelings of not being welcome and not belonging in that space (Taussig, 2021).

*‘I understand my city isn’t actively trying to send me the message that I’m unwanted. My community isn’t actively trying to make me move back in with my parent. The businesses in this area aren’t forbidding me from spending my money there. That can’t be said for a lot of groups of people throughout history and even today. Instead, the message I hear the most is something more like, “We’re just not thinking about you at all” - a sentiment that intends no harm even as it diminished an entire population’ (Taussig, 2021, p. 219)*

There are several standards for accessibility, for example the Web Accessibility Initiative (WAI) by the World Wide Web Consortium (W3C) which includes many resources for making the web more accessible and this will become mandatory soon, European standards EN 301549 (ICT accessibility), EN 17210 (accessibility to the built environment), EN 17161 (accessibility following “Design for all” standards) and EN 301549 (accessibility of websites and mobile applications)(*Accessibility Standardisation - Employment, Social Affairs &*

*Inclusion - European Commission, n.d.*), in the Netherlands specifically there is the certification of accessibility called “Nederlands keurmerk voor Toegankelijkheid (NLKT)” awarded with 4 levels (bronze, silver, gold and platinum) for each level of accessibility of a public building (*Nederlands Keurmerk voor Toegankelijkheid, n.d.*) and building regulations “Besluit Bouwerken Leefomgeving” which includes some standards for accessibility (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, n.d.) and the internationally recognized Integral Accessibility Standard (ITstandaard) (*Integrale Toegankelijkheid Standaard ITs, n.d.*). The rights of people with disabilities have been recorded by the United Nations (*United Nations Convention on the Rights of Persons with Disabilities - Employment, Social Affairs & Inclusion - European Commission, n.d.*). However, the majority of these requirements are about specific accessibility guidelines and are more like a checkbox at the end to ensure that the rules were followed, rather than an fully inclusive approach.

### Assistive technology (AT)

Assistive technology can be defined in different ways. From the point of view of professionals designing and developing AT, it is often described as technology that ‘can assist individuals with disabilities to achieve optimal function and independence’ (Phillips & Zhao, 1993, p. 36). Disabled people often have a definition that is closer to supporting them to being able to do the things they want to do and do them in an easier, more comfortable way. The focus is usually less on “optimal functionality” and “independence” because these terms can be ableist, especially when these are the designer’s definition of optimal functionality and independence (Hamraie & Fritsch, 2019; Costanza-Chock, 2020).

Assistive technology is often abandoned or not even used because it is inaccessible or doesn’t fit the needs and wants of the users they were designed for (Garber & Gregorio, 1990) (Phillips & Zhao, 1993). Batavia & Hammer identified 17 factors that are important for evaluating AT (affordability, compatibility, consumer repairability, dependability, durability, ease of assembly, ease of maintenance, effectiveness, flexibility, learnability, operability, personal acceptability, physical comfort, physical security, portability, securability and supplier repairability) and offer guidance in the selection, design and manufacturing process (Batavia & Hammer, 1990). These factors are also attributes often missing from developed AT and, therefore, have low adoption and high abandonment rates.

The main theme in this problem is that AT is not being developed for what the users want and need, and this comes from not involving users in the design process. This lack of transparency in the design process and not involving users creates a low sense of ownership from the users, which in turn results in low adoption rates (Martí Carrillo et al., 2018).

### The digital divide

In HCI, the choices made in design that can end up discriminating against disabled people from using a product is called the Digital Divide (Rogers, 2001; Cullen, 2001), the divide between those who benefit from technology and those who do not or do not have access to it. The Digital Divide’s creation does not represent a designer’s purposeful discrimination (Gregor et al., 2005). ‘Few designers set out deliberately to exclude certain groups of people from using their systems. It is most likely done more from ignorance or from accepting inaccurate stereotypes’ (Gregor et al., 2005, p. 288), a sentiment shared by Rebekah Taussig (2021).

## Ableism

The Oxford English Dictionary defines ableism as ‘Discrimination in favour of able-bodied people; prejudice against or disregard of the needs of disabled people’ (*Ableism - Quick Search Results | Oxford English Dictionary*, n.d.). This definition has a focus on able-bodied people, which is not inclusive of disabilities that are not physical, such as neurodivergence, even though neurodivergent people can also experience ableism (Mellifont, 2023). Non-disabled could be a better way of describing this, but this can make disability seem more black and white than it is; we can move in and out of this category by getting injured, pregnant or ageing. Disability is also shaped just as much, if not even more, by the context than by the body. Before glasses were invented, many more people fell into the blind category and, thereby, the disabled category, but when glasses were invented, not having 20/20 vision was no longer seen as a disability (Taussig, 2021).

*The idea that some of us are firmly fixed in the able-bodied category is fiction. A world built on speed, productivity, more, more, more, and far too few bathrooms and bathroom breaks does not consider or care for the actual bodies we live in. In other words, ableism affects us all, whether we consider ourselves disabled or not. In its most boiled-down, squished together, simplified form, ableism is the process of favoring, fetishizing, and building the world around a mostly imagined, idealized body while discriminating against those bodies perceived to move, see, hear, process, operate, look, or need differently from that vision. Often the greater the deviation, the greater the discrimination. (Taussig, 2021, p. 9-10)*

‘Tackling systemic ableism may feel like tilting at windmills, but it’s still easier to address than some kinds of failing within ourselves’ (Moore, 2020, pp. 75-76). Describing ableism and pinpointing the exact way it feels is difficult; ableism can feel distant and abstract, but at the same time, disabled people deal with it daily. Can it even be explained to someone who has not experienced it as such? ‘Ableism can be hard to hold on to or pinpoint because it morphs’ (Taussig, 2021, p. 15). In the world we live in today, ableism is often more subtle than overtly cruel, which also takes the form of micro-aggressions. Calling disabled people brave for executing everyday tasks like going to work. The notion that reading a book is always superior to listening to an audiobook. The conviction that all deaf people would prefer to be hearing. And many more. ‘All of these different flashes of the same oppressive structure. Ableism separates, isolates, assumes. It is starved for imagination, creativity and curiosity. It’s fuelled by fear. It oppresses. All of us.’ (Taussig, 2021, p. 15)

*Ableism pushes assumptions like: Some bodies/minds/modes are inherently and always preferable to others. Hearing/speaking is always better than deafness/signing. Bipeds walking is definitely preferable to paraplegics wheeling. Each of us has a “whole,” “unmarred,” “perfect” body that we were meant to have; the paralysed, autistic, deaf version is just a sadder, lesser version of that original intent. (This tenant is wrapped up in narratives of fat, ageing, gender-nonconforming bodies, too, of course). (Taussig, 2021, p. 11)*

Disabled people are regularly dehumanized subtly and more obviously (Parker et al., 2020; Omonojo, 2022; Sitruk et al., 2023; Ryan, 2020; Rasset et al., 2022). During the height of the COVID-19 pandemic, discussions were had about who was worth saving, and disabled people appeared at the bottom of those lists (Omonojo, 2022), with campaigns starting like the “Geen dor hout” in the Netherlands for elderly, disabled and vulnerable people to be protected and get medical help when ill (#GeenDorHout – *Officiële website van actiegroep*



#GeenDorHout, n.d.). Some argue that this dehumanization is at the root of ableism (Rasset et al., 2022).

## Disability justice

Disability justice is a framework that looks beyond mere disability rights, which is often focused on laws and accommodations and misses a more comprehensive and intersectional framework (Sins Invalid, 2020). 'A disability justice framework understands that: All bodies are unique and essential. All bodies have strengths and needs that must be met. We are powerful, not despite the complexities of our bodies, but because of them. All bodies are confined by ability, race, gender, sexuality, class, nation state, religion, and more, and we cannot separate them' (Sins Invalid, 2020, para. 14-15).

The 10 principles of disability justice are: 1. Intersectionality, 2. Leadership of those most impacted, 3. Anti-capitalist politic, 4. Cross-movement solidarity, 5. Recognizing wholeness, 6. Sustainability, 7. Commitment to cross-disability solidarity, 8. Interdependence, 9. Collective access, 10. Collective liberation (Berne et al., 2018).

## Independence vs interdependence

The view that the independence of disabled people is the goal of accessibility is criticized by disability activists, and independence is called a myth (Sins Invalid, 2019; Taylor, 2018; Mingus, 2010).

*"No one is actually truly independent; we are all interdependent. The difference between the needs that many disabled people have and the needs of people who are not labelled as disabled is that non-disabled people have had their dependencies normalized."  
(Ki'tay D. Davidson)*

This may seem at odds with the often positive representation of independence (Bennett et al., 2018), but 'independence and interdependence are not dichotomous or mutually exclusive' (Bennett et al., 2018, p. 163). The problem is that independence as a requirement of existence is ableist (Hamraie & Fritsch, 2019). 'Independence empowers people with disabilities to take control over their access needs. But instilling interdependence establishes them as contributors to –not just recipients of– community support and assistance' (Bennet et al., 2018, p. 163).

## Access intimacy

Access intimacy is a concept created by Mia Mingus on her blog Leaving Evidence (<https://leavingevidence.wordpress.com/>). She describes it as 'access intimacy is that elusive, hard to describe feeling when someone else "gets" your access needs. The kind of eerie comfort that your disabled self feels with someone on a purely access level. Sometimes it can happen with complete strangers, disabled or not, or sometimes it can be built over years. It could also be the way your body relaxes and opens up with someone when all your access needs are being met. It is not dependent on someone having a political understanding of disability, ableism or access' (Mingus, 2011, para. 4). Access intimacy is an experience that anyone, disabled or not can feel. In many different ways, it can be felt by parents, women of colour, queer and trans people, etc. It's hard to describe the experience, and even though some people have felt it, they don't always have the words to describe it. Access intimacy is also a feeling often shared between disabled people (or disabled and non-disabled people) when the other person just gets it, an automatic understanding of access needs in a shared

lived experience of ableism. This doesn't mean that the access needs are precisely the same or that they even know the other person's access needs. It's that shared understanding and instant familiarity to ask for support (Mingus, 2011). 'Access intimacy is interdependence in action' (Mingus, 2017, para. 18).

*'It has felt like an unspoken, instinctual language between different people, like an entirely unique way of being able to communicate and connect. Similar to meeting someone you just "click with," access intimacy has felt like a distinct form of attraction, desire and energy on to itself. Access intimacy is something I am coming to understand that I need in my life; something that I cannot (and don't want to) live without. I need it to literally be my whole self because access is such an intimate part of my life as a queer physically disabled woman of color adoptee. Without it, relationships exist under a glass ceiling or split by thick frosted windows, with huge pieces of myself never being able to be reached. Without it, there is survival, but rarely true, whole connection' (Mingus, 2011, para. 6-7).*

Volion further explores access intimacy by comparing different disabled bloggers' opinions and definitions surrounding access intimacy, including critiques of some that access intimacy does not address the labour of access (2020). Still, Mia Mingus addresses the weight of inaccessibility, 'sometimes access intimacy doesn't even mean everything is 100% accessible. Sometimes, it looks like both of you are trying to create access as hard as you can with no avail in an ableist world. Sometimes it is someone just sitting and holding your hand while you both stare back at an inaccessible world' (Mingus, 2017, para 9). 'Together, we share a kind of access intimacy that is ground-level, with no need for explanations. Instantly, we can hold the weight, emotion, logistics, isolation, trauma, fear, anxiety and pain of access' (Mingus, 2017, para 5).

## Agency

Agency is the capacity to act (Zidjaly, 2016; Schlosser, 2015); being in a position of power to make decisions and exert control over one's own life (Spiel et al., 2019; Wehmeyer, 2004), sometimes also referred to as self-determination (Wehmeyer, 2004). Something that has traditionally not been afforded to disabled people (Spiel et al., 2019; Wehmeyer, 2004), even though agency/self-determination is important for the quality of life (Wehmeyer, 2020; Cegarra et al., 2023; McDougall et al., 2016). Disabled people should have agency over their life. This includes being able to decide what products they use, how they use these, and to be able to adapt these products when they don't fit with their needs; however, not all disabled people are afforded this agency; they are often constricted to what insurance or government decides what they need. For example, a woman has been fighting the municipality for years to get the assistive technology she needs (Goorhuis, 2023), and even when you do get the aids you need here in the Netherlands, you don't own the AT. Therefore, you cannot make permanent changes to it. You can get money to buy the AT yourself, but you get little help with that and have to pay for maintenance and repairs yourself (*Wmo-aanvraag voor een hulpmiddel*, n.d.).

## Design as a skill

'Design is a highly complex and sophisticated skill. It is not a mystical ability given only to those with recondite powers but a skill which, for many, must be learnt and practised rather like the playing of a sport or a musical instrument' (Lawson, 2005, p. 14). 'Designers must not only decide what effects they wish to achieve, they must also know how to achieve them. So,



our civil engineer must understand the structural properties of concrete and steel, whereas our fashion designer must appreciate the characteristics of different fabrics' (Lawson, 2005, p. 10). Designers often express their designs visually and graphically; it would be quite challenging to become a designer without developing the ability to draw, but these drawings can't be made just for aesthetic appreciation, so they would fall under art. Drawings are made to explain concepts, and drawings or other visual materials are used to share ideas with stakeholders or the people who manufacture the products (Lawson, 2005). Once designers have mastered these competencies and skills, it is often the case that designers can perform them unconsciously (Lawson, 2005), not even fully aware they are using them, which makes design a challenging skill to describe.

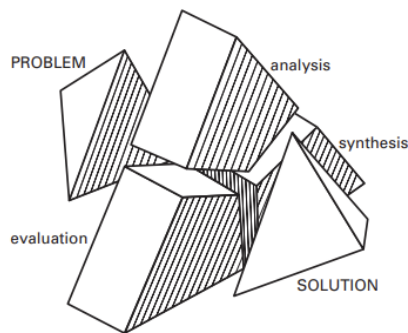
Design thinking has gained popularity ever since the term was used as the book title by Peter G. Rowe (1991). Design thinking is a particular way designers think about and solve problems, for example, in problems where a certain value is aspired to, but the object and the working principle to achieve this value are unknown. 'Performing the complex creative feat of the parallel creation of a thing (object, service, system) and its way of working is the core challenge of design reasoning. This double creative step requires designers to come up with proposals for the 'what' and 'how', and test them in conjunction' (Dorst, 2011, p. 525).

### The design process

'Many writers have tried to chart a route through the process from beginning to end. The common idea behind all these 'maps' of the design process is that it consists of a sequence of distinct and identifiable activities which occur in some predictable and identifiably logical order' (Lawson, 2005, p. 33). It would be great if the design process were this structured and logical, just a road map with checkpoints along the way, but the truth is that design is a messy and non-linear process. One step might come after another, but designers might have to return to step one to discover more about the problem before continuing. Researchers cannot agree on which exact phases can be defined and how these are related to each other. The process is challenging to define and present in a logical visual structure (Lawson, 2005). Generally, researchers can agree that the design process consists of three types of activities: analysis, synthesis and evaluation; Lawson came up with one visual representation of these activities as they relate to the problem and solution in a design process, which can be seen in the figure (4) below. Often, because of the complex nature of design problems, when a solution is found for one problem, many more problems are created (Lawson, 2005). Therefore, the process is non-linear, and designers must jump back and forth from solution to problem using different activities.

**Figure 4**

*The design process*



*Note.* The design process seen as a negotiation between problem and solution through the three activities of analysis, synthesis, and evaluation. From Lawson, 2005. Alt text: schematic of the design process with sort of building blocks with the words “problem, evaluation, analysis, synthesis and solution” next to them.

## Creativity

Creativity has many definitions, but can generally be understood to be the process of creating artefacts/products, with at times the addition of it having to be novel and useful in some way (Glăveanu, 2010; Tierney & Farmer, 2002; Shalley et al., 2004; Amabile, 2018; Zhou, 1998; Zhou & Shalley, 2003). Creativity research has gone through several revolutions, ‘the shift from the concept of the solitary genius (the ‘He-paradigm’) to that of the solitary normal and creative individual (the ‘I-paradigm’) and, further along, to the idea of ordinary individuals being creative only in their relation to one another (the ‘We-paradigm’)’ (Glăveanu, 2010, p. 148). That last revolution represents the shift to a cultural model of creativity, which can only be understood in relation to context, time, and group reference.

Disabled people are often excluded from creativity research, either explicitly, implicitly or methodologically. However, when looking at the cultural model of creativity, disabled people should not be excluded from creativity research. Disabled people are involved in different sub-cultures of disability that non-disabled people often don’t get insight into. Examples include Deaf culture and neurodiversity culture. Disability culture refers to both the overarching culture as well as the multitude of smaller sub-cultures, which are all created by disabled individuals instead of a grouping from outside of the disability community (Jones, 2022). ‘Cultural models describe creativity in terms of groups sharing values, experiences, and resources’ (Jones, 2022, p. 491). Disabled people are uniquely qualified to take part in this creativity because disability culture, in large part, is about sharing values, experiences and resources through activism and sharing tips in the form of “hacks” or crip(tastic)-hacking for surviving in an ableist world.

## Resources for creativity

There is also the investment theory of creativity by Sternberg, a confluence theory with six distinct but interrelated resources needed for creativity: 1. intellectual skills – the ability to see problems in new ways, analytical skill to analyse which ideas are worth pursuing. 2. Knowledge – knowing enough about the field to be able to move forward but not too much, because this can lead to a closed perspective. 3. thinking styles – decisions about how to use skills, a preference for thinking and decision to think in new ways. 4. Personality – willingness to overcome obstacles, take sensible risks, tolerate ambiguity and self-efficacy. 5. Motivation

– intrinsic, task-focused motivation. 6. Environment – An environment supportive and rewarding of creative ideas (2006). Similar aspects are discussed in the framework developed by Shalley et al. (2004).

### Creative confidence

Confidence has been cited as a necessary condition for creativity (Bandura, 1977). Beghetto et al. showed that creative confidence, creative achievements and creative activities are correlated (2021). Confidence is the quality of being certain of your abilities or having trust in people, plans, or the future (*Confidence - Cambridge Dictionary*, 2024). Self-efficacy is sometimes used in place of confidence when talking about creative confidence; self-efficacy is defined as a person's belief that they can be successful when carrying out a particular task (*Self-Efficacy - Cambridge Dictionary*, 2024). Regarding creative confidence, these definitions can be combined into feeling assured/having faith in one's ability to create/make.

### Democratizing innovation, reappropriating technology

'Empirical studies show that many users—from 10 percent to nearly 40 percent—engage in developing or modifying products. When taken together, the findings make it clear that users are doing a lot of product modification and product development in many fields' (von Hippel, 2005, p. 4). This is also known as democratizing innovation, reappropriation of technology or hacking, where users start modifying products or using them for purposes other than originally designed. This practice has always been there, but especially in the current times, it is easier than ever. Now more than ever, consumers can access relatively cheap “desktop manufacturing”, like 3D printers, desktop laser cutters, and CNC machines (Anderson, 2012; von Hippel, 2005). 'While large-scale manufacturing processes tend to be inaccessible to those operating outside of major companies housing production lines, the so-called “democratization” of fabrication technologies, including 3D printing, is making it possible for the individual to produce a variety of items in small workshops and even at home. Spanning a range of sectors' (Shaw et al., 2017, p. A83).

*Lower the barriers to entry and the crowd pours in. That's the power of democratization: it puts tools in the hands of those who know best how to use them. We all have our own needs, our own expertise, our own ideas. If we are all empowered to use tools to meet those needs, or modify them with our own ideas, we will collectively find the full range of what a tool can do. Transformative change happens when industries democratize, when they're ripped from the sole domain of companies, governments, and other institutions and handed over to regular folks. (Anderson, 2012, p. 63)*

Democratizing innovation has many benefits; it's becoming easier for users to get exactly what they want by designing it for themselves. This design and innovation by users also seem to increase social welfare. It does also have a negative side for manufacturers. Open innovations change the structures of social divisions of labour (von Hippel, 2005). 'Many firms and industries must make fundamental changes to long-held business models to adapt. Further, governmental policy and legislation sometimes preferentially supports innovation by manufacturers. Considerations of social welfare suggest that this must change' (von Hippel, 2005, p. 2). There are ways for manufacturers to adapt and change. Von Hippel suggests three general possibilities; '(1) Produce user-developed innovations for general commercial sale and/or offer custom manufacturing to specific users. (2) Sell kits of product design tools and/or “product platforms” to ease users' innovation-related tasks. (3) Sell products or

services that are complementary to user-developed innovations. Firms in fields where users are already very active in product design are experimenting with all these possibilities' (von Hippel, 2005, p. 15).

One-size-fits-all commodity goods dominate our world; if you want to stand out, you create products that serve individual needs, not general ones. Custom products fit better, not just with the user's product needs but also with their physical bodies, style, and use case. Custom products are now only a privilege available for the rich; it is a luxury not many can afford, but digital manufacturing could change this. There is no cost to complexity and no penalty for small batches (Anderson, 2012).

### Maker movement

The democratization of manufacturing technology further fuels the advancing maker movement (Shaw et al., 2017). According to Hatch in his Maker Movement Manifesto, the core principles of the maker movement are; 'make, share, give, learn, tool up, play, participate, support and change' (Hatch, 2014, pp. 1-2). The Maker's Bill of Rights (figure 5) reflects the philosophy and underlying beliefs of the Maker movement of working on innovating with technology outside of the professional world and the accompanying supply and demand. It rejects a normative way of production and supports an inherent human desire for creativity (Shaw et al., 2017).

*'What exactly defines the Maker Movement? It's a broad description that encompasses a wide variety of activities, from traditional crafting to high-tech electronics, many of which have been around for ages. But Makers, at least those in this book, are doing something new. First, they're using digital tools, designing onscreen, and increasingly outputting to desktop fabrication machines. Second, they're the Web generation, so they instinctively share their creations online. By simply bringing the Web's culture and collaboration to the process of making, they're combining to build something on a scale we've never seen from DIY before'*  
(Anderson, 2012, pp. 20-21)

**Figure 5**

*The maker's bill of rights*



*Note.* From: Torrone, 2006. Alt-text: Flyer with “the maker’s bill of rights” at the top, below are statements each with a square block in front of them; Meaningful and specific parts lists shall be included. Cases shall be easy to open. Batteries shall be replaceable. Special tools are allowed only for darn good reasons. Profiting by selling expensive special tools is wrong and not making special tools available is even worse. Torx is OK; tamperproof is rarely OK. Components, not entire sub-assemblies, shall be replaceable. Consumables, like fuses and filters, shall be easy to access. Circuit boards shall be commented. Power from USB is good; power from proprietary power adapters is bad. Standard connectors shall have pin-outs defined. If it snaps shut, it shall snap open. Screws better than glues. Docs and drivers shall have permalinks and shall reside for all perpetuity at archive.org. Ease of repair shall be a design idea, not an after-thought. Metric or standard, not both. Schematics shall be included.

## Hacking

‘Hacking is now a widely discussed and known phenomenon but remains difficult to define and empirically identify because it has come to refer to many different, sometimes incompatible, material practices’ (Jordan, 2017, p. 528). Some definitions of hacking only include the illicit remote breaking into computer systems. Still, there are now also broader definitions as those of Himanen and Wark that describe a specific social practice as hacking, and they open the possibilities of hacking virtually anything, like in the instance of “life hacking” or other similar practices (Himanen, 2010; Wark, 2005, Jordan, 2017). ‘At present hacking is associated with a wide range of acts from rigging an election to so-called “lifehacks” (e.g., tying brightly coloured ribbon to luggage for the purpose of being able to identify it more easily among a sea of otherwise unremarkable suitcases)’ (Bell et al., 2020, p. 658). The origin can be traced back a long time; the history of hacking, according to Jordan, can be divided into 4 phases: 1. Prehistory (core practices were developed), 2. Golden age of cracking (hacking became a self-conscious identity and community mainly defined by breaking into computers and maturing free open source software), 3. Hacking divides (rise of serious cybercrime, hacktivism, the division of Open Source and Free Software and hacking as an ethic), 4. Diffusion of hacking (consciousness of state-sponsored hacking, re-rise of hardware hacking in maker labs and hackerspaces, diffusion of hacking into a broad ‘clever’ practice) (Jordan, 2017).

## Hackathons

'Hackathons are short-term events at which participants work in small groups to ideate, develop and present a solution to a problem. Despite their popularity, and significant relevance to design research, they have only recently come into research focus' (Flus & Hurst, 2021, p. 1). Initially construed as programming events focused on solving a problem, focussing on software development, hackathons have been reappropriated to encompass a range of technologies, issue areas, and participatory design activities, including hacking for "social good" (Briscoe & Mulligan, 2015; Birbeck et al., 2017; Taylor & Clarke, 2018; Porter et al., 2017; Hope et al., 2019). Hackathons are not new to design practice or education. Their role in design research is also growing (Flus & Hurst, 2021; Moys et al., 2023). Examples of hackathons in engineering, product, software, systems and user experience design are well documented (Flus & Hurst, 2021; Moys et al., 2023).

The increasing interest in hackathons aligns with the current (fifth) wave of design, which is about applying design to understand the future (Cooper, 2019). 'Hackathon events increasingly challenge participants to solve complex problems, focusing on benefitting the world and our futures' (Flus & Hurst, 2021, p. 2). 'Hackathons are already recognised as good for building students' collaboration experience and gaining experiential learning. The participants' positive responses to working in multidisciplinary teams indicate that this might have significant benefits for building foundations for inclusive learning in diverse cohorts (both within and across programmes)' (Moys et al., 2023, p. 11).

The original format for the hackathon was often alienating to people not part of the American, white, able-bodied, cis male representation of technology (Hope et al., 2019). 'There has been a recent move towards intentional diversification of hacklabs, makerspaces, and hackathons, specifically along lines of gender, race, and sexual orientation. Examples include DiscoTechs (pioneered by the Detroit Digital Justice Coalition), CryptoParties, Trans\*H4CK, #A11yCAN Hackatons, and the Make the Breast Pump Not Suck Hackathon and Policy Summit, among many others' (Costanza-Chock, 2020, p. 27) 'Other critiques of the hackathon format challenge the positivist epistemology that presumes a knowable, bounded problem space with an optimal, technical solution that can be tidily understood and prototyped in a weekend' (Eaves, 2012 as referenced in Hope et al., 2019, p. 3).

'When disability or illness enter the fold of hackathons, 'it might result in blood-sugar management apps or videogames that model how to interact with healthcare professionals, or vehicles that enable broader access for wheelchair users' (Yergeau, n.d., Enter the Hackathon section). Products that disabled people don't always want or need, or it is too similar to something they already use. That is not to say that hackathons never produce anything "good"; rather, the argument is that often disabled people are not part of these hackathons; disability is seen as pitiable and in need of remediation. Hackathons with disability as the focus are held without disabled people in the organization, without consulting disabled people, and sometimes the views of disabled people are even disregarded. Organizers claim to know more about the disabled experience because a disabled person's view is "inherently self-focused and idiosyncratic". Hackathons offer many opportunities. Still, the history of hackathons shouldn't be disregarded, and learnings should be taken from it; by taking an inclusive approach instead (Yergeau, n.d.), hackathons could benefit from these disabled perspectives.



## Online making community

There are several online maker communities where makers all over the world can share their projects, have discussions, and learn from each other. Three well-known and widely used platforms are The Make magazine, Thingiverse, and Instructables. There are also 2 online communities that are specifically focused on people with disabilities and/or neurodiverse people. Many communities/databases include many AT designs (Buehler et al., 2015).

**Table 1**

*Online maker communities*

<b>Name</b>	<b>Target group</b>	<b>Purpose</b>	<b>Link &amp; sources</b>	<b>Notes</b>
<b>The make magazine</b>	Expert/ professional makers are often interviewed, but the platform is for both novice and expert/ professional makers	Blog posts about projects & news from makers, discussion forums	<a href="https://makezine.com/">https://makezine.com/</a> ( <i>Makezine Projects</i> , 2024) (Hurst & Tobias, 2011)	Not disability focussed, although occasional DIY AT posts, although some ableism, cure mentality and saviour complex.
<b>Instructables</b>	Individual makers and teachers and, thereby, children	Makers share projects with instructions with comments for feedback/advice + teacher sections with grade-appropriate school projects + host contests.	<a href="http://www.instructables.com">www.instructables.com</a> ( <i>Yours for the Making</i> , n.d.) (Hurst & Tobias, 2011).	Not focussed on disability but quite some DIY AT projects
<b>Thingiverse</b>	Novice to advanced makers, anyone with access to a 3D printer	Maker project sharing platform, focus on 3D printing	<a href="http://www.thingiverse.com">www.thingiverse.com</a> (Thingiverse.com, n.d.) (Hurst & Tobias, 2011)	It's not disability-focused, but there are many AT projects (key turner, parametric ring pen holder, assistive switches, wrist braces, controllers for smartphones by head movement and bite down, etc.).
<b>Makers making change</b>	Disabled people or others who know disabled people	Open-source database for 3D models for assistive devices or other DIY AT projects made by and for the disabled community	<a href="http://www.makersmakingchange.com">www.makersmakingchange.com</a> ( <i>Everyday Assistive Technology - For the Community, by the Community.</i> , n.d.)	Disability focus
<b>ANDY</b>	Neurodivergent people (self-identification or official diagnosis), is open to anyone who wants to join	DIY community, discuss, create and share	<a href="https://andy.utwente.nl/">https://andy.utwente.nl/</a> ( <i>ANDY's - UTwente Neurodiverse Community</i> , n.d.) ( <i>New Community for Neurodiverse Students and Employees</i> , 2023)	Neurodivergent focus, initiative for University of Twente staff and students

## Accessible making & hacking

'By empowering individuals with the means and knowledge to create their own assistive technologies (and iterate on these designs as their needs change), they will be able to produce technologies that meet their specific needs and avoid limitations of existing assistive technology development' (Hurst & Kane, 2013, p. 635). The tools needed for making are becoming increasingly accessible in terms of acquiring them with reduced prices and benchtop machines becoming available. However, these tools might still not be physically accessible to disabled people.

'Traditional manufacturing machines (band saws, lathes, and drill presses) frequently require many physical requirements of their users. These include the ability to stand for long periods of time, precise manual dexterity, and accurate vision, all of which limit who can operate these machines. Furthermore, operating these machines requires special training and knowledge, and can be extremely dangerous when misused' (Hurst & Kane, 2013, p. 636) but in the past decade professional manufacturing machines have been adapted to become suitable for personal use, and they have become smaller (desktop), lower in price, and less training is required to be able to use them. These include 3D printers, CNC milling machines and laser cutters.

*'3D printing makes it possible to produce individualized aids that are not financed by health insurance carriers and thus closes the gap between medically necessary aids and objects of daily use' (Bosse & Pelka, 2020, p. 42).*

Criptastic hacking/accessible making needs the redistribution of expertise and knowledge on how to create AT or hack commonly used objects, a community to share projects to be able to learn (Sánchez Criado et al., 2016). With computer-controlled machines, the user's main task is to design, and a computer controls the machine. Less manual labour is involved, making it more accessible to people with physical disabilities (Hurst & Kane, 2013). Because a computer controls these machines, this also offers more compatibility with screen readers or other assistive technology. Opting for outsourcing 3D printing services can make it more accessible for disabled people to 3D print (Kantaros et al., 2022). Sarwar and Wilson systematically analysed the literature on making and accessibility and concluded that 'only a few interventions directly supported accessible design, exploration, and modification functionalities' (Sarwar & Wilson, 2022, p. 3). They also concluded that these often only work for a few disabilities. They see opportunities in accessible workshops, materials and community support for collaboration among diverse makers. This can lead to more accessible environments and provide the needed community support (Sarwar & Wilson, 2022), 'but this comes with interdependence, cooperation and negotiation among the makers' (Sarwar & Wilson, 2022, p. 3).

*DIY within punk functions on and concretises the premise that anyone can do it, anyone can take part, anyone can be a punk. It is supposed to be affirming, empowering even, because it situates itself as an alternative to the gate-keeping inherent in corporate or institutional-led music industries and cultures. Unfortunately, it has become its own form of unconscious gate-keeping, wielded as a means to prevent critique of ableist, racist, sexist, misogynistic, homophobic or transphobic behaviours and assumptions within the punk scene. ((Nguyen, 2012, Fiscella, 2012, Sabin, 1999, O'Brien, 1999) as referenced in (Stewart & Way, 2023, p. 14)*



Other ways of making 3D printing specifically more accessible are, for example, working with physical materials (like clay or foam) first and scanning these to create digital 3D models for 3D printing (Buehler et al., 2014). Makers with physical disabilities who cannot use a keyboard and mouse use a sip-n-puff to be able to 3D print (Turner, 2020; *quadriplegic 3D printing a stupid light fixture #3dprint #3dprinted #3dprinter #3dprinting*, n.d.). People with disabilities can participate in maker activities, which might need to be adapted based on their needs and skills, from only choosing a 3D model that someone else prints all the way to fully designing a 3D model in CAD software and 3D printing it themselves (Linke et al., 2018). Many disabled people figure out how to make making accessible by themselves and share this with other disabled makers (Rolling Inspiration, 2019; Poposki, 2019; Creations, n.d.; *Quadriplegic Uses SOLIDWORKS and 3D Printing Technology to Beat the Odds*, n.d.; Perry, 2024).

DIY-making is not the solution to all societal problems; Long-term societal changes still need to happen while holding space for smaller, more practical solutions. People need these solutions now and can't wait for the decades it might take for the whole system to change. It is essential to see these DIY maker solutions for what they are: small, practical, and short-term solutions. It might lead to more significant changes, but advocacy and work still need to be done on these more considerable societal changes. Not all maker tools and machines are also accessible to disabled people; specific skills are required, and physical accessibility of machines like 3D printer buttons and the strength needed to use drills or other manual tools can be barriers. Hook et al. mention several barriers to participation for disabled people to create their own DIY AT or adapt AT: a lack of skill and confidence, scarcity of time (which was specific for parents of disabled children), practicality and robustness of solutions, required knowledge to ensure safety and not wanting to make permanent changes to medical devices because of concerns of not being allowed/risking relationship with medical professionals (2014).

### Crip(tastic) hacking

Disabled people partake in the practice of crip hacking, even if they do not always call it that; sometimes, it is called disability life hacks or chronic illness hacks. In literature, it would fall under democratizing innovation or technology appropriation, even though this literature is often not fully inclusive and intersectional (Wojciechowska, 2019). When looking at how lead users are defined: '1. Lead users face needs that will be general in a marketplace – but face them months or years before the bulk of that marketplace encounters them, and 2. Lead users are positioned to benefit significantly by obtaining solutions to those needs (von Hippel, 1986; Hannukainen & Hölttä-Otto, 2008). Disabled people are exciting candidates because they adhere to both characteristics (Conradie et al., 2014). Disabled people have lay knowledge. 'Lay knowledge is based on individual experience of the problem and it can be discussed with peers. Lay people can also appropriate scientific expertise (lay expertise) related to the issue that concerns them' (Lhoste, 2020, p. 2). Disabled people have the knowledge and characteristics to be lead users and create innovative technology. 'Disabled people are experts and designers of everyday life' (Hamraie & Fritsch, 2019, p. 2)

*A criptastic version of hacking is one that rails against forced normalization, one that moves from body-tweaking to something collective, activist, and systemic. I am asking us to imagine the possibilities if hacking were a disability-led movement, rather than a series of apps and patches and fixes designed by non-disabled people who cannot even be bothered to talk with disabled people. When activists make claims about "hacking," they're suggesting we engage in activist*

*work that goes against some kind of institutional grain. There is resistance and tinkering involved in any act of hacking. Hackers are makers (and sometimes breakers). (Yergeau, n.d., Towards Criptastic Hacking section)*

Crip(tastic) hacking can range from using products not marketed to disabled people as an adaptive device (e.g. electric mixers, electric bread slicers, dishwashers, coffee makers, robot vacuums, etc.) or products marketed mainly to the elderly (e.g. can openers, stair lifts, etc.) or making adaptations to everyday existing products (figure 6, figure 7, figure 8), or making products that already exist but making them more fitting with the person's style (figure 9), or creating products that don't exist yet (figure 10, figure 11, figure 12), it can include rearranging furniture to fit everyone's needs for stimming or mobility, it can include anything that disabled people partake in that makes changes to objects, spaces or systems to make them better suited for them and other disabled people, it is messy, dynamic and participatory (Yergeau, n.d.). However, Buehler et al. noted that most publicly available AT 3D models in their study were not created by disabled makers (2015). Buehler et al. theorise that disabled people not self-designing could be because of the perceived difficulty of 3D modelling and fabrication or the inaccessibility to design tools (2015).

**Figure 6**  
*Water bottle loop*



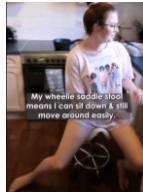
*Note. From Water Bottle Loop, 2023. Alt text: A white person in a wheelchair holds a water bottle in a bottle holder. They have tied rips around it to create a loop they have their thumb in.*

**Figure 7**  
*Bike dog leash holder*



*Note. From chronicallyjenni, 2024. Alt text: a white woman in a wheelchair with the device and a dog on a leash attached to it.*

**Figure 8**  
*Wheelie saddle stool*



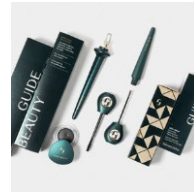
*Note. From chronicallyjenni, 2022. Alt text: A white woman in her kitchen on a rolling saddle stool*

**Figure 9**  
*Wheelchair spoke cover*



*Note. From Izzy Wheels— Wheelchair Wheel Covers, n.d. Alt text: A white woman in a bright pink suit sits in a wheelchair, showing off her floral wheel covers.*

**Figure 10**  
*Accessible beauty tools*



*Note. From Guide Beauty | About Us, n.d. Alt text: a flat-lay of beauty tools with ticker more accessible handles*

**Figure 11**  
*Adaptive shoes*



*Note. From BILLY Footwear, n.d. Alt text: A white child is showing his shoes, which are undue with a zipper so that feet with AFOs can easily go in and out of them.*

**Figure 12**  
*PICC-line cover*



*Note. From PICCPerfect® Antimicrobial PICC Line Cover, n.d. Alt text: an arm is showing with a PICC line above the elbow with a PICC-line fabric cover over it.*

Jay Dolmage has described access as a way to move (2015). If access is a way to move, and hacking is a way to move, we can move away from software and techno-cures and focus on the process. We do not just design for disabled bodies but also the disabled spaces that disabled people exist in and how bodies and spaces move and interact with each other. Access is not a checkbox that you can check; it is a continuous process, and the work never ends. Access is a verb.

Criptastic hacking, or hacking-as-moving, is disabled-led. Disability hacktivism is only ethical if it is led by people with disabilities. We are the movers, not the moved-upon. We are the ones who should be hacking spaces and oppressive social systems; we should not have our bodies and our brains hacked upon by non-disabled people. [This] does not mean that there is not room for non-disabled

people, or that non-disabled people are somehow exempt or prevented from doing the work of disability rights. What this does require, however, is a reorientation. It involves setting aside our most emetically cherished of disability tropes—heroism, pity, charity—or the celeb-righteous anger of buying chairs and ramps for “ungrateful half-persons”. (Yergeau, n.d., Towards Criptastic Hacking section)

In the Type 1 Diabetes (T1D) community, there is the #WeAreNotWaiting movement. They are hacking their T1D tech to link to each other, innovating faster than researchers and manufacturers. #WeAreNotWaiting believe manufacturers are taking too long to release products that provide functionalities that they find important, such as being able to upload glucose meter data to the cloud’ (O’Kane et al., 2016, p. 3454). Although these innovations are great for getting custom solutions to people who need them, challenges also emerge. Despite the availability of open-source designs, most people who could benefit from these types of custom tech don’t have the technical knowledge to participate in this type of making (Lindtner et al., 2014).

### Research questions

From the research presented in this chapter, we can see that disabled people are discriminated against and deal with inaccessible or unsuitable products, for example, AT and this can be a result of not involving disabled people in the research or design process, including creativity research. People are reclaiming control over their products by reappropriating technology, uniting in the maker movement, organising hackathons, and sharing their work in online communities. Disabled people also partake in similar activities, specifically crip-hacking; however, because of ableism and inaccessibility, they are not accepted everywhere, and they are more often the topic of a hackathon than a participant in it. When looking at online maker communities, some are geared towards disabled people. However, the majority of the people who would benefit from this type of custom tech don’t have the technical skills to be able to participate in the movement. There is no crip hacking community, yet that teaches disabled people design and maker skills to support the increase of their creative confidence so they can partake in the maker movement and feel more agency in the design and use of their products. From this, the resulting research questions for this research are:

RQ1. How may the creative confidence in hacking and making of disabled people be supported?

RQ1a. How may a hacking activity by disabled people to design for justice be supported?

RQ1b. How does a creative learning activity impact the creative confidence of disabled people who are non-designers?

## Reflexivity

Assistive technology is amazing, and I have loved reading about the people crip-hacking their products and environment to make them more suitable for them. However, it has a sour taste sometimes. The language surrounding the development of AT for disability can turn ableists, especially the saviour complex along the lines of “These disabled people could not function without this technology” or inspiration porn. “A disability is a superpower” is exhausting. It’s difficult because these people or companies are doing something good, developing and freely sharing (designs of) AT, but at the same time, the language around it makes it hard to get excited about it. Crip-hacking, of course, is a more positive experience because disabled people are doing it themselves, and therefore, the language surrounding disability is more likely to be neutral. Although disabled people are not immune to ableism, and internalized ableism is a thing within the community.

Disability has been defined in this chapter, but this is something that is difficult to do, and it might not be possible to define it truly: the experience of disability is so varied that it might not be possible to catch them all into one clear definition.

It’s also strange to read about literature that disabled people are examples of lead users in democratizing innovation or fitting in the models of creativity research and to then find out that marginalized people are often excluded. There is such a diversity of valuable experiences that are either purposefully excluded or just not even considered; that is such a shame and a loss and lack in research and design.

# 4.



## Related work

Design significantly impacts the end-user when ‘discriminatory design, or the unequal distribution of affordances and disaffordances, may also be experienced as microaggressions by individuals from marginalized groups’ (Costanza-Chock, 2020, p. 44). Design methods can reinforce these discriminatory practices or attempt to prevent, eliminate or reduce discriminatory practices. In this section, I will explain the different design methodologies used to design better products or create a more inclusive design process. This illustrates the differences between these design methods and clarifies the eventual choice of design method for this research.

At the end of this chapter, several toolkits will be discussed. These toolkits have been developed with a focus on supporting creativity or making by disabled people, showing examples of what is available and identifying gaps that could be filled.

### First-person methodologies

First-person methodologies are qualitative research methods that focus on the researcher as the subject of inquiry ‘to facilitate a more personal point of view by emphasizing reflexivity and personal voice’ (Duncan, 2004, p. 30). First-person methodologies include things like somaesthetics, autoethnography, duoethnography, autobiographical design, autoethnographical research through design, micro-phenomenology, embodied ideation, design memoirs and more (Desjardins et al., 2021). First-person methods can involve observing one's own experience within a particular group or subculture, one's usage of technology, or perhaps a designer's or researcher's process of designing and using a new artefact (Desjardins et al., 2021).

### Somaesthetic Design

‘Somaesthetics, an interdisciplinary field of theory and practice grounded in pragmatist philosophy with the focus on the attunement of the body-mind or soma, has been adapted as a theoretical foundation for several experience-centered approaches to interaction’ (Lee et al., 2014, p. 1055) initially proposed by the philosopher Richard Shusterman (2008). Soma is the self that is a united whole of mind and body, in which our physical being produces and affects our thinking, and our mental and emotional experiences influence physical outcomes. By putting together the two words soma, the bodymind, with aesthetics, our sensory appreciations, the focus is on the importance of bodily movements as part of our ways of being and thinking. All our experiences and interactions with the world happen through the body (Shusterman, 2008; Höök et al., 2015; Hook, 2018). ‘Practicing somaesthetics has the potential to improve the ideation process of interactive product design’ (Lee et al., 2014, p. 1055).

### Embodied (design) ideation

Embodied (design) ideation (EDI) is part of Embodied Design (ED), which has its roots in phenomenology, pragmatist aesthetics, embodied cognition and embodied, embedded and enacted minds. EDI centres the designer's or user's embodied experience in the design process and takes inspiration from somatic practices (Turmo Vidal & Márquez Segura, 2018). EDI includes design activities like bodystorming (Smith, 2014) and embodied sketching (Márquez Segura et al., 2016).

First-person methodologies can take many forms and are interpreted differently by different people. Some focus heavily on the designer's experience and can disregard the unique

expertise of future users. These future users are seen as initial information sources. Still, they were not active participants in the process, like in the 2014 paper of Lee et al., where they mentioned that ‘minimizing the influence of irrelevant activities was an important issue, and we needed the subjects to be willingly immersed in somaesthetic reflection and the design process for a certain period. We also wanted them to be free from the constraints relevant to stakeholders’ interests’ (Lee et al., 2014, p. 1056). The designer’s self and lived experience are the most important data sources, and this has been criticized for being self-indulgent, introspective, and individualized (Duncan, 2004; Holt, 2003). Other researchers interpret, for example, somaesthetic design as a shared experience: ‘In somatic facilitation, the shared enactment of a specific process within a community of practice has the purpose of picking up where verbal language falls short in articulating experience’ (Loke & Schiphorst, 2018, p. 58), which can be a more inclusive way of incorporating somaesthetic design into a methodology.

## Universal design

‘In large part due to the efforts of Disabled activists, an approach known as universal design (UD) has gained reach and impact over the last three decades’ (Costanza-Chock, 2020, p. 52). UD focuses on making objects, places and systems we design accessible to the broadest possible set of potential users. It emphasizes that designers should try to design for everyone, including those whose needs are often overlooked. We can make objects, places, and systems that function better for everyone (Costanza-Chock, 2020).

Broadly, universal design means that the products which designers design are universally accommodating, that they cater conveniently for all their users. On the route towards this goal a product that was initially designed primarily for the mass market of normal able-bodied people could have been subsequently refined and modified – the effect, with accommodation parameters being extended, being that it would suit all its other potential users as well, including people with disabilities. (Goldsmith, 2000, p. 1)

UD is relatively theoretical and can fall short by not recognizing that intersecting structures of race, class, gender and disability will influence how design can be disadvantaged to some users more than others. This distribution of advantages should be made more explicit. Then, we can prioritize designs where the advantages are shifted to those currently disadvantaged to create a more equitable design (Costanza-Chock, 2020). UD also does not require the involvement of (future)users. ‘We [disabled people] are usually left out of the conversations around tech for disability. There are ongoing calls for universal design, but this design employs and imagines our bodies (often as the basis for professional certification) while rarely (if ever) simply asking us what we need’ (Shew, 2023, p. 8).

## Value Sensitive Design (VSD)

Value Sensitive Design is a methodology that recognizes that tools are never neutral and that power is reproduced in designed objects, processes, and systems (Winner, 1980; Fry, 2010; Costanza-Chock, 2020). VSD has been developed by information scientists and philosophers Batya Friedman and Helen Nissenbaum in an attempt to address unintentional biases in the design of computing systems (Friedman & Nissenbaum, 1996, 1997; Friedman et al., 2002; Friedman et al., 2013; Costanza-Chock, 2020). VSD urges designers to be intentional about the values they encode in their design, but it does not propose any set of values. It does not include an intersectional understanding of racial, gender, disability, economic, environmental, and decolonial justice. ‘VSD never questions the standpoint of the professional designer,



does not call for community inclusion in the design process (let alone community accountability or control), and doesn't require an impact analysis of the distribution of material and symbolic benefits that are generated through design. Values are treated as disembodied abstractions, to be codified in libraries from which designers might draw to inform project requirements' (Costanza-Chock, 2020, p. 66).

## Human-Centred Design

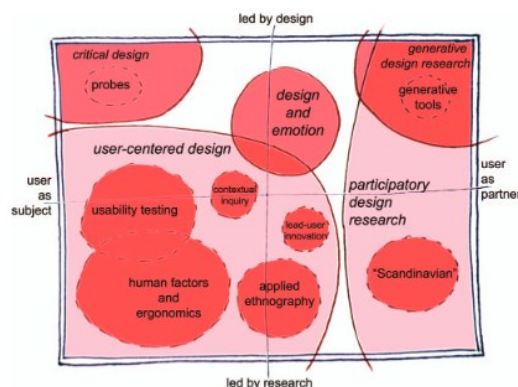
'Human-centred design (HCD) is also known as "people-centred design", "user-centred design (UCD)", "person-centred design", and "user/client-oriented design"' (Zhang & Dong, 2009, p. 2), Steen et al. and Walters differentiate between UCD and HCD. They argue that HCD places more significance on individual stakeholders' needs and the broader context (Steen et al., 2004; Walters, 2005), but others often use the terms interchangeably.

The term "User-centred design" originates from Norman and Draper's book *User-centred system design: new perspectives on Human-computer interaction* (Norman & Draper, 1986). Research on HCD originates in the fields of ergonomics and human-computer interaction. The ISO 9241-210 offers a formal definition of HCD as 'Human-centred design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance' (International Organization for Standardization, 2019, Introduction section).

Some researchers do raise concerns with the effectiveness and efficiency focus of this definition; for example, Giacomini raises problems in applying HCD to consumer products since the customer does not always adopt the point of view of a "user" or "tool" (Giacomini, 2014). Gasson also raises concerns about the focus on usability and the goal-oriented nature of HCD, which can lead to overlooking the social context of use (Gasson, 2003). Snaders & Stappers have attempted to create an overview to visualize the differences and relationships between UCD/HCD and other related design methods in the figure (13) below.

**Figure 13**

*Overview of the differences and relationship between UCD/HCD and other related methods*



*Note.* The current landscape of human-centred design research as practiced in the design and development of products and services From. Snaders & Stappers, 2008. Alt text: a visual schematic of different design methods and how they relate to each other. At the bottom it says "led by research" and at the top "led by design" on the left



“user as subject” and on the right “user as partner” User centred design is in the lower left corner making it mostly led by design and user as subject.

IDEO offers a broader definition of HCD, including the social context of use. ‘Embracing human-centred design means believing that all problems, even the seemingly intractable ones like poverty, gender equality, and clean water, are solvable. Moreover, it means believing that the people who face those problems every day are the ones who hold the key to their answer. Human-centred design offers problem solvers of any stripe a chance to design with communities, to deeply understand the people they’re looking to serve, to dream up scores of ideas, and to create innovative new solutions rooted in people’s actual needs’ (IDEO, 2015, p. 9). Since Human-centred design seems to have many different ways in which it is practised, and it encompasses other participatory methods, human-centred design is quite broad. It does not include much focus on systemic issues and how these can be either reinforced or prevented by discrimination through design.

### Participatory action research (PAR)

‘PAR seeks to understand and improve the world by changing it. At its heart is collective, self reflective inquiry that researchers and participants undertake, so they can understand and improve upon the practices in which they participate and the situations in which they find themselves. The reflective process is directly linked to action, influenced by understanding of history, culture, and local context and embedded in social relationships. The process of PAR should be empowering and lead to people having increased control over their lives’ (Baum et al., 2006, p. 854). In PAR, participants are seen as co-researchers and co-designers, important partners in the design and research process (Costanza-Chock, 2020). For example, in empowerment evaluation (Fetterman, 2015) where participants in research are experts of their experiences from disability studies and the social model of disability, the notion that disabled people should be a part of research about them under the sentence ‘Nothing about us, without us’ (Spiel et al., 2020) this idea is not new. PAR has a comprehensive view of the context of use, including history, culture, and local context, and is embedded in social relationships; however, there is no explicit mention of discrimination or systemic issues that influence the context of use.

### Co-design

Codesign can be traced to Scandinavian efforts in the 1960s and 1970s to include workers and managers in sociotechnical systems design (Costanza-Chock, 2020). Co-design is a practice where people collaborate or connect their knowledge, skills and resources in a collective creativity that is applied throughout a design process (Zamenopoulos & Alexiou, 2018; Sanders & Stappers, 2008). Codesign considers community co-researchers and co-designers rather than research subjects or test users (Costanza-Chock, 2020). Co-design strongly focuses on involving participants of the target group but does not explicitly mention diversity and inclusion practices during recruitment, which could mean that things like discrimination and systemic issues are overlooked. Also, these participatory practices can be tokenistic (Farrington, 2016).

### Citizen science

The call for collaborative, participatory methods that involve the expected target group of the technology to be developed is becoming increasingly louder. Citizen science is a method that has been claimed to be an answer to this call. Citizen science is a method that refers to having the general public participate or contribute to scientific research (Vohland et al., 2021;

Hecker et al., 2018). 'The world is facing unprecedented social, environmental and economic challenges that will require policymakers, businesses, scientists and citizens to open up to one another and find new ways of collaborating. In our digital age, we are reinventing the way knowledge is produced, distributed and acted upon. And an approach based on citizen science will be part of this new relationship between science and society' (Hecker et al., 2018, p. v). The trend of scientists increasingly utilizing citizen science shows a societal desire to participate more actively in knowledge production. Many scientists are discovering the benefits of opening research and science up to the public (Hecker et al., 2018). 'To invent new innovative ways to tackle societal challenges we need to involve those most affected – the citizens themselves' (Hecker et al., 2018, p. v). Citizen science is especially prevalent in the health research, 'during the last two decades, the role of patients in health research has changed considerably from being passive objects of research to increasingly becoming active partners' (Caron-Flinterman et al., 2005, p. 2575). There is however also another side to citizen science, Lawrence Susskind and Michael Elliott point to the paternalistic side of citizen science where participation in science is highly restricted and regulated and citizens are not empowered to make decisions, they are merely seen as a source of information not a partner in the process (1983). 'Paternalistic patterns of participation rarely lead to substantial alterations in the distribution of power or to the redistribution of goods and services' (Susskind & Elliott, 1983, p. 7). Diversity of participants is another problem, often the vast majority of participants are white, highly educated and affluent (Pateman et al., 2021; Pandya & Dibner, 2018; Allf et al., 2022; Hunter et al., 2023), which can create biased data and reinforce biased narratives. 'the benefits of engaging in contributory projects are likely inequitably distributed across the population' (Hunter et al., 2023, p. 2).

## Ethnography

Ethnography is a method based on direct observation, with an emphasis on the importance of observing first-hand what people do and say in certain contexts. There are two types of strategies within ethnography, either non-participant observation or participant observation. In the case of non-participant observation the researcher observes the subjects from a distance, not interfering with their action so to not influence their behaviour. The participant observation strategy is the opposite, the researcher establishes a direct relationship with the subjects and participating in their activities (Silverman, 2011; Hammersley, 2006).

'Ethnography is a methodology with more than one hundred years of history. It arose in the Western world as a particular form of knowledge about distant cultures (typically non-Western ones) which were impenetrable to analysis since we had only fleeting contact or brief conversations. Despite its good intentions (to gain deeper understanding), ethnography is still a colonial method that must be de-colonialized' (Silverman, 2011, p. 32), and there is a lack of focus on inclusivity, equity and giving participants the power to make decisions.

## Context mapping

Context mapping is a method to get a better understanding of the context of use. This helps designers design products that fit seamlessly into the lives of the users. This practice can be seen as a participatory design practice and is an important element of many other participatory practices. The "context of use" is a vague term with many meanings, Froukje Sleeswijk Visser et al. define the context as all factors that influence the experience of a product use (2005). This method could be seen as quite comprehensive, especially if it includes factors of systemic issues, but often when this method is put into practice it often means looking at the whole target group and creating a representative persona (or personas)

and looking at their context of use. This can mean that individual context of use and marginalized groups are not represented. This makes the method too vulnerable to favouring the needs of the majority or the privileged.

## Inclusive Design

'Inclusive design is design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference' (Inclusive Design Research Centre, n.d., under section Philosophy). The Inclusive Design Research Centre (IDRC) sees disability as socially constructed and relational rather than binary (disabled or not). 'Disability is a mismatch between the needs of the individual and the design of the product, system or service'. With this framing, disability can be experienced by anyone excluded by the design. Accessibility is, therefore the ability of the design or system to match the requirements of the individual' (Costanza-Chock, 2020, p. 53). Inclusive design places emphasis on considering a wide range of human characteristics, which leads to enhancing the accessibility of products, and everyone can benefit from that, not just disabled people (Abascal & Nicolle, 2005). 'The group of designers and researchers who use this approach call for "one size fits one" solutions over "one size fits all." At the same time, they acknowledge that "segregated solutions" are technically and economically unsustainable' (Costanza-Chock, 2020, p. 54). Inclusive design is focused on the individual and their limitations and abilities and focuses heavily on the outcome, even including design exclusion tools to measure final products rather than the process (Uriartt, 2024).

## Design Justice

'A paradigm shift to design that is meant to actively dismantle, rather than unintentionally reinforce, the matrix of domination requires that we retool. This means that there is a need to develop intersectional user stories, testing approaches, training data, benchmarks, standards, validation processes, and impact assessments, among many other tools' (Costanza-Chock, 2020, p. 54). Retooling for design justice means developing new approaches to key design methods' (Costanza-Chock, 2020, pp. 66-67) and methods for decision-making and what these decisions are based on. Retooling for design justice means being aware of the impact you as a designer have; for example, initial design decisions about who to include and exclude will produce a self-reinforcing spiral (Costanza-Chock, 2020) if we are not conscious of these decisions. 'Design justice builds on a long history of related approaches, such as value-sensitive design, universal design, and inclusive design' (Costanza-Chock, 2020, p. 66).

Design justice is a framework that can help in creating better, more inclusive, more equitable design. Design justice 'is about the relationship between design and power and the growing community of designers, developers, technologists, scholars, educators, community organizers, and many others who are working to examine and transform design values, practices, narratives, sites and pedagogies so that they don't continue to reinforce interlocking systems of structural inequality' (Costanza-Chock, 2020, p. 1). Sasha Costanza-Chock's goal is to advance the growing conversation about the pitfalls and possibilities of design as a tool for social change (Costanza-Chock, 2020).

Design justice principles (*Read the Principles*, n.d.):

1. We use design to sustain, heal and empower our communities as well as to seek liberation from exploitative and oppressive systems

2. We center the voices of those who are directly impacted by the outcomes of the design process
3. We prioritize design's impact on the community over the intentions of the designer
4. We view change as emergent from an accountable, accessible, and collaborative process, rather than as a point at the end of a process
5. We see the role of the designers as a facilitator rather than an expert
6. We believe that everyone is an expert based on their own lived experience and that we all have unique and brilliant contributions to bring to a design process
7. We share design knowledge and tools with our communities
8. We work towards sustainable, community-led and -controlled outcomes
9. We work towards non-exploitative solutions that reconnect us to the earth and to each other
10. Before seeking new design solutions, we look for what is already working at the community level

*Design justice provides a lens that we can use to analyse design narratives. In other words, what stories are told about design problems, solutions, contexts, and outcomes? Who gets to tell these stories? Who participates, who benefits, and who is harmed? Design justice considers a dual pragmatic/utopic approach that simultaneously offers concrete suggestions for immediate implementation to improve people's quality of life while also calling out power inequalities and larger structural forces that impact people's life chances in the long run. (Costanza-Chock, 2020, p. 134)*

The design studio And Also Too has been a key actor in the development of design justice ideas and practices. And Also Too uses co-design to create tools for liberation and visionary images of the world they want to live in. 'Design is a powerful tool. It is often practised without accountability, resulting in generations of harm in communities affected by racism, colonialism, and poverty. We are working to transform that harm. We practice design in ways that are accountable to the communities that will be impacted by the outcomes of what we are making. We look at each project through the following lenses: Who benefits?, Who is impacted?, Who participates?' (*And Also Too – Collaborative Design Studio*, n.d.) Design Justice is a good method for creating a better design process that is more diverse, inclusive and equitable. Design justice looks at larger patterns like the matrix of domination and how design either reinforces that or favours the needs of the marginalized. It looks at the longer-term actions we can take to create better systems, but it also focuses on practical applications that people need now. This makes it particularly useful for creating more diverse, inclusive and equitable designs. Because it is very focused on the design process and is very comprehensive, this method will be used moving forward.

### Supporting DIY-AT & creativity

According to several studies, maker spaces and the variety of tools within them stimulate creativity and help users develop creative competencies such as self-awareness and self-esteem and contribute to a strong sense of community (Othman et al., 2022; Taheri et al., 2020; Duenyas & Perkins, 2021). 'They accomplish this by allowing virtually any member of the general public with creative ideas to participate in the design, production, and distribution of goods and services' (Othman et al., 2022, p. 4). Many tool(kit)s have been developed to support creativity in making or hacking, many in the form of DIY-AT toolkits. Examples of these can be found in the table (2) below.

**Table 2***DIY-AT toolkits*

<b>Name</b>	<b>Description</b>	<b>Source</b>
TapeBlocks	Low-cost, low-fidelity toolkit that aims to improve the accessibility of making for people living with intellectual disabilities together with coaches and makers. Focus on electronics.	Ellis et al., 2021
A11yBits	a tangible toolkit that empowers blind and low vision (BLV) people to easily create personalized do-it-yourself assistive technologies (DIY-ATs). Focus on electronics.	He et al., 2023
DIY-Abilities	a series of workshops for people with disabilities in which participants could learn different maker technologies and complete their own maker project	Meissner et al., 2017
Design your life	Co-design toolkit for user-initiated design of technology to empower autistic young adults. An exploratory research study about the development and initial experiences of Design Your Life, a new design approach implementing the user-initiated design of technological environments that support autistic young adults to live independently.	Waardenburg et al., 2022
CoCoCo	Co-designing a co-design toolkit for co-bots to empower autistic adults. An exploratory study to empower autistic adults to truly design their own (non-preprogrammed) collaborative robots. The Co3 toolkit of linkable building blocks guides the designer and autistic participants through an iterative co-design process.	Aslam et al., 2019
DIY kit Makey Makey	The results suggest that designing for appropriation can give special educators a more active and creative role in technology adoption and benefit special education by increasing accessibility, motivation and interaction possibilities. However, the results also inform interaction designers and researchers about issues to be considered when DIY kits are used by both nontechnical users and users who have a wide range of special needs.	Mäkelä & Vellonen, 2018
AT makers	Co-design case study with a series of workshops with the goal of studying how three distinct types of participants—occupational therapists (OTs), industrial designers (IDs), and an end-user with physical disabilities co-designed do-it-yourself (DIY) ATs.	Aflatoony & Jin (Susan) Lee, 2020
Hackability	Hackability is a methodology designed three years ago in Turin, Italy, to envisage the cross-contamination of skills among makers, designers, and people with disabilities. This methodology encourages people with disabilities to express	Russo et al., 2018

	their needs and actively collaborate in the design and fabrication of custom solutions.	
IoTgoID	Micro-electronics tools, coupled with card-based tools, are employed for prototyping smart devices with non-experts. Lately, researchers have started investigating what tools can actively engage people with intellectual disabilities (ID) in their prototyping.	Gennari et al., 2024
AccessTeleopKit	AccessTeleopKit allows the user to create different interfaces for different tasks, allowing the user to carry out various tasks. The researchers present two studies involving six users with severe motor limitations, demonstrating the power of AccessTeleopKit in creating custom interfaces for different user needs and preferences.	Ranganeni et al., 2024
TronicBoards	Various simplified electronic toolkits are increasingly available to help different user groups engage with technology. However, they are often inaccessible for people with intellectual disabilities (IDs), who experience a range of cognitive and physical impairments. To address this gap, TronicBoards, a curated set of accessible electronic modules, was developed.	Senaratne et al., 2022
Tickers and Talker	Three-dimensional models are important learning resources for blind people. With advances in 3D printing, 3D models are becoming more available. However, unlike visual or tactile graphics, there is no standard accessible way to label components in 3D models. Tickers and Talker is a labelling toolkit that enables users to add and access audio labels to 3D-printed models. The toolkit includes Tickers, small 3D-printed percussion instruments added to 3D models, and Talker, a signal processing application that detects and classifies Ticker sounds.	Shi et al., 2016



## Reflexivity

Many methods discussed in this chapter either focus on the individual experience (e.g., first-person methodologies) or try to create a more inclusive product or design process. The problem with the majority of them is, however, that it's unclear if people from marginalized communities, or disabled people specifically, were involved in the development of the method itself. I suspect several of them weren't because of the problems they had. Somaesthetic design can be quite an ego-centric method where the designer's experience of the user's circumstances is central instead of simply asking the user about their experiences; the same can be said about embodied design ideation, although the execution of the method makes the difference here.

Even though I am part of the marginalised group that I am designing for, this does not mean that my experience of disability and technology is universal. I don't want to design just for me; I want and feel obligated to design for a more diverse group of people with diverse experiences, needs, and opinions. Therefore, many first-person methods are not suitable as equitable and inclusive design methods.

Universal design creates the illusion that a perfect design that will cater to every person exists, which it most likely does not, with contradicting needs of users (e.g. bright flashing for alarms for deaf people, which can cause problems for people with autism or blind people with some vision), as well as ignoring the inherent difference in power each user is afforded by design decisions. VSD makes designers aware of what values they encode in their designs, but it's left at that; the method stays neutral on what values are positive and which ones are negative and for what reason; they still leave it up to the designer to decide what values to design for. Human-centred design or User-centred design has some ableist narratives encoded into it with a focus on productivity and efficiency of people, which, as Shew has explained, can become techno-ableism (Shew, 2023).

In the regular consumer market, there is much feedback. Either people don't buy your product at all, or they do and have problems with it, request specific changes or additional functions, etc., by complaining about it online or going with a competitor's product, but with the market of assistive technology, this is not as much the case. In many ways, disabled people get these devices through insurance/municipal government, and they will decide what they cover/what assistive technology they get access to. There is less of a choice of purchase, so even if the product doesn't work well with you, it's still better than not having anything at all, even if these are sometimes not suitable (*After eight years of struggle, still no wheelchair for Deldense*, 2023) or in some cases even dangerous (*Philips CPAP Lawsuits*, n.d.).

The toolkit presented at the end of this chapter highlights that the focus is often still on co-design, and very few focus on the disabled person taking control and designing and making something themselves. There is still much room for improvement.



# 5.

## Methodology

This methodology is set up to work within the design justice framework. Two research activities with disabled participants took place: a mini-hackathon with conversations around the process and disability and a creative learning experience with a diary study with pre- and post-use interviews to answer the research questions:

### **RQ1. How may the creative confidence in hacking and making of disabled people be supported?**

This question is answered by developing a toolkit using the results of the sub-research questions.

#### **RQ1a. How may a hacking activity by disabled people to design for justice be supported?**

Answered by a summary of the results from Activity 1 – a mini-hackathon, which resulted in requirements for the toolkit with quotes from the transcript and/or design justice principles to support them

#### **RQ1b. How does a creative learning activity impact the creative confidence of disabled people who are non-designers?**

Answered by a thematic analysis of the results from Activity 2, a diary study with pre-use and post-use interviews

### **The expected contributions**

- Research that offers insight into how disabled people hack, and how they can be supported in this. Then using these results to create requirements for the toolkit to increase the creative confidence of disabled people
- A prototype of Disabled Design Quest, a toolkit for helping disabled people explore and build their creativity by learning about 3D printing and putting what they learn into practice with practical application
- Showing the positive impact of the Disabled Design Question prototype on the creative confidence of non-designer disabled people
- An example of how disabled people can be included in the development of a solution and research

### **Activity 1: mini-hackathon**

Activity 1 was an exploratory workshop, in the form of a mini-hackathon. This form was chosen because one of the main activities that disabled people partake in when adapting technology is called *crip-hacking*. This puts the disabled experience into focus and can be a tool of connection. Therefore, a mini-hackathon was organized where people from different disciplines and backgrounds, together with disabled people, partake in a communal hacking activity. This was done to learn more about how people hack and how they could be supported in this process to answer RQ1a.

### **Objective**

This activity was exploratory. Its purpose was to see what the participatory design process through hacking is like, to gain insight into how people hack and make, and to answer RQ1a, how this could be supported.

## Participants

Recruitment of participants was done via posters (see figure 12) hung around campus, promotion via the Diversity Equity & Inclusion (DE&I) team of the University of Twente (UT), the Student Affairs, Coaching and Counselling (SACC) office at the UT, the Design Lab and via personal connections via WhatsApp, email and LinkedIn (see figure 13 and 16). No restrictions on demographics of participation were put in place (except for age, participants have to be 16+ to be able to give consent per university regulations) to get a wide diversity of participants. Participation was open for anyone interested, but participation recruitment was also specified for disabled people, designers, makers or researchers. Diversity within the groups is guaranteed by creating multi-disciplinary teams with at least one disabled person. Some disabled people won't have the ability or skills to put their creative input into creative output. Therefore, non-disabled makers were invited to help bring ideas into reality. The recruiting message and the hackathon were in English, which does narrow the possible participants, since non-English speaking participants will not be able to partake, the choice to do this has been made to make sure collaboration between all participants was optimal and English in that case chosen as the language most participants will speak as it is the language of communication at the UT. Participation was limited to those able to come to the Design Lab physically, accessibility information was available at sign-up, but certain disabilities may prohibit a person from participating. Informed consent forms were signed by each participant, and positive advice from the Ethical Committee of Natural and Engineering Sciences was acquired.

## Organization

On campus, participants were recruited via social media posts and physical posters (Figures 14, 15, 16 and 17). Participants signed up via the sign-up form and received an email with a link to the Miro board (figure 18); they could drag their name into a group to create the group they would be in during the mini-hackathon. Participants who identify as disabled received an extra mail with tips from a disabled person to a disabled person on tips for during the hackathon about letting the members of their group know about how they would like them to talk about disability, safeguarding their privacy and other tips (see Appendix F) and to the non-disabled participants, a similar email was sent on how to support the disabled participants and make the collaboration go smoothly (see Appendix G). For the schedule of the mini-hackathon, see Appendix E. The DE&I team at the university was involved in giving feedback on the accessibility of the event and giving a talk/a video about what they do at the university. Unfortunately, this talk didn't happen due to communication problems. The researcher gave the participants some information about the DE&I team at the UT. The data collected, their aim and the data protection plan are in the table (3) below.

**Figure 14**  
Recruitment poster



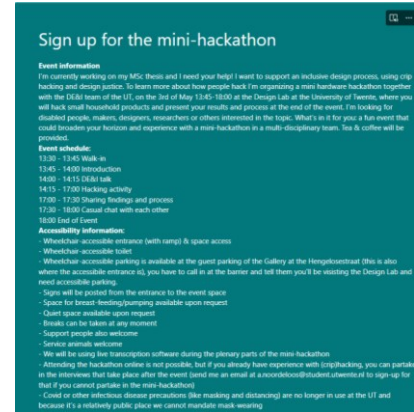
Note. Alt text: poster with design lab, university of Twente and DE&I team logos at the top, icons for people with disabilities in bright colours. Title: “Mini-hackathon” with the event details. Colourful icons for small household appliances and a QR code to sign up.

**Figure 15**  
Social media post image/invite



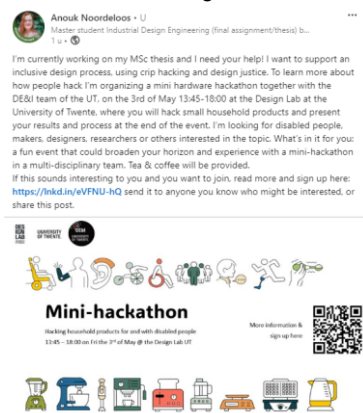
Note. Alt text: smaller version of the poster in figure 11 but in a different format for social media.

**Figure 16**  
Sign up form



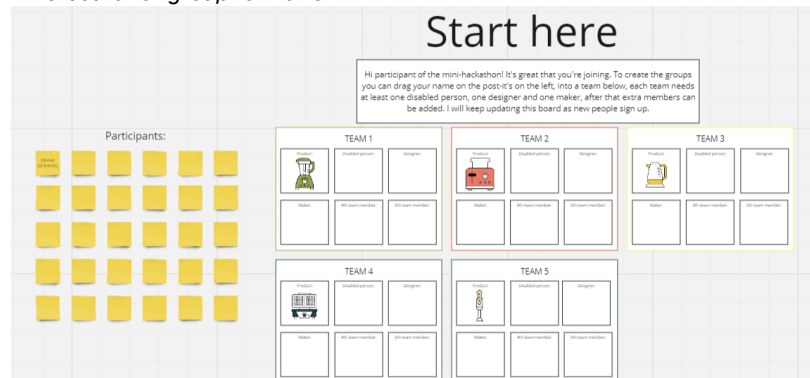
Note. Made in Microsoft forms. Alt text: screenshot of the sign-up form in Microsoft forms.

**Figure 17**  
Social media post with recruitment message



Note. Alt text: screenshot of social media post to recruit participants for the mini-hackathon

**Figure 18**  
Miro board for group formation



Note. For privacy reasons, the Miro board version is used before being filled in with participants' names. Alt text: an online whiteboard program (Miro) is shown, with a collection of post-it notes on the left where the participants' names were placed. Then, to the left of that, there is a big title at the top saying “Start here.” Underneath is an explanation for the participants of how the board works. Then, underneath that are several boxes where participants can place their post-it and be connected to a “case”, a household appliance that they will hack during the hackathon.

**Table 3***Data collection*

<b>Data collected</b>	<b>How collected</b>	<b>Why collected</b>	<b>Safekeeping</b>	<b>Analysis type</b>	<b>Use</b>
First and last name, pronouns, email address, age group, what they call themselves (maker, researcher, scientist, designer), if they identify as disabled, if they want to become a case owner (if disabled), preference for which appliance to work on, accessibility needs	Online sign-up form (see Appendix B)	Communication with participants, demographics, group making	Online collected through Microsoft Forms was temporarily saved on OneDrive Server, then downloaded and saved on SURFDrive, and then anonymized for use in the thesis.	Combine and summarize	Demographic info on participants when describing results Contacting participants Creating the groups (their name and description will be added to the MIRO board for group making by the participants)
Attitudes and how participants talk about disability, inclusivity, design, etc.	Observations during the various parts of the mini-hackathon and asking the participants questions about what they are doing and how they are approaching it (Appendix K)	Get a baseline about how people hack without a toolkit (RQ1a) and what features need to be in the toolkit to support this process	Observations are noted down, digitized and anonymised, and original data is stored on SURFDrive	Combine and summarize and take quotes for main takeaways.	Answer RQ1a
The participant's experience and expectations of the activity, through this, be able to get a gage on implicit biases	Experience and expectations form (see Appendix D)	Get a baseline about how people hack without a toolkit (RQ1a)	Forms will be digitized, anonymised and original forms stored on SURFDrive	Summarize	Answer RQ1a
Information about the hacking process from the participant's point of view and their results of the mini-hackathon. Questions will be asked about what steps they took/approach, how the hacked object is an improvement upon the original in terms of accessibility, and others (any questions that don't fit at that time will	Asking questions to the presenting groups, recording presentations and Q&A to record their answers (for transcript see Appendix I)	Get a baseline about how people hack without a toolkit (RQ1a) and what features need to be in the toolkit to support this process	The recording will be transcribed, anonymised and original data stored on SURFDrive	Combine and summarize and formulate into requirements for the toolkit	Answer RQ1a

be moved to activity 2) (full list of questions, see Appendix J)					
Pictures of participants during the hacking activity	Taking pictures during the hackathon	Show context for how the hackathon activity took place in the thesis and colloquium	Faces blurred for anonymization, and original pictures saved on SURFDrive	Not applicable	Show how the hackathon event took place in the thesis and colloquium
The hacked object	The participants hand in the hacked objects	Show the result of Activity 1	The object is stored physically, and pictures will anonymized and originals saved on SURFDrive	Not applicable	Show objects produced at the hackathon place in the thesis and colloquium
Consent	Consent form		The physical forms will be scanned in and saved on SURFDRIIVE		

*Note.* This table displays the data collection, when it was collected, why it was collected, how it was saved, how it was analysed and used.

### *Accessibility of the event*

Accessibility information (accessible entrance, accessible bathrooms, service animals welcome, etc.) was posted on the sign-up form and reiterated in the email that participants received to confirm their sign-up. A question was added to the sign-up form to ask participants about their accessibility needs, and there was also an option to fill in any needs not listed.

### Tools and materials

- Tool cart of the Design Lab with box cutters and cutting mats
- The Design Lab will mainly supply creative/prototyping materials, and extra materials were bought to supplement (markers, cardboard, tape, glue, string, 3D stickers/buttons, paper and pens for drawing/sketching)
- Small household appliances to hack (water kettle & toaster) These are chosen because they are small objects that most people have in their house or are familiar with, and it is easy to change them. Also, many disabled people struggle to use these appliances, such as water kettles, because they are heavy and need to be tilted with hot water inside, which can be dangerous. Toasters often don't get the bread out high enough so it hard to grab it and the buttons are often small, the cleaning drawer at the bottom is hard to open
- Miro board for group creation (everyone can have access to it, and make changes to it, so this will promote the collaborative process)
- Card set with design justice principles (see Appendix H) (to help the participants while they are hacking to remember the design justice principles that were discussed at the beginning of the mini-hackathon event)
- PowerPoint presentation with slides on DE&I, prototyping, crip hacking and design justice and inspiration images (see Appendix I)
- Microsoft forms sign-up form (see Appendix B for the full form)

- Informed consent form (see Appendix A)
- Forms for expectations & experiences designing with disabled people (see Appendix D)

The mini-hackathon was held at UT's Design Lab, a collaborative creative space with several workshops and creative materials that can be used during the hackathon.

### Ethical considerations

Each participant filled out an informed consent form. They have the right to revoke this consent at any time. They also have the right to get insight into the data that has been collected about them and have this rectified if they feel misrepresented or deleted. Positive advice from the Ethical Committee of Natural and Engineering Sciences (NES) at the University of Twente has been obtained—application number: 240203, date of advice: 18-04-2024.

### Activity 2: Diary study with pre- and post-use interviews

Activity 2 consisted of both a diary study and semi-structured pre- and post-use interviews to evaluate the impact of DDQ on the creative confidence of disabled people to answer RQ1b.

Ideally, the toolkit Disabled Design Quest (DDQ) would have been tested by having a large number of participants do a pre-use and post-use survey and getting the opportunity to use the prototype for several months so they could walk through the entire process at their own pace and the effectiveness of the toolkit can be quantified. Unfortunately, this was not feasible due to the time constraints of this thesis project. Therefore, the focus of the evaluation was on quality instead of quantity. The first interview was centred around determining the participant's definition of confidence and creativity and gauging their thoughts, feelings and experience with self-design/hacking/adapting products and 3D printing. The diary study was added to see the change over the course of the evaluation, and the second interview was then used to gauge how the participant self-report a change to their creative confidence according to their definition and a change in their thoughts and feelings around self-design/hacking/adapting products and 3D printing.

### Objective

The objective of this activity was to evaluate the impact of doing a creative learning experience supported by DDQ on the creative confidence of the participants. Creative confidence has been defined in the previous chapter as feeling assured/having faith in being able to create/make/hack things. Therefore, in this activity, the participants are asked about their creative confidence at several points throughout the activity, and they give it a grade at the beginning and the end, and they are asked to describe their activities and experience.

### Participants

#### Inclusion criteria

- Self-identification as disabled/neurodivergent

#### Exclusion criteria

- Under 16 (restriction from ethical guidelines of the University of Twente)
- Self-identification as a designer/maker/inventor

### Recruitment

Recruitment was done through personal connections and social media (LinkedIn, Instagram and Facebook); possible participants were sent a message with the sign-up link, and they received an email (Appendix M) after signing up to schedule a date for the first interview and proceeding diary study and second interview. The goal was to have at least 5 people participating.

### Incentives/Compensation

The participants received a printing service for a 3D print of a model of their choice, up to 200 grams, with a printing time of 5 hours.

### Pre-use interview

The pre-use interview was semi-structured (Baxter et al., 2015). The data gathered in this interview, their aim and the data protection plan can be found in the table (4) below. The interview will take place in person or online (whichever the participant prefers) and is expected to last approximately 20 minutes. The questions are used to determine how the participants define creativity and confidence and gauge the participants' experience, thoughts, and feelings about self-design/hacking/adapting products and 3D printing.

**Table 4**

*Data collection activity 2 – pre-use interview*

Data collected	How collected	Why collected	Safekeeping	Analysis type	Use
Demographic information	Microsoft Forms sign-up form	To give demographic information in the results chapter and check in- and exclusion criteria	The information is temporarily saved on the University of Twente's Microsoft OneDrive. It is then downloaded and uploaded to SURFDrive, and it is anonymized for use in the thesis.	Combining & summarizing	Demographic information in the results chapter
Participants' definitions of creativity and confidence. Self-reported confidence in creative capabilities. Self-reports of partaking in creative activities. Participant report on accessibility and how this impacted their experience. Artifacts produced by the participants.	Audio recording Microsoft Windows (transcript can be found in Appendix P)	To determine how DDQ impacted the creative confidence of the participants and activities and features that supported this	Anonymised and original data saved on SURFDrive	Thematic analysis	Answer RQ1b
Consent	Informed consent form		The physical forms will be scanned in		



			and saved on SURFDRIVE, or if the activity takes place online, it will directly be saved to SURFDRIVE		
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*Note.* This table displays the data collection, when it was collected, why it was collected, how it was saved, how it was analysed and used.

## Tools and materials

- Microsoft Teams for videoconferencing with the participant for the interview
- Microsoft audio recorder for recording the interview in-person or online
- Link to Figma prototype DDQ for showing the participant the prototype during debriefing after the interview
- Informed consent forms (Appendix L) for giving informed consent for the pre-use and post-use interview and the diary study
- Messaging apps/email for communications during the diary study (whichever is the preference of each participant)

## Interview

The interview started with an opening and introduction of the interviewer and the project, getting permission to record and signing consent forms.

The interview questions include asking the participants about their definitions of confidence and creativity and how they rate their creative confidence. They are also asked about their creative experience and whether they have ever been frustrated by design and attempted to resolve this issue. They are also asked about their experience and outlook on 3D printing and how it would feel to be able to adapt/hack a product that didn't work for them.

The full list of interview questions can be found in Appendix O.

The interview ends with sending the participant the link to the DDQ prototype, opening it together, explaining the procedure again, and asking about their preference for dairy. They are asked if they have any questions and wished fun.

## Diary study

The diary study will be a momentary assessment. The participants will have access, go through the courses in the Figma prototype, and fill in the diary about this experience (Janssens et al., 2018).

At 3 stages, the participants will fill in the diary, answering the questions customized to fit each stage. There will also be space in the diary between these stages where the participants are free to write or doodle anything they want, thereby creating a combination of fixed and random time-point assessments. The participants can choose between a physical or online version of the diary (figure 17 and figure 18). The overview of the data collected through this diary study, their aim and the data protection plan can be found in the table (5) below. The participants had 2 weeks to complete all 3 stages. After they had completed stage 3, the second interview was scheduled. When the participant had not completed all of the stages in the 2 weeks, the second interview was scheduled after these 2 weeks. For accessibility reasons, two participants sent part of their diary via voice notes/audio recording, which were written out by the researcher for analysis. 1 participant also asked for clarification on some

diary questions. These were explained or reformulated so they understood the question being asked. For one participant who did not have a good comprehension of the English language, the interviews and diary were translated into Dutch, their native language. Then, the recording was transcribed and then translated into English. All the questions for the diaries can be found in Appendix O.

**Table 5**

*Data collection activity 2 – diary study*

Data collected	How collected	Why collected	Safekeeping	Analysis type	Use
Self-reported confidence in 3D-printing and creative capabilities. Self-reports of activities the participant has participated in and their feelings surrounding it, including overcoming challenges. Participant report on accessibility and how this impacted their experience. Images and other visual material produced by the participants.	Physical diary or online diary in Miro (results can be found in Appendix O)	To determine how DDQ impacted the creative confidence of the participants and activities and features that supported this	Data will be temporarily stored on the Miro website during the study and then downloaded and stored on the University of Twente SURFDrive.	Thematic analysis	Answer RQ1b

Note. This table displays the data collection, when it was collected, why it was collected, how it was saved, and how it was analysed and used.

## Stages

Stage 1: First use of the prototype by the participant

Stage 2: After the participant has requested the print of a 3D model through the 3D printing service form

In the first level of the 3D printed course within the prototype, the goal is for the users to find a 3D model online and have it printed by a 3D printing service. For this evaluation, the researcher will print the models so the participants don't have to incur any costs. The participants can request a print with the printing service request form, and they have to input all the information that is typically required from other print services (for example, <https://www.3dprintportaal.nl/product/3d-print-service/> or <https://3d-demand.nl/3d-on-demand-printservice/>) and upload the .stl file. The end of the form will have a message that will prompt the participants to fill in the diary.

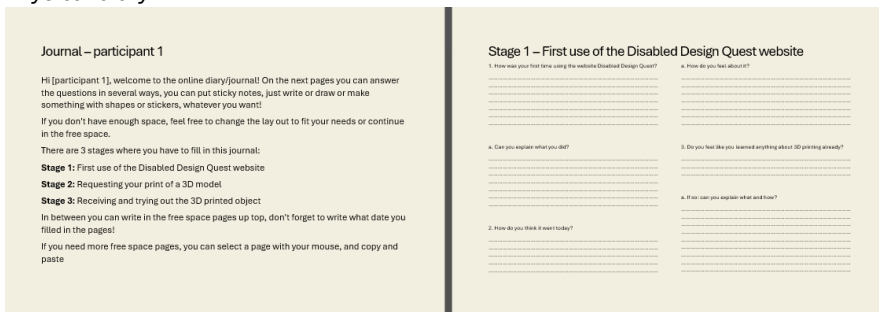
Stage 3: After the participant has received the 3D-printed object they requested and has tried the object out

The model that the participant has sent in will be 3D printed to their specifications and then either sent to them by post or handed over personally if possible. The package will include a note prompting the participants to try out their printed model and then fill in the diary.

## Tools and materials

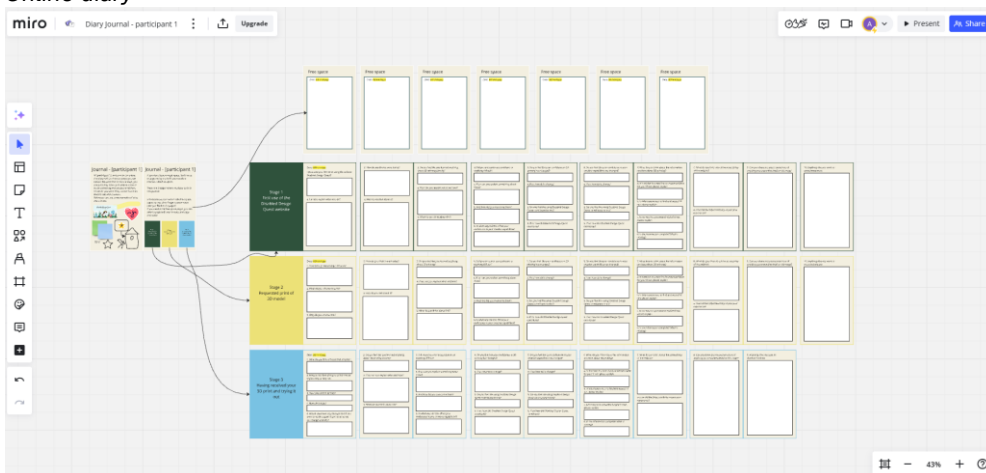
- Link to Figma prototype DDQ for giving the participant access to the prototype
- Physical diary booklet (figure 19) / Digital diary in Miro (figure 20 and 21)
- Printing service request form (Microsoft Forms) (Appendix N)
- Messaging apps/email for communications during the diary study (whichever is the preference of each participant)

**Figure 19**  
Physical diary



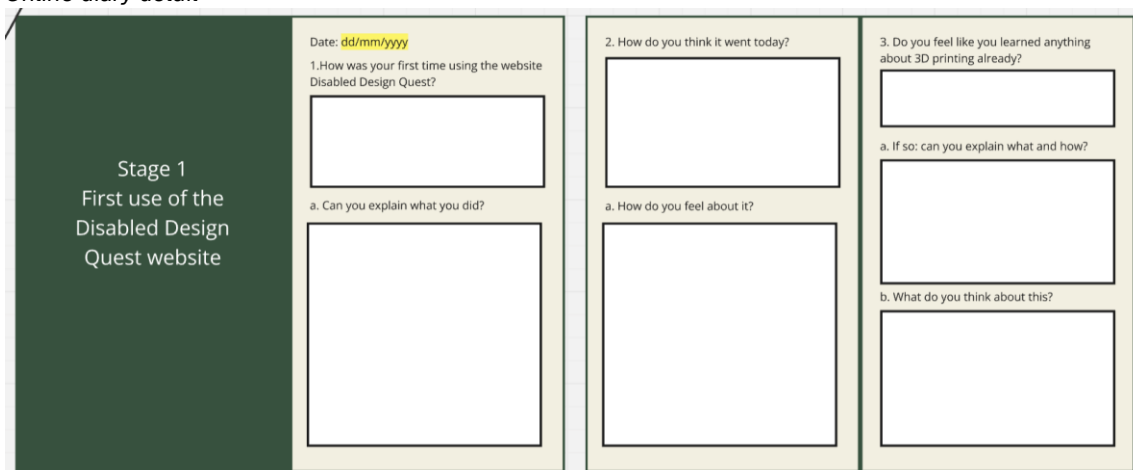
Note. Alt-text: Spread of first pages of the diary with instructions and questions of the first stage

**Figure 20**  
Online diary



Note. Alt-text: Overview of all diary pages in Miro an online whiteboard application

**Figure 21**  
Online diary detail



Note. Alt-text: Detail of diary pages stage 1 Miro, the first page is green and states: “stage 1: first use of the Disabled Design Quest website”, the next pages each have a questions and a box for the answer.

## Post-use interview

The post-use interview is a semi-structured interview (Baxter et al., 2015). The data gathered in this interview, its aim, and the data protection plan can be found in the table (6) below. The interview will take place in person or online (depending on the participant's preference) and is expected to last approximately 30 minutes.

**Table 6**

*Data collection activity 2 – pre-use interview*

Data collected	How collected	Why collected	Safekeeping	Analysis type	Use
Self-reported confidence in 3D-printing and creative capabilities and if they plan to implement this further. Self-reports of activities the participant has participated in and their feelings surrounding it, including overcoming challenges. Participant report on accessibility and how this impacted their experience. Artifacts produced by the participants. Participants reported which features were helpful and which weren't and how this may be changed.	Audio recording Microsoft Windows (for the transcript see Appendix P)	To determine how DDQ impacted the creative confidence of the participants and activities and features that supported this	Anonymised and original data saved on SURFDrive	Thematic analysis	Answer RQ1b

Note. This table displays the data collection, when it was collected, why it was collected, how it was saved, and how it was analysed and used.

**Tools and materials**

- Microsoft Teams for videoconferencing with the participant for the interview
- Microsoft audio recorder for recording the interview
- Messaging apps/email for communications during the diary study (whichever is the preference of each participant)

**Interview introduction**

- Greeting & opening the interview
- Getting permission to record, start recording

The interview starts with a greeting and asking permission to record. The questions determine how the participants would self-report their creative confidence according to their definitions of creativity and confidence. It also looks at how the participants' thoughts and feelings about self-design/hacking/adapting products and 3D printing have changed from the answer they gave at the first interview. The complete list of interview questions can be found in Appendix O. The interview ends with thanking the participant for their participation, and they are asked if they would like to stay up-to-date on the progress of this project.

**Expected outcomes**

Evaluation with experts by experience on the impact of DDQ on the creative confidence of disabled people.

*Minimally acceptable result*

The result that would be acceptable as showing that Disabled Design Quest successfully increases creative confidence in disabled people is when more than half of the participants 3D print something during the testing weeks and self-report an increase in creative confidence.

## Analysis

The data generated by the interviews and diary study was analysed in a thematic analysis. This method was chosen to analyse the qualitative data by coding and finding themes within these themes to uncover the meaning behind the participants' words.

This analysis was done according to the six steps of Braun & Clarke: familiarization of data, generation of codes, combining codes into themes, reviewing themes, determining the significance of themes, and reporting findings (2021). The transcript and diary entries were coded using a bottom-up approach, and the codes were created based on the transcript's content and diaries. These codes were then grouped into themes. These themes are further explained in Chapter 9.

## Ethical considerations

Each participant filled out an informed consent form. They have the right to revoke this consent at any time. They also have the right to get insight into the data that has been collected about them and have this rectified if they feel misrepresented or deleted. Positive advice from the Ethical Committee of Natural and Engineering Sciences (NES) at the University of Twente has been obtained. Application number: 240203, date of advice: 18-04-2024.

## 6.

## Results activity 1

Activity 1 was a collaborative co-design session branded as a mini-hackathon. Out of seven people who signed up, six ended up participating, four participants in the 16-25 years old range and two in the 26-35 years old range. Three participants identify with he/him pronouns, and three identify with she/her pronouns. The participants could self-identify as makers, designers, researchers, scientists or others by checking one or multiple boxes in the sign-up form. Among the participants, four identified as makers, three as designers, two as researchers, one as scientists, and two checked each other and described themselves as inventor and student. Three participants identified as disabled, and three did not identify as disabled. Of the disabled people, one was neurodivergent, two had both a physical disability and were neurodivergent. The participants were also asked about their experience with anything related to the hackathon topic and their expectations. These can be seen in the table (7) below. The researcher decided to join in on the mini-hackathon because the participants had trouble getting started. This participation did influence the mini-hackathon focus towards the researchers and Participant 4's disability, which were similar. The focus might have been on another disability if the researcher had not participated.

The participants hacked an electric water kettle to be more usable for people with physical disabilities related to the arms/hands. The hacked object included a crocheted handle that was added to the existing water kettle to provide an extra handle for stabilizing the water kettle while pouring the water. Images of this can be seen in the figures (22, 23, 24, and 25) below. The participants also sketched their ideas, as seen in the figure (26) below.

**Table 7**

*Participants answers on survey asking about their experience and expectations*

Participant number	Experience	Expectations
<b>Participant 1</b>	I have previously designed/researched for & with blind, neurodiverse & intellectually disabled individuals in different contexts. I expect that I will learn something new about whichever user group I will work with today.	I expect to have a good time & to get creative with others
<b>Participant 2</b>	Automated lights in house	To make something
<b>Participant 3</b>	I did some projects on designing for specific users during my studies, mostly cognitive disabilities such as autism and dementia	I expect to make a quick prototype of a household product so it's more suitable for a disabled person's life
<b>Participant 4</b>	I am disabled, work in disability/neurodiverse focussed company	To talk, learn and make with a focus on disability
<b>Participant 5</b>	I don't have much experience but I am good at making stuff!	To build things
<b>Participant 6</b>	Zero experience	I was expecting software based hacking mostly, but now that is changing to lo-fi prototyping

**Figure 22**  
Participant 4 and 6 during activity 1



Note. Participant 4 demonstrates a different way to use the water kettle, with two hands. Alt text: a photograph of a white female (participant 4) is standing and holding a water kettle with 2 hands on the side of the kettle, she is next to a table in a room with other chairs and windows, right at the edge of the photograph is a white male (participant 6) sitting at the table, he is looking at participant 4.

**Figure 23**  
Participant 6 and 1 during activity 1



Note. Participant 6 shows how he uses the water kettle and asks questions about it to participant 4. Alt text: In the same setting as figure 16, the white male (participant 6) is showing how he would use a water kettle, points his finger and is talking to other participants. A woman of colour (participant 1) is sitting next to him looking at him.

**Figure 24**  
Participant 3, 4 and 6 during activity 1



Note. Participant 3 is working on attaching the crocheted handle to the water kettle. Alt text: a white female (participant 3) is sitting while working on attaching a crocheted handle onto the electric kettle. Another white female (participant 4) is standing next to her taking pictures with her phone. A white male (participant 6) is standing next to them both and is looking at the water kettle.

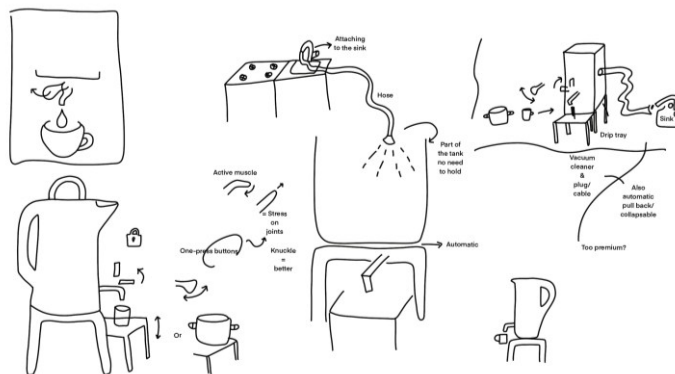
**Figure 25**  
Participant 3 and 6 during activity 1



Note. Participant 4 tests the hacked water kettle. Alt text: a white female (participant 4) is standing and is testing the new handle on the water kettle by pouring water into a ceramic mug that's on the table in front of her. A white male (participant 6) is standing next to her looking at the water kettle.

**Figure 26**

*Ideation sketching of participants during activity 1*



Note. Ideation sketches made by the participants during Activity 1 were traced digitally, and the text was digitized for readability. Alt text: The image is a collection of line sketches in black on a white background displaying new designs for a hot water dispenser to replace an electric tea kettle, several different variations are shown, from a water/lemonade type of tap to a kettle with a tap installed at the bottom that can be locked closed, and has a stand for added height to be able to place a pot underneath, some drawings of fingers bend with active muscle and strain on joints put next to it, and a 1 press button and knuckle is better in words. Then there is a drawing of a tank on a stand filled by a hose connected to a kitchen tap and part of the tank so no need to hold the hose is being written next to it. The words automatic are written next to the point where the tank and the stand connect, and there is a tap with some kind of container underneath. There is another version of an electric kettle with a tap on a stand. Another variation of the tank with the hose, but now with a pull-back/collapsible hose that is like a vacuum cleaner and plug or a cable.



Activity 1 was recorded and transcribed. From this transcription (see Appendix K), together with the design justice principles and accessibility guidelines, requirements can be determined for the toolkit. These requirements can be seen below. Each requirement is supported by either a quote from the transcript or a design justice principle; this will be noted between brackets behind the requirement. The requirements are grouped by the themes Atmosphere, Design Process, and Tools.

## Requirements

### *Atmosphere*

- **Needs:**
  - **1. Disability pride and DE&I** An atmosphere of disability pride, diversity, equity and inclusion. (Design Justice principle 1 (We use design to sustain, heal and empower our communities as well as to seek liberation from exploitative and oppressive systems) and 2 (We center the voices of those who are directly impacted by the outcomes of the design process))
  - **2. Accessible** As accessible as possible to disabled people. Using the guidelines for accessibility guidelines from the European Accessibility Act for products and services as inspiration ('For me, let's say I don't have a strong disability, so I need to do something to get the information out of the people I'm working with, and then vice versa, maybe to, yeah. I don't know, I get your, I completely get what you're saying, though, like if you have the opportunity to make it as accessible as possible, let's do it' (act. 1, p6) 'Also, because a lot of people think that making things baseline accessible is very difficult, and they just need to think about it' (act. 1, p4) 'Yeah, yeah, and it's an opportunity to showcase it and everything' (act. 1, p6).)
- **Wants:**
  - **3. Access intimacy** Explores the atmosphere of access intimacy ('I've really enjoyed talking to you, I really felt a connection, a shared understanding of disability and how it effects me and how it feels. Yeah, I know what you mean, I always try to describe that feeling, but I'm not sure how. Have you ever heard of access intimacy? That's the closest I've come to a word for the feeling.' (act. 1, observations & quotes casual chats).)
  - **4. Designer is invited into disabled world** Invites designers into the disabled world instead of the other way around ('also the care disabled people do for each other, you are not just a care taker or a care receiver, you can be both' 'maybe the toolkit should be about bringing designers into the disabled world instead of the other way around, have them get to know that access intimacy' (act. 1, observations and quotes casual chats)). Design Justice principle 5 (we see the role of the designer as a facilitator rather than an expert).
  - **5. Interdependence** Fosters interdependence without negatively affecting the disabled person ('You cannot conclude, uhm, you cannot use this without each other, and I'm not saying you have to make all the bright colours, saying that if you are colourblind, you really can't use it if you're a disabled designer' (act. 1, p3) 'But I think those two separate, and make it inclusive, but also design it in such a way that you need each other' (act. 1, p3). 'Facilitating interdependence

without the disadvantaging the disabled person' (act. 1, p4).) Interdependence is also one of the principles of disability justice (Berne et al., 2018).

### *Design Process*

- **Needs:**
  - **6. Guidance through process** The toolkit must guide the users through the process and offer tools and resources along the way ('And I didn't want to then also decide what you were going to do. And I think you wanted a little bit more guidance than I was initially planning to give' (act. 1, researcher)) and Design Justice principle 7 (We share design knowledge and tools with our communities).
  - **7. Disabled led** Supports crip hacking with possibility of bringing professionals in, but the process is disabled person led. ('You just want a stamp of approval' (act. 1, p4). 'Yeah exactly. We asked. It was approved' (act. 1, p3). 'We asked a "card-carrying member". We had someone sign off on behalf of all disabled folks' (act. 1, p4).) Design justice principle 10 (Before seeking new design solutions, we look for what is already working at the community level. We honor and uplift traditional, indigenous, and local knowledge and practices) and 2 (We center the voices of those who are directly impacted by the outcomes of the design process) and 8 (We work towards sustainable, community-led and controlled outcomes). Design Justice principle 4 (We view change as emergent from an accountable, accessible, and collaborative process, rather than as a point at the end of a process)) and Design justice principle 8 (We work towards sustainable, community-led and controlled outcomes)).
  - **8. Crip-hacking instead of new design** Guidance towards crip hacking instead of completely new designs as a first step ('I think the biggest difference is the first one we were trying to redesign the product' (act. 1, p3). 'And the second one is just hacking' (act. 1, p1). 'Yeah, exactly. More hacking. This is just what you have and how to make it work for this user situation.' (act. 1, p3)).
- **Want:**
  - **9. Embodied interaction** Something physical for embodied interaction ('You know, like, and that's also the embodied interaction part because like you have something physical' (act. 1, p1).

### *Tools*

- **Need:**
  - **10. Getting to know creative materials** Include in the process the introduction/getting to know the creative materials ('There is some things... What are the things we can do stuff with it?' (act. 1, p5) 'Yeah, all of those things [points to all the materials available in the room]' (act. 1, researcher)).
- **Want:**
  - **11. Collection of creative materials** The toolkit needs to have a collection of creative materials, including additional materials such as a crochet hook, LEGO dots for texture or braille ('I recently saw a video, I don't know if you've seen it, of like Lego bringing out those like Braille Legos. I don't know if it's correct. Legos can also be useful, actually' (act. 1, p1). 'Yeah, I saw that video

also, but they were like almost like paintings that you make with them' (act. 1, p3). 'Oh, the dots, yeah' (act. 1, researcher). 'Yeah. But you can also use them for Braille and I've seen people also use it for printing' (act. 1, p3). 'Oh, cool' (act. 1, researcher). 'And also, yeah, I think that's a good point that you can instead of the diamond stickers' (act. 1, p3). 'Yeah, include that kind of Lego.' (act. 1, researcher). 'You don't have to have all the answers. You just gotta go find them. And then have the tools to go find them. Yeah. Assorted tools. Based on situations' (act. 1, p4).

- **12. Design justice always visible or integrated into process** Design Justice principles could be helpful but they should be integrated into the toolkit and process more, either by having it always shown (e.g. on a poster) or integrating it in the design process ('We did look at it [the design justice principles cards at some point. But it's not like involved in the process' (act. 1, p1)).

# 7.



## Ideation

The design of the toolkit started with the ideation phase. Several ideation sessions took place in this project phase, reflecting the converging and diverging structure of the double diamond model (Kochanowska et al., 2022; Ball, 2019). The first ideation took place before activity 1; however, to show the ideation process in its entirety, the first ideation is also included in this chapter. The second ideation took place right after activity 1, and after some reflection, another session took place with a new target group.

### First ideation

The ideation session's goal was to create a toolkit. Peters et al. (2021) explained several benefits of design tools and toolkits. Ideation 1 aimed to result in an idea that could already be used during Activity 1.

### *Hacking tool cart*

The hacking cart (figure 27) is the result of the first ideation session; the cart is a metal cart on wheels that will be placed in the Design Lab, and the hacking tool cart is intended to be used by designers and disabled (future) users. This cart is a toolkit that has many different creative materials, including cards about design justice, cards on examples of crip-hacking, cards with getting to know each other, and/or empathising exercises. The cart differs from tool carts already present at the Design Lab because these contain physical tools like pliers, cutters or screwdrivers. They don't contain tools like cards with design justice principles, empathising activities and crip-hacking examples. This new hacking tool cart brings together both the physical making tools and conversation and empathising tools.

This cart can be a good starting point for a collaborative design session between a designer and a disabled participant. It can be used for the beginning stages of the design process to determine the scope and problem space and for early prototyping. The tool cart will be placed at the Designlab near the workshop spaces (figure 28); it is easy to roll into a collaborative space for a design session with (future) users (figure 29). The getting-to-know/empathizing cards can help to get a better understanding of each other's perspectives on design and start the sharing of experiences; the cart makes tools easily accessible to anyone joining the session; they can grab things and start using them. The QR code leads to an explanation about the cart, links to extra resources like explanations on design justice, crip-hacking, hacking in general, and the maker movement and links to 3D printing databases to get examples or inspiration. The cart makes it easy to grab the design justice principles and let the design process be led by the principles and create a more inclusive process and result.

**Figure 27**

*Hacking tool cart*



*Note.* Alt-text: A three-layer rolling cart with a paper hanging on the side that reads ' Hacking tool cart, scan to learn more' with a QR-code is filled with boxes with cards, a glue gun, paintbrushes, paint bottles, tape, a ball of wool, post-it notes, electronics parts, a soldering iron, a cup of scissors, a cup of pens, and pencils.

**Figure 28**

*The hacking tool cart at the design lab workshop space*



*Note.* From: Nesvarova, 2017. Alt-text: The DesignLab, a desk with four people standing or sitting around it, is in the background, as are the workshop spaces. The tool cart sketch from Figure 27 is placed to show where it would be.

**Figure 29**

*The hacking tool cart in use in a collaborative session*



*Note.* Alt-text: There is a large oval-shaped table with nine people around it. Next to it is the hacking tool cart from Figure 27. One person is a wheelchair user, one person has headphones on, they are turned to one another and talking, one person is writing something down, one has just sketched something, another is holding papers, another is holding the design justice cards, and some items of the hacking tool cart are on the table (glue gun, scissors, cards, pen).

## Second ideation

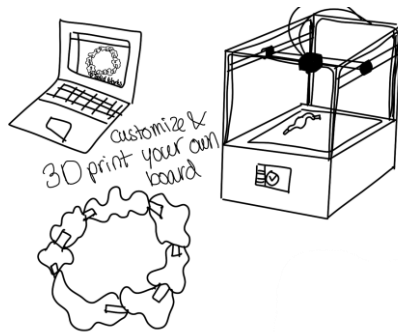
The second ideation took place after Activity 1, with 5 ideas implementing ideas from the participants of Activity 1. These included gamification, which is adding game elements to a non-game context (Nah et al., 2014). Nah et al. showed the benefits of gamification for learning (2014). Gamification also includes elements like interdependence, embodied interaction, customization, and guidance through the design process as a result of Activity 1.

### *Idea 1: 3D print your own board game*

Idea one is a board game that can be 3D printed (figure 30). The design and STL files can be found online, and instructions on how to make adaptations can be provided so the board can be customized to the players. The game board employs game elements like rules, decisions, levels, and avatars (user can 3D print their avatar to be used in the game). Design agencies can use this in participatory sessions with disabled people. The design agency can print a new gameboard depending on the needs of the particular person participating in the session; they can also customize it depending on which phase of the design process they are in and which steps they want to take during the session. It fits well with requirement 2. accessibility because it can be adapted to be accessible to the players and requirement 6. Guidance through the design process, because it has a pathway leading through the design process, and requirement 9. Embodied interaction because it is a physical game.

**Figure 30**

Sketch idea 1



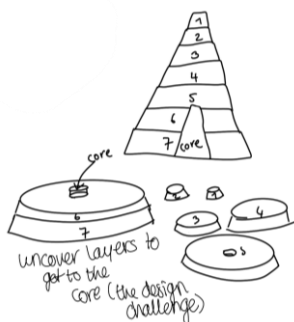
Note. Alt-text: a laptop with 3D modelling software showing, a 3D printer that is printing a part of the board, and then the end result of putting the 3D printed pieces together like a puzzle, with the text: “customize & 3D print your own board”

*Idea 2: Uncover layers and get to the core*

Idea two is a physical game that starts with the full tower with all the rings assembled (figure 31); then for each ring/disk, there is an assignment for the players to get to know each other and the design problem better. Once the assignment is completed, the disk can be removed from the tower, each time getting closer to the core of the design problem; at the 5th disk, the core starts to become visible/tangible. For each assignment, something is learned and written down; at the end, when only the core is left over, there should be a lot of information documented or discussed, and from this, the design challenge can be formulated; it relies heavily on collaboration and interdependence. This game has several game elements: challenges, goals, and visible progress, which can help with engagement, enjoyment and a sense of accomplishment (Nah et al., 2014). Anyone wanting to collaborate with disabled people can use this; although it was created for designers to connect with disabled people as the future users of the product they are developing, it could also be applicable for legislators when consulting/collaborating with disabled populations or other situations. It is designed with these requirements in mind: 6. Guidance through process, 9. Embodied interaction.

**Figure 31**

Sketch idea 2



Note. Alt-text: a tower of circular pieces with a small cone with the word core in it. The cylindrical pieces are numbered 1 to 7, and number 5, 6 and 7 have a hole in them where the core fits in, with the text: “uncover the layers to get to the core (the design challenge)”

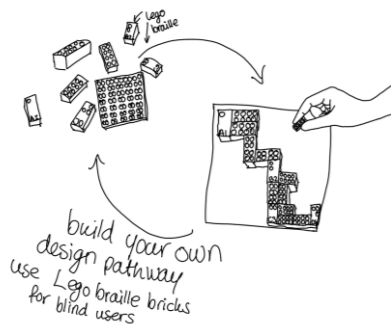


### *Idea 3: Build your design path with LEGO*

Idea 3 is a LEGO base plate with a collection of 2x6 LEGO blocks and LEGO braille blocks (*Play with Braille – English 40656 | Other | Buy Online at the Official LEGO® Shop NL, n.d.*) (figure 32). A designer and a disabled person can together build the board out of LEGO bricks, thereby shaping the design process they will go through together. For some blind people, braille can be helpful therefore, for each step in the process; a LEGO braille block can be used, which has a braille letter or number (they are the same, but the meaning changes depending on the use of the special number sign which makes it a number (The Braille Alphabet – PharmaBraille, n.d.)) to indicate the step of the design process, this is done to make it as accessible as possible (requirement 2) have some embodied interaction (requirement 9) Building it out of LEGO blocks means that it is customisable, the blocks can be put into different shapes on the base plate creating a zigzag or a circle, even creating a visual and tangible representation of the design process.

**Figure 32**

*Sketch idea 3*



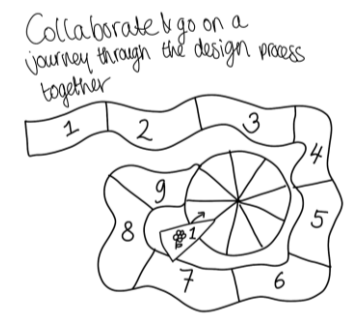
*Note.* Alt-text: LEGO bricks in a pile, with some braille Lego bricks, next to it: a hand building a path from Lego bricks, including the braille bricks to indicate different stages of the design process with a letter or number with the text: “Build your own design pathway, use braille Lego bricks for blind users”

### *Idea 4: Garden path boardgame*

Idea 4 includes a physical board roadmap with 9 steps towards a new design or crip-hacked solution (figure 33). Each step has a card with an assignment; there are extra cards with extra information about different skills, materials, prototyping methods, etc. When each assignment is fulfilled, a little piece of the flower bed can be added so at the end, there is a beautifully blooming flowerbed. A designer and a disabled person will collaborate on accomplishing these assignments can fill up the flower bed; the assignments guide the users through the design process (requirement 6), each one explaining something about a part of the design process, e.g. getting to know the creative materials for prototyping (requirement 10). The users both have to agree that an assignment is accomplished before the flowerbed part can be placed (requirement 5); there are also checks where the disabled person is asked to evaluate if they are happy with the result of the stage or if they want to go back and make changes. The game also comes with a collection of creative materials (requirement 11). The game employs several game elements: challenges, visual progress, in-game rewards, stages and visual elements.

**Figure 33**

Sketch idea 4



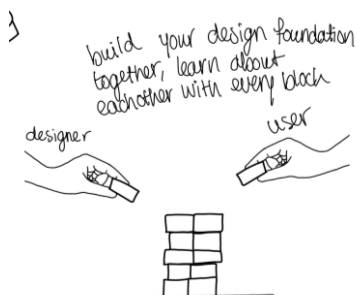
Note. Alt-text: a game board with 9 steps to get to the finish, each step is represented with a piece of a circle in the middle, this gets filled along the way at the end it is full, the one piece that is put there as an example has a 1 and a flower on it, the text reads: “collaborate & go on a journey through the design process together”

#### *Idea 5: Build your design foundation together*

Idea 5 is based on building blocks to build a tower (requirement 9) with a designer and a disabled person; this is symbolic of the foundation they are laying for the design (figure 34). With each block, they get to know each other a little better and empathise with each other through the assignments; both players have to contribute a block; otherwise, it won't be a stable tower, being symbolic of the interdependence of the designer and the disabled person (requirement 5). The designer asks the disabled person to be invited into their world (requirement 4) and to learn from them, about what their access needs are and how they see the world (requirement 3). It contains some game elements like peer interaction and collaboration, visible progress, and customization (Nah et al., 2014).

**Figure 34**

Sketch idea 5



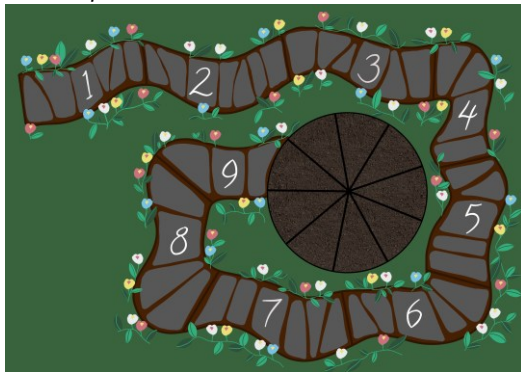
Note. Alt-text: a tower of square blocks, two hands each placing another block on the tower; the text reads: “Build your design foundation together, learn about each other with every block”.

#### *Detailed design idea 4*

The choice is made to work idea 4 out further because it fulfils many of the requirements and contains many gamification elements. Idea 4 will be worked out further, trying to add elements that help to fulfil more of the requirements. The design roadmap is a boardgame with 9 steps towards a new design or crip-hacked solution (see figure 35). Each step has a card with an assignment (see figure 36), there are extra cards with extra information about different skills, materials, prototyping methods etc. When each assignment is fulfilled a little piece of the flower bed can be added so at the end there is a beautifully blooming flowerbed (see figure 37). It celebrates disability culture (requirement 1), and the users learn about crip-

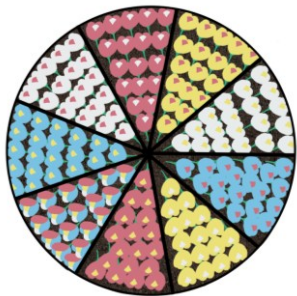
hacking and design along the way, learning through doing. The graphic design includes a garden path leading towards a garden bed. The flowers are in the colours of the disability pride flag (figure 38 and 39). The goal is to fill up the garden bed with flowers by executing each assignment along the way, each step on the path has a card with an assignment, and this can be followed linearly to go through the design process and crip-hack an already existing product (requirement 8) or can be used to create a new design if one doesn't exist yet (figure 40).

**Figure 35**  
Roadmap board



Note. Alt text: a digital drawing of a boardgame like a garden path towards the middle garden bed. The garden path is divided up into 9 segments, as is the garden bed. There are flowers growing beside the path in the colours of the disability pride flag. Everything is on a green background.

**Figure 37**  
Filled flowerbed



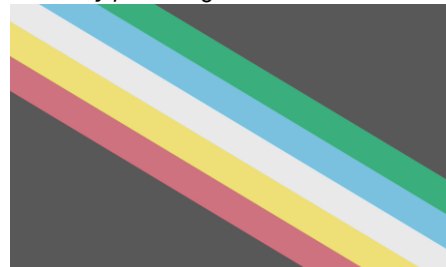
Note. Alt text: A digital drawing of the flower bed can be seen, with each of the 9 segments fitted into the 9 slots of the garden bed. Each segment has flowers in different colours of the disability pride flag (red with a white heart, blue with a yellow heart, yellow with a red heart, etc.). They all fit neatly in the circular flower bed.

**Figure 36**  
Some of the cards that go with the roadmap board



Note. Alt text: a digital drawing of a stack of cards in grey can be seen. The first card has as a title: 4. Try-out prototype. With an image of a box on a roll of paper an icon for prototyping and drawing. Below is more information, but the text is illegible

**Figure 38**  
Disability pride flag



Note. From Magill, 2020. Alt text: a "Straight Diagonal" version of the Disability Pride Flag: A charcoal grey flag with a diagonal band from the top left to the bottom right corner, made up of five parallel stripes (going from the bottom up; left to right) in red, gold, pale grey, blue, and green.

**Figure 39**  
Graphic design and theme of first ideation toolkit



*Note.* Alt-text: a nature scene with grass and colourful flowers, in the colours of the disability pride flag, there is a black woman in a white dress with long dark hair and a yellow sunhat in the middle of the image; she is holding a disability pride flag. In the background, there are trees, and there is a blue sky with clouds. There is text in the image which reads: Disabled Design Quest – A quest towards inclusive design in a flourishing collaboration between disabled people and designers.

**Figure 40**  
Design roadmap in use



*Note.* Alt-text: There is a large oval-shaped table with nine people around it. On the table is the design roadmap board from Figure 31. One person is a wheelchair user, one person has headphones on, they are turned to one another and talking, one person is writing something down, one has just sketched something, another is holding papers, another is holding a sheet of paper, and some creative items are on the table (glue gun, scissors, sketching paper, pen).

### Lo-fi prototype

Idea 4 was worked out further; as part of this process, a low-fidelity (lo-fi) prototype (figure 41 and 42) was created to get a feel for the idea physically and see how it would work in practice. It became clear during the testing of this prototyping that it would be good if the whole board and individual pieces were magnetized (figure 43), in the idea sketches, it was taped to the refrigerator, but magnets would make it easier to move the smaller pieces on the board, this would also make it less permanent, it's easier to go back a step if dissatisfied, it can be hung on a refrigerator, but also on a magnetic whiteboard, it was also nice to take the specific piece that is currently being worked on and put it on the table while working on it, together with the card with the explanation (figure 44).

**Figure 41**  
The design roadmap board on the fridge



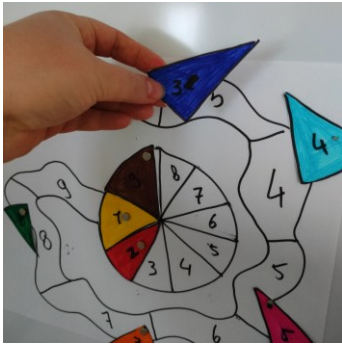
*Note.* Alt-text: On the front of a white fridge door is a gameboard with 9 steps drawn on paper. Around the gameboard are several pie-slice-shaped pieces numbered 1-9 and coloured in different colours. Three pieces are placed in the middle of a circle sliced up like a cake, and the others are with the corresponding step on the board.

**Figure 42**  
Close-up roadmap board prototype



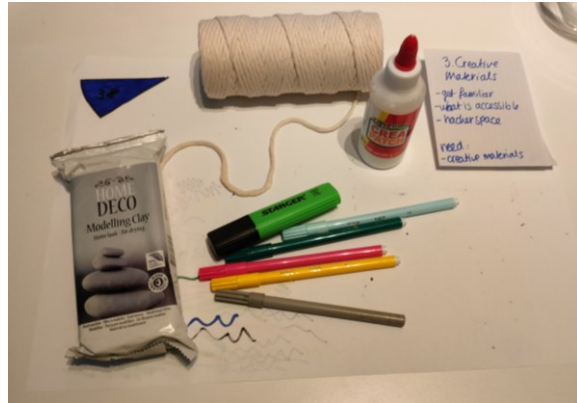
*Note.* Alt-text: a gameboard with 9 steps is drawn on paper on the front. Around the gameboard are several pie-slice-shaped pieces that are numbered 1-9 and coloured in different colours. Three pieces are placed in the middle of a circle sliced up like a cake, and the others are with the corresponding step on the board.

**Figure 43**  
Step 3 picked up



Note. Alt-text: a gameboard with 9 steps is drawn on paper on the front. Around the gameboard are several pie-slice-shaped pieces that are numbered 1-9 and coloured in different colours. Three pieces are placed in the middle of a circle sliced up like a cake. The others are with the corresponding step on the board. Piece 3 is being picked up by a hand.

**Figure 44**  
Step 3 executed



Note. Alt-text: Creative materials (rope, air dry clay, markers, glue) are sprawled on a table. Next to them is a paper with the text "3. Creative materials" and a list beneath it: "Get familiar, what is accessible, hackerspace. Need: creative materials." Piece number 3 from Figure 39 is also next to the materials.

### *Use case scenario*

A designer at a design agency is looking online for methods and toolkits to use for collaborating with disabled people. They find a design roadmap, a boardgame-like toolkit with all the steps of a design process and several tools that offer insight into inclusivity, crip-hacking and design justice, they order it for the office. When it arrives, they have a little look at what is in the box; they see design justice principles on cards, a board with the roadmap printed on it, some creative materials, etc. They set up a meeting with other designers at the office and invited several disabled people via an advocacy organization. On the day they introduce the roadmap to everyone and start playing, they go through several steps and start to create some sketches and a simple prototype; the disabled people are active participants giving input on design decisions, and the designers take this on board. After discussing the prototype, they decide to end the session for the day, and they thank the disabled people for coming and participating. Several weeks of designing and developing the prototype further into a more high fidelity prototype go by without the designers contacting the disabled people again, the designer feels like they got a lot of valuable input from the disabled people, and now they develop it further on their own. They schedule an evaluation session with different disabled people and get their fresh opinions and input on the design; the designers make some minor adjustments to the design and are satisfied with the design.

### *Design reflections*

The design roadmap idea can be a helpful tool for designers, but the way it is designed now, designers and disabled people are not on a level playing field; the initiative and the power lay with the designer, and this is not in line with the design justice principles (4. We view change as emergent from an accountable, accessible, and collaborative process, rather than as a point at the end of a process, 5. We see the role of the designer as a facilitator rather than an expert, and 8. We work towards sustainable, community-led and controlled outcomes.) and the goal of this thesis. I wanted to bridge the gap between disabled people and design, but I approached this from the wrong direction, I assumed that bringing in a designer with all the knowledge would be a good way to bridge the gap between disabled people and design, but when we look at what is already happening at the community level (like in design justice



principle 10. Before seeking new design solutions, we look for what is already working at the community level. We honor and uplift traditional, Indigenous, and local knowledge and practices) I should look at how disabled people currently practice design, by crip-hacking, and there are disabled people who maybe need some support in discovering and exploring the world of crip-hacking, making and design, but crip-hacking is already something practised by the community, that should be my focus.

After this reflection, I decided to do another round of ideation, focussing on the disabled experience and how I can lower the barrier to entry into the crip-hacking, making and design world.

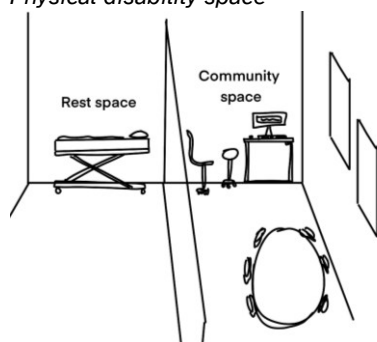
### Third ideation

In the 3<sup>rd</sup> ideation session, seven new ideas were created: 1. a physical disability space, 2. a physical crip-hacking roadmap board, 3&4. learning about crip-hacking and design in a non-linear way with cards or an app, 5. having a printable build-your-own roadmap, 6. an online disability crip-hack community, and 7. a skill tree. These ideas will be explained below, each with their positives and negatives. In Chapter 8, the ideas will be compared and contrasted, and one idea or a combination of several ideas will be chosen to pursue further.

#### *1. Physical disability space*

This idea consists of a physical space located in a public environment, for example, in a university, composed of 2 rooms, one for resting and one for community building and disability pride (figure 45 & 46) (requirement 1 & 9). There is a computer in the corner of the room with several accessibility programs installed like Dragon Naturally Speaking and Kurzweil to try out, but also information about design and crip-hacking, and how to adapt tools and materials to work for each individual's needs for example when going to the design lab. There is also a database with many resources and information on how to get access to them. There are monthly meetings with disabled students who discuss current issues they are facing, planning on making the campus more accessible and providing peer-to-peer support (requirement 5 & 7). There are posters with the design justice and disability justice principles on the walls (requirement 12), as well as the disability flag. The space is designed to be the most accessible. It can be with height adjustable desk and table, various options for seating, temperature that can be adjusted, as well as the brightness and colour of the light; this goes for both parts of the room. An accessible bathroom is right next to it (requirement 2). People from outside the disabled community, e.g. policymakers, designers, etc., can be invited to join in on a session in the room (requirement 4).

**Figure 45**  
Physical disability space

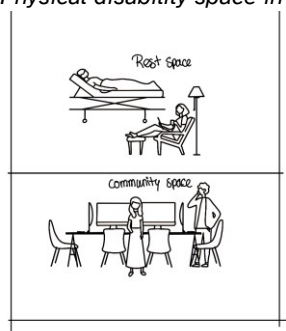


Note. Alt text: In the image, there is a sketch of a room with a partition in between, on the left, there is a height-adjustable bed, and on the right, there is a desk with a computer, desk chair, stool and conference table, there are blank posters on the wall

**Positives:**

- A physical space offers the opportunity to get together with the community
- A physical resting space at for example a university building for students to rest at in between classes
- Fully accessible space to feel the access intimacy (requirement 3) that might be lacking at the rest of the university

**Figure 46**  
Physical disability space in use



Note. Alt-text: the physical disability space from figure 42, but now with a person in the bed, a person in a lounge chair and 2 people standing around the conference table which has computers on it

**Negatives:**

- Doesn't support crip hacking as much as other ideas
- Difficult to prototype & test within the time and monetary constraints of this project

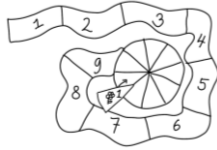
*2. Physical crip-hacking roadmap*

A toolkit with in it a physical board roadmap (requirement 9) with 9 steps towards a new design or crip-hacked solution (requirement 8) (figure 47 and 48). Each step has a card with an assignment; there are extra cards with extra information about different skills, materials, prototyping methods, etc. When each assignment is fulfilled, a little piece of the flower bed can be added so at the end, there is a beautifully blooming flowerbed. It celebrates disability culture (requirement 1), and the user learns about crip-hacking and design (requirement 8) along the way, learning through doing. They can invite others to join them and help them, but it's up to them; they have control (requirements 4 & 7). The user is provided guidance through the design process (requirement 6), but they can choose to follow their own path if they feel like that fits them better. The roadmap is designed with principles from scaffolding by breaking up the learning of making into separate chunks and providing tools to be able to tackle these smaller parts while still highlighting that they are part of a bigger, more complex subject like design or crip-hacking (Reiser & Tabak, 2014). The roadmap can be hung on metal surfaces because the back is magnetic, so it can be hung on the user's fridge, whiteboard or other metal structure in their home or workshop (figure 45). The board and cards have QR codes that can be scanned where the text will be read out loud. The lines on the board will also be raised to make it tactile (requirement 2). The toolkit will include the board roadmap, card decks and a collection of creative materials that the user is also introduced to in steps in the process (requirements 10 & 11). It is designed with many game



elements, visual progress, visual elements, and challenges, which can improve engagement and a more productive learning experience and performance (Nah et al., 2014).

**Figure 47**  
*Physical crip-hacking roadmap*



*Note.* Alt text: In the picture, a boardgame-like track towards a middle point is displayed consisting of 9 segments. The middle point is a circle consisting of 9 pie-shaped spaces. One pie-shaped piece is hovering above the middle point with an arrow pointing to one of the spaces.

**Figure 48**  
*Roadmap in the kitchen*



*Note.* Alt-text: a simple kitchen with a man standing in front of a fridge looking at the roadmap from figure 44 which is hung on the fridge.

**Positives:**

- Physical board for the embodied interaction
- Leads the users through the design process

**Negatives:**

- Not easy to get to a lot of people because it's a physical product

**3. Online disability crip-hack community**

An online community (figure 49 and 50) that is disabled people-led (requirement 7). The community is initially set up with resources and information, but users are invited to take over and change and add to the online community how they see fit, lead users can become moderators. The set-up is with disability pride, where users can share how creative disabilities people can be (requirement 1). Users can also chat with each other in different channels dedicated to different topics; users can share their own crip-hacking projects, ask for input or help from others, or users can start working together on projects (requirements 5 & 8). There are video courses about skills, design and materials (requirement 10) integrated into the community that can be watched at any moment (requirement 6). The courses are also always with subtitles and image/video descriptions. Videos will also be available in written form, the courses are self-paced and feedback and support is available from advanced makers (requirement 2). The learning part of the community is structured in a way that makes it approachable to novice users, the learning is divided into smaller challenges which start at the novice level, the more advanced skills are locked away until the novice challenges are completed, making the learning more manageable, the support is also decreased in the higher advancement challenges, and making learning visible, according to scaffolding principles (Belland, 2014). The online community makes use of many gamification elements such as badges for courses and/or projects completed, users being able to create an avatar, experience points for when they have used a certain skill in many projects, levels within each skill that can be learned (woodworking: level 1), peer interaction and collaboration, and unlockable content. All these elements can help to improve engagement, enjoyment and motivation in the learning process (Nah et al., 2014).

**Figure 49**  
*Online disability crip-hack community*



Note. Alt text: a sketch of a computer internet browser can be seen with a search bar at the top and beneath that a title that reads: DIY disability community. Underneath are sketch lines representing future text.

**Positives:**

- Online so a large amount of people can make use of it
- I can be easily changed and control can be given to the users
- Gamification elements improve engagement, enjoyment and motivation in the learning process (Nah et al., 2014).
- Supports collaborative work and access intimacy (requirement 3)
- Different types of information can be shared (video, audio, messages, articles, blogs, etc.) so there is always a format that is accessible to the user (requirement 2)

**Figure 50**  
*Using the online crip-hack community*



Note. Alt-text: a man in a wheelchair sitting in front of his desk with a computer screen, which is supposed to represent him using the online disability community from figure 52.

**Negatives:**

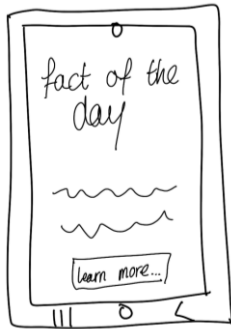
- Doesn't have the physical embodied experience part
- Different online making communities already exist

*4. Learn about crip-hacking and design in a non-linear way app*

An app where the users get different info each day (figure 51 and 52). There is a fact or the day; there are skills, materials and other information about crip-hacking and design to discover (requirements 6, 8 and 10). It supports a non-linear way of learning. Users are randomly shown facts, or they can flip through information in the app by themselves (requirement 7). The app also includes a forum where questions can be asked, collaborations can be started, and people can find their community. Lead users can become moderators and influence the topics that are started on the forum. Several game elements have been designed into the app: peer interaction and collaboration, freedom to choose the difficulty level, and customisation, which can lead to more engagement, enjoyment and a more productive learning experience (Nah et al., 2014). There are buttons with each piece of media to have it spoken out, videos come with subtitles, and every image has an alt-text. The moderators can add additional accessibility features when the users need something (requirement 2).

**Figure 51**

Learn about crip-hacking and design in a non-linear way app



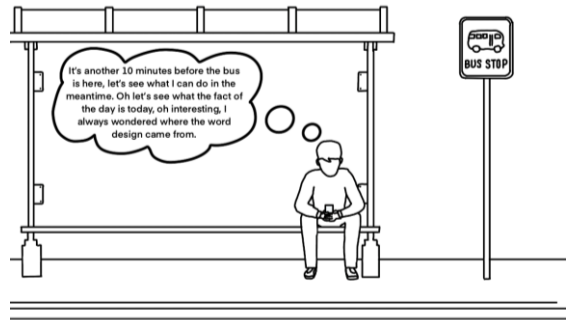
Note. Alt text: A sketch of a phone screen can be seen with a title that says "Fact of the day." Sketch lines underneath suggest more text could be placed there, and there is a button underneath that reads "Learn more..."

**Positives:**

- The app is easily shareable with many people
- Supports a non-linear way of learning
- Supports collaboration and finding community

**Figure 52**

Using the crip-hacking app at the bus stop



Note. Alt-text: A bus stall with a bench. A boy is sitting on it holding his phone. A thought bubble reads, "It's another 10 minutes before the bus is here. Let's see what I can do in the meantime. Oh, let's see what the fact of the day is today. Oh, interesting. I always wondered where the word design came from."

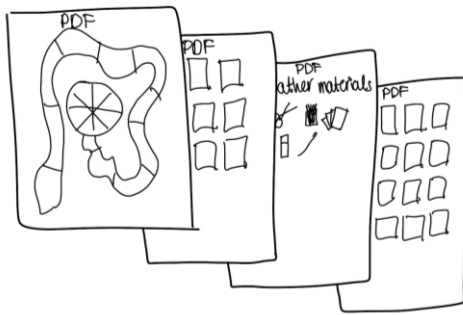
**Negatives:**

- Not editable by users, less disabled community-led
- Users are not really being led through the design process, users would have to self-initiate more
- Risk of abandonment of use if all information is known since there is not much possibility for user input to be added to the resources in the app

*5. Printable build your own roadmap*

A printable roadmap board that can be edited to fit best the needs of the user (requirements 2 and 7) (figure 53 and 54). The roadmap includes the steps in a design process with cards on skills, materials, how to prototype, inspiration from other crip-hackers and links to more resources online (requirements 6, 8 and 10). The users get access to the documents and they can edit it to their wants and needs and print it out. This ensures the element of embodied interaction while keeping it adaptable to different users, and it can be more easily distributed (requirement 9). Elements of design justice and disability pride are taken up in the text and visual design of the roadmap (requirements 1 & 12). Game elements included in the design are customization, visual elements, and stages, which can help to improve engagement, enjoyment and a more productive learning experience (Nah et al., 2014).

**Figure 53**  
*Printable build your own roadmap*



*Note.* Alt text: A sketch of several paper sheets can be seen. The first one has a boardgame-like track on it, the second one has several rectangular shapes, which are cards, the third sheet has drawings of creative materials, and the last page has more rectangular shapes/cards. They all say PDF at the top.

**Positives:**

- Element of physicality for embodied interaction
- Adaptable for different users
- Easily distributable

**Figure 54**  
*Using the print-out roadmap*



*Note.* Alt-text: A woman sits at a desk behind her computer. On the wall behind the computer, seven printed-out sheets of paper can be seen, which is supposed to represent the print-out roadmap from Figure 50.

**Negatives:**

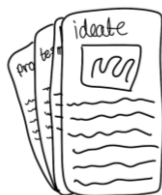
- No online community building
- Less accessible to people with some physical disabilities because the board has to be physically made

*6. Learn about crip-hacking and design in a non-linear way cards*

A deck of cards (figure 55 and 56) that each has information about different stages of design, what crip-hacking is, materials, skills, etc. (requirements 6, 8 and 10). These cards can be used either in order or they can be shuffled and picked at random to learn in a non-linear way. This supports the learning about crip-hacking and design without having to follow the entire process or work on a project while using it. Users can easily put it in their pocket and bring it anywhere. The user can also place the applicable card next to the project they are working on to remind them of the stage they are currently at (figure 47) (requirement 9). It is also adaptable; if the user finds certain cards not applicable, these can be taken out (requirement 7). There are several game elements designed into the cards: customization, freedom to choose a difficulty level, replay or do over, and visual elements which can have a positive effect on enjoyment, engagement and performance (Nah et al., 2014). The cards have a QR code on the back, which will open a link where the card's text is spoken out for blind users or neurodivergent people who like listening to things while doing another task (requirement 2).

**Figure 55**

Learn about crip-hacking and design in a non-linear way cards



Note. Alt text: A sketch of a stack of cards can be seen. The one on top reads ideate, and sketch lines display that more text and an image can be added. The text on the other cards cannot be read.

**Figure 56**

Woman using the crip-hacking cards



Note. Alt-text: A woman is kneeling next to a table, sawing a piece of wood. The cards from figure 46 are on the table.

### Positives:

- Can be played in a linear and non-linear way
- Easy to transport and keep

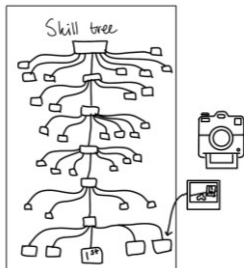
### Negatives:

- Creates a less immersive experience while using
- Unsure if this leads to actually practising crip hacking
- Less accessible to people with dexterity issues

## 7. Skill tree

The skill tree overviews different maker and design skills that can be learned (figure 57 and 58). They are organized in a certain way to ensure specific basic skills are already completed before trying more advanced skills, e.g. before 3D printing, basic material knowledge (requirement 10) and insight into the different 3D modelling software are necessary; this ensures some guidance through the design and maker process (requirement 6). The user still has the control to choose what skill to do next, depending on their goals (requirement 7). For each skill at each level, there is a QR code on the skill tree, which can be scanned to get instructions on how to approach the skill, what is needed and how to evaluate if the challenge has been completed with a satisfactory result. The skill tree can be printed out and hung in a place in a disabled person's home so they see it often. When people are over, they can show off their progress, and people who see it can offer their support for skills that haven't been mastered yet and foster a feeling of access intimacy (requirement 3). When they have tried a certain skill and feel like they mastered it, they can take a picture with the Polaroid camera and add it to the skill tree (requirement 9). Scaffolding is used to help users learn about crip-hacking and design and master maker skills. The skills are organized from easy to advanced; there are different levels for certain skills, and you need specific skills to do other, more advanced skills. When progress is being made, and more skills are mastered, projects become more free and less supported. There is still a feedback mechanism in that people can still give feedback when they see the skill tree, but there is not as much guidance about how to approach the project (Belland, 2014; Reiser & Tabak, 2014). The skill tree can be customized to fit the user's goals; for example, they can leave out skills that they have already mastered in the past, and adaptations can be made for accessibility needs (requirement 2). Certain game elements are designed into the skill tree: levels, goals, customization, leaderboard and visible progress, which can help increase engagement and motivation (Nah et al., 2014).

**Figure 57**  
Skill tree

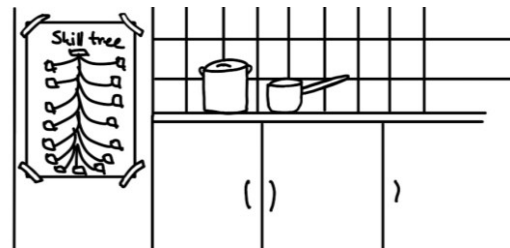


*Note.* Alt-text:  
The skill tree of a tree-like structure with different labels on each branch, together with a Polaroid camera to add pictures of completed projects/skills

**Positives:**

- Lowers the barrier to ask for help
- Can be hung in a visible place for a reminder to keep working on it
- Structures the skills in a logical manner, which makes it easier to get started as a novice
- Ability to customize with skipping skills already mastered or going up a level
- Can be downloaded and printed, therefore be shared with many people
- Low cost

**Figure 58**  
Skill tree poster in the kitchen



*Note.* The skill tree is printed out on poster-sized paper and hung up in a user's kitchen

**Negatives:**

- Contains fewer disabled community elements
- Not as suitable to take it with you to a workshop

# 8.

## Conceptualization

In the tables below (8, 9, and 10), the ideas from Chapter 7 are compared to the requirements set up in Chapter 6 to differentiate between the need and want requirements, each having a different weight. The need requirements get a weight of 2, and the want requirements get a weight of 1. The idea(s) with the most points are conceptualized and prototyped.

**Table 8**

*Evaluating how well the ideas include the requirements (needs)*

Requirement \ Idea	1. Disability pride and DE&I	2. Accessible	6. Guidance through process	7. Disabled led	8. Crip hacking instead of new design	10. Getting to know creative materials	Total	Total with weight
1. Physical disability space	✓	✓	X	✓	X	X	3✓	6
2. Physical crip-hacking roadmap	✓	✓	✓	✓	✓	✓	6✓	12
3. Online disability crip-hack community	✓	✓	✓	✓	✓	✓	6✓	12
4. Non-linear learning crip-hacking and design app	X	✓	✓	✓	✓	✓	5✓	10
5. Printable roadmap	✓	✓	✓	✓	✓	✓	6✓	12
6. Non-linear learning crip-hacking and design cards	X	✓	✓	✓	✓	✓	5✓	10
7. Skill tree	✓	✓	✓	✓	✓	✓	6✓	12

Note. The table displays how well each idea fulfils the needs part of the requirements

**Table 9**

*Evaluating how well the ideas include the requirements (wants)*

Requirement \ Idea	3. Access intimacy	4. Designer is invited into disabled world	5. Interdependence	9. Embodied interaction	11. Collection of creative materials	12. Design justice principles always visible or integrated into process	Total:
1. Physical disability space	✓	✓	✓	✓	X	✓	5✓
2. Physical crip-hacking roadmap	X	X	X	✓	X	X	2✓
3. Online disability	✓	X	✓	X	X	X	2✓



<b>crip-hack community</b>							
<b>4. Non-linear learning crip-hacking and design app</b>	X	X	X	X	X	X	0✓
<b>5. Printable roadmap</b>	X	X	X	✓	X	✓	2✓
<b>6. Non-linear learning crip-hacking and design cards</b>	X	X	X	✓	X	X	1✓
<b>7. Skill tree</b>	✓	X	X	✓	X	X	2✓

Note. Table displays how well each idea fulfils the wants part of the requirements

**Table 10**

*Total points acquired for each idea*

<b>Idea</b>	<b>Total points needs</b>	<b>Total points wants</b>	<b>Total for both</b>
<b>1. Physical disability space</b>	6	5	11
<b>2. Physical crip-hacking roadmap</b>	12	2	14
<b>3. Online disability crip-hack community</b>	12	2	14
<b>4. Non-linear learning crip-hacking and design app</b>	10	0	10
<b>5. Printable roadmap</b>	12	2	14
<b>6. Non-linear learning crip-hacking and design cards</b>	10	1	11
<b>7. Skill tree</b>	12	2	14

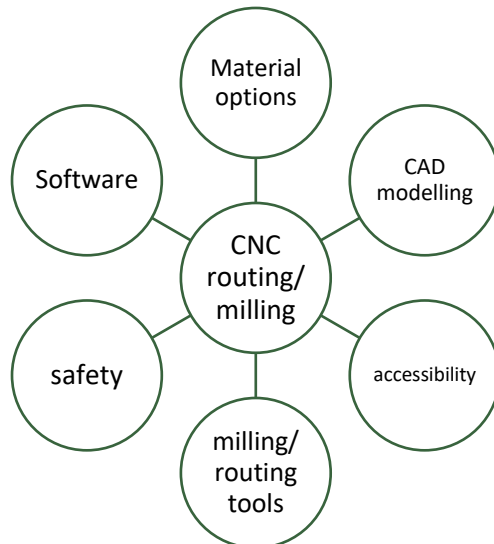
Ideas 2, 3, 5 and 7 have 14 points, while the others have fewer points. Elements from different ideas are combined to create the final concept. Specifically, the skill tree is combined with an online disability crip-hack community, with some elements of non-linear learning combined with game elements from the roadmap idea. The skill tree has opportunities to share and ask for help from others outside the disability community. The online disability community adds to this from an online perspective to get feedback and help and share capabilities inside the disability community. In personal communications with disabled people, I spoke about what was holding them back from participating in making even if they wanted to. They mentioned not knowing where to start, where to look for the right information and feeling overwhelmed at the amount of information available (Anonymous, personal communications, June 21, 2024); combining these ideas can offer a solution.

A choice was made to look at desktop manufacturing because it offers many possibilities and can be, in some ways, more accessible than physical making and adapting things for people with disabilities (Hurst & Kane, 2013). To start conceptualizing the idea, mind maps of the different desktop maker machines that are somewhat accessible in price or likely present at

hacker/maker spaces; this includes a CNC routing/milling machine (figure 59), 3D printer (figure 60) and a laser cutter (figure 61).

**Figure 59**

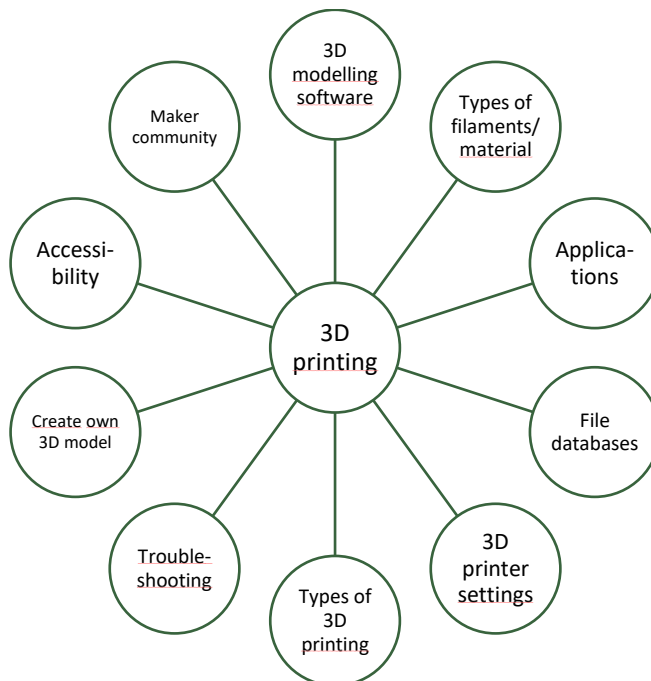
*Mindmap CNC routing/milling*



*Note.* Alt-text: A mindmap with a middle circle with the words 'CNC routing/milling', the circles around it read 'Software', 'Safety', 'Milling/routing tools', 'accessibility', 'CAD modelling', 'material options'.

**Figure 60**

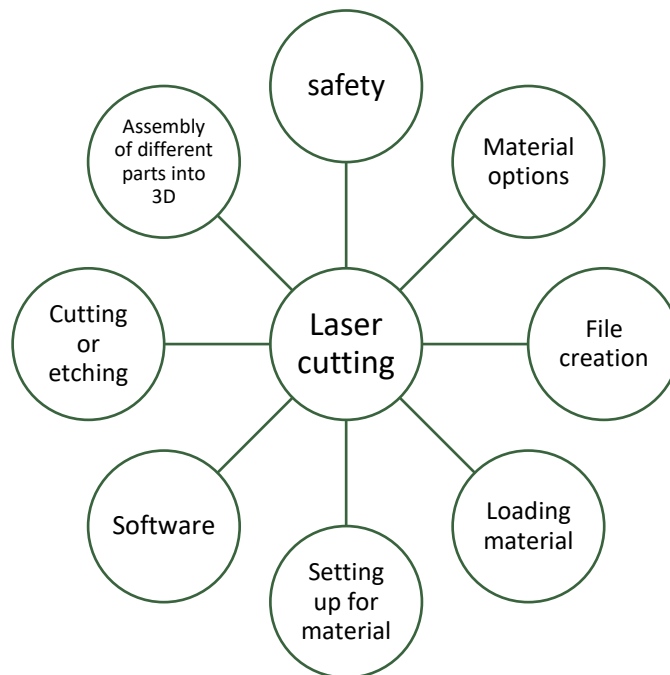
*Mindmap 3D printing*



*Note.* Alt-text: a mindmap with a central circle which reads '3D printing' the circles around it read '3D modelling software', 'Maker community', 'accessibility', 'create own 3D model', 'troubleshooting', 'types of 3D printing', '3D printer settings', file databases', 'applications', 'types of filament/material'.

**Figure 61**

*Mindmap laser cutting*

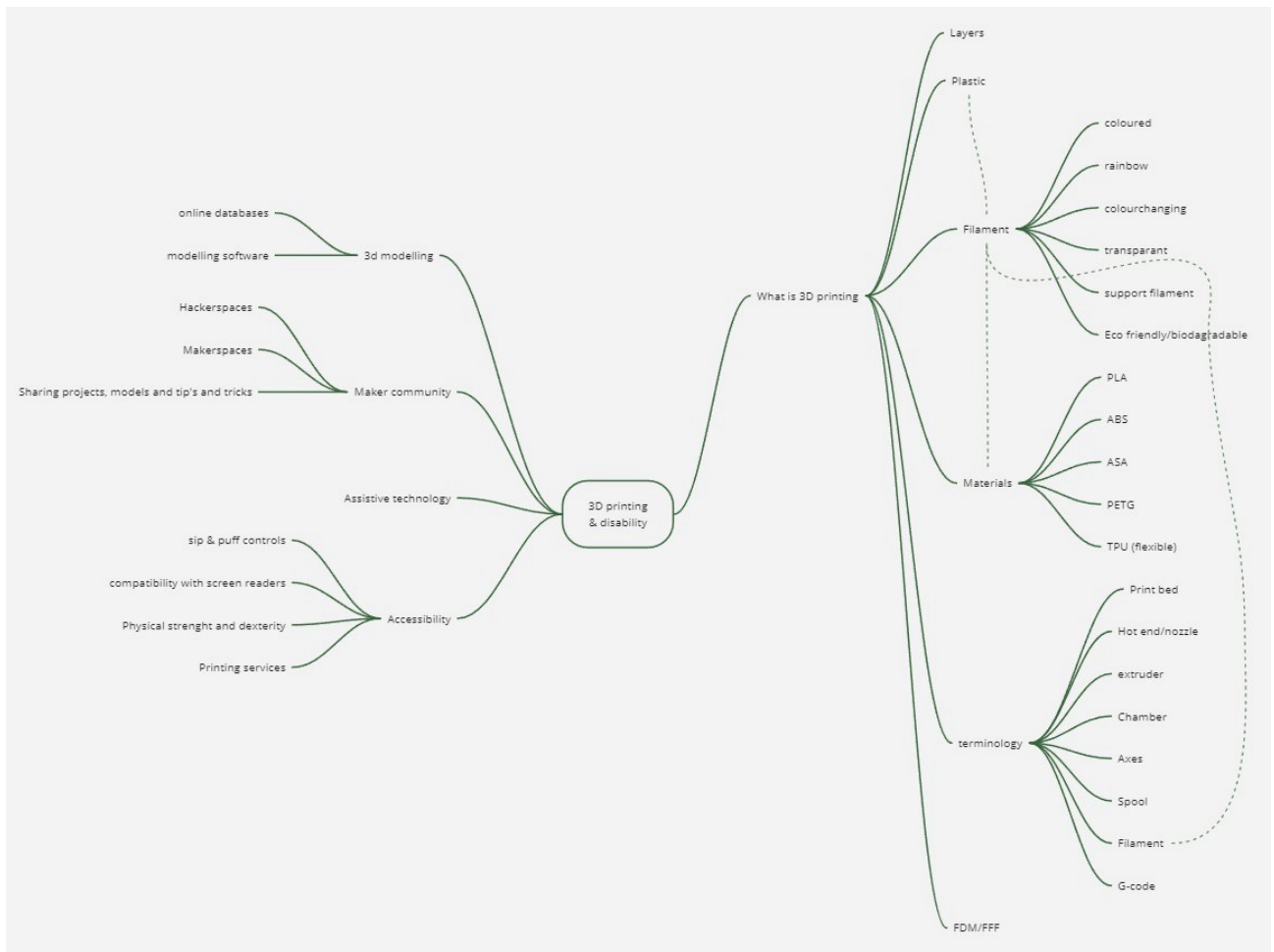


*Note.* Alt-text: a mindmap with a central circle which reads 'laser cutting', the circles around it read 'safety', 'assembly of different parts into 3D', 'cutting or etching', 'software', 'setting up for material', 'loading material', 'file creation', 'material options'.

A choice is made to focus on 3D printing because of the large possibilities of 3D printing for people with disabilities, and it has a relatively low barrier of entry compared to other desktop manufacturing machines. There are files available for free online and 3D-printing services therefore it is relatively easy to get started with it, and the printers have also become more user-friendly and require less technical knowledge to operate than before (Waylin, 2024; Gershenfeld, 2005) for example auto bed levelling, first layer scanning with LiDAR and prompts for maintenance and an intuitive user interface. There is also less of a demand for physical capabilities, whereas for laser cutting or CNC milling/routing, there is a need for the user to load big sheets of material into the machine, which is a little easier with 3D printing, some brands like Bambu Studio have included keyboard shortcuts for better accessibility (*Bambu Studio Keyboard Shortcuts and 3D Scene Operations*, n.d.) but also leaves a lot to be desired as can be read in an open letter by a blind user (user\_1467926946, 2023) who says that the compatibility with screen readers is not adequate. Other desktop manufacturing machines could be added to the platform, but the 3D printer is an excellent place for beginners. To start thinking about what 3D printing entails, a more elaborate mind map (figure 62) was created for 3D printing to see what someone who doesn't know anything about 3D printing should learn to be able to print 3D models.

**Figure 62**

*Brainstorm/mindmap 3D printing*



*Note.* Alt-text: a mind map of 3D printing & disability, from the middle bubble, 5 branches come off of it: 1. 3D modelling, which has 'online databases' and 'modelling software' branching off it. 2. Maker community, with 'hackerspaces' 'maker spaces' 'sharing projects, models and tips and tricks' branching off it. 3. Assistive technology, 4. Accessibility, with 'Sip & puff controls' ', compatibility with screen readers' ', physical strenght and dexterity' and 'printing services' branching off it. 5. What is 3D printing, with 'Layers', 'plastic', 'filament (coloured, rainbow, colour-changing, transparant, support filament, eco-friendly/biodegradable)', 'Material (PLA, ABS, ASA, PETG, TPU (flexible))', 'terminology (print bed, hot end/nozzle, extruder, chamber, axes, spool, filament, g-code)', 'FDM/FFF'. There are cross-links between filament at 2 locations and between plastic, material and filament.

There is quite a bit of information to know about and skills to acquire. Therefore, the choice is made to create 3 levels, from an entry-level with low technical skills necessary, via a 3D printing service or via a maker space to printing it themselves. This helps overcome some of the challenges of lacking technical skills or knowledge (Kantaros et al., 2022). Then, the following levels include more and more parts of the 3D to hopefully come to a place where users can 3D print their own designs. This will not be achievable for everyone, but there is still enough possibility to use 3D printing even if the highest levels are not achievable. There will be badges for each level, so there is a beginner badge for people who just started and then each for each level they have completed. This badge will be an icon that is at a member's profile.

## Platform user interface conceptualization

The concept consists of two parts, an online community with courses on 3D printing and the skill tree. To conceptualize the online community, sketches were created to ideate the user interface (figure 63) with the different parts of the platform like a homepage/landing page, a menu, a projects page, courses pages, profiles and messaging possibilities. The platform's name will be Disabled Design Quest, which stands for disabled people going on a quest, a journey to create amazing things with 3D printing and learn about crip-hacking and design along the way.

**Figure 63**

Sketch User interface

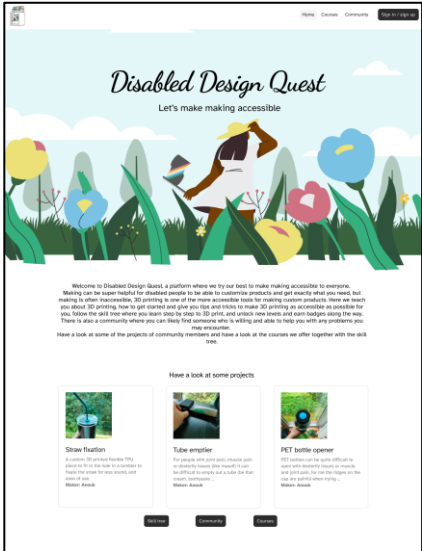


*Note.* Alt-text: sketches for the user interface of the platform with 9 screens. 1. A home page with a picture with 'Let's make making accessible' and a start button. 2. A screen with a drop-down menu with all the different pages on the platform. 3. Another home screen with 'Disabled Design Quest' as a title, with a subtitle of 'let's make making accessible' and flowers and leaves underneath. 4. A project screen with a title 'Projects by other makers' 5. A course screen with 3D printing and 3 levels. 6. A screen over level 1 of the 3D printing course with a video. 7. A profile page with 5 bubbles with messages, my courses, add project, skill tree and settings. 8. Another option for profile page, with a big picture, a name, bio and badge and their projects. 9. A messaging page with 2 conversations and bubbles with messages back and forth.

This platform was then prototyped in Figma. Figma offers various options to prototype user interfaces on phones, tablets and desktops. It is free, easy to use, and offers accessibility settings to make the prototype more suitable for screen readers. For this prototype, a choice was made to create for the desktop since this is also what will be used to control the 3D printer. Still, the idea for the final product is that it can be used on multiple devices, but there is not enough time in this project to develop the prototype for multiple devices.

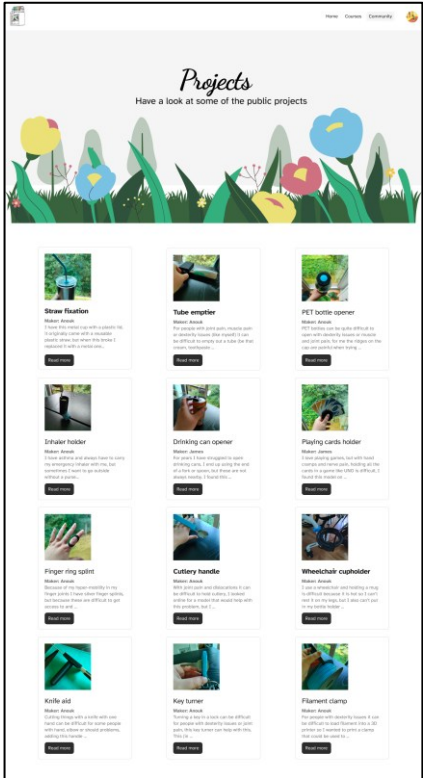
Certain parts will be designed to be publicly accessible (see an overview of projects, courses overview page and the skill tree), and the rest are only available if you log in or create an account as a member (figure 64 and 65). This is done for a few reasons: to motivate people to also contribute, not just be visitors, and also to offer some sort of safety of members sharing, basically like being among friends and to have easier contact. For example, the forum is only open to members, also to avoid spam. It will be easy to create an account and get a membership, so the barrier to entry will still be low.

**Figure 64**  
Home page platform v1



Note. Alt-text: This is a screenshot of a webpage with 'Disabled Design Quest' as the title and 'Let's make making accessible' below it. Below that is a decorative image with greenery and colourful flowers and a black woman with a sunhat holding a disability pride flag. Below that is a piece of text that is illegible in this screenshot. Below it is a subtitle, 'Have a look at some projects,' with 3 images of projects and 3 buttons underneath with illegible text.

**Figure 65**  
Project page platform v1



Note. Alt-text: This is a screenshot of a webpage with 'Projects' as the title and 'have a look at some public projects' below it. Below it is a decorative image with greenery and colourful flowers. Below it are pictures of the different projects, with a piece of illegible text beneath it and a button that says 'read more'.

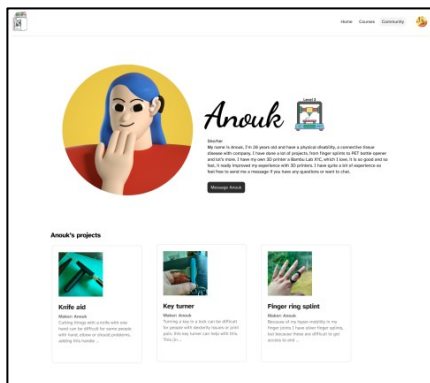
Several choices were made in this prototype, the font that was chosen was Atkinson Hyperlegible which was developed by the Braille Institute to be better readable for people with low-vision (*Atkinson Hyperlegible Font*, n.d.) and it's also a sans serif font which makes it more legible for people with dyslexia (*Dyslexia Friendly Style Guide*, n.d.) and other types of neurodivergence (*Typography*, 2023), except for titles on the pages which had a more decorative font (dancing script) which fit with the aesthetic of the fun colourful nature inspired decorative images used in each page. The decorative elements are nature-themed, with the colours from the disability pride flag with complementary colours. Other colours are used to create a good contrast between the background colour and the text colour. Nature symbolizes power, strength, freedom and independence, among other things (Nature Symbolism in Literature, 2024), which are qualities that fit well with the goal of the platform. The character on the home page is a black woman; this is done because women, especially black women, are underrepresented in media, so it was important to me to make this the

character on the home page. The woman is not visibly disabled, because the spectrum of disability is so wide that it is left open to also be inclusive to people with invisible disability, sensory disabilities or neurodiversity.

The icons for the profiles are one of a woman with a hearing aid and a man who is holding flowers to indicate the variety of users and disabilities (figures 66 and 67). The test profile will be used by participants of the expert by experience evaluation. The profile image for this profile is a bookworm, a worm, because it fits with the nature theme, but is also neutral and gender-neutral, so many different users will be able to use it without feeling incongruency with the profile image. There is a book because this is about learning (figure 68).

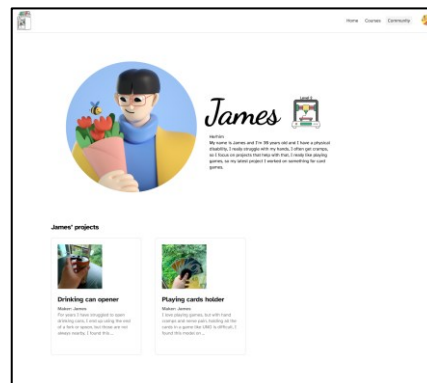
Several game elements are included in the design of the platform to gamify the learning experience. Some examples of game elements are badges for each level completed, peer interaction and collaboration via the forum and messaging, un-lockable content to be accessible when one level is completed, avatar creation to be customized for individual representations, visual elements creating a recognizable aesthetic, which is done with the nature theme and the flowers in colours of the disability pride flag and visual progress which is incorporated into the skill tree where skills that have been completed show this visibly. Nah et al. showed that these game elements can increase engagement, motivation, enjoyment and a sense of accomplishment, which will help the users use the platform and learn (2014).

**Figure 66**  
Profile Anouk



*Note.* Alt-text: This is a screenshot with an avatar of a white woman with long blue hair and a hearing aid. She is wearing a red shirt. The name Anouk is next to it, and there is an illegible piece of text beneath it and example projects.

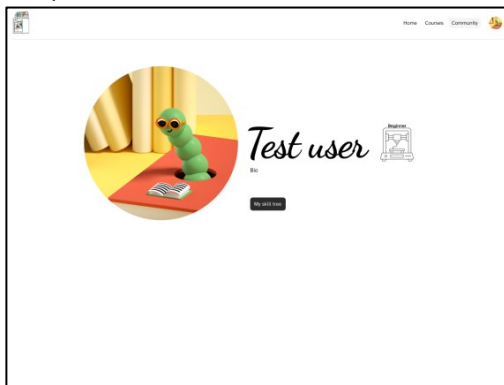
**Figure 67**  
Profile James



*Note.* Alt-text: This is a screenshot with an avatar of a white man with short blue hair and red glasses. He is wearing a blue shirt with a yellow cardigan. The name James is next to it, and there is an illegible piece of text beneath it and example projects.



**Figure 68**  
*Test profile*

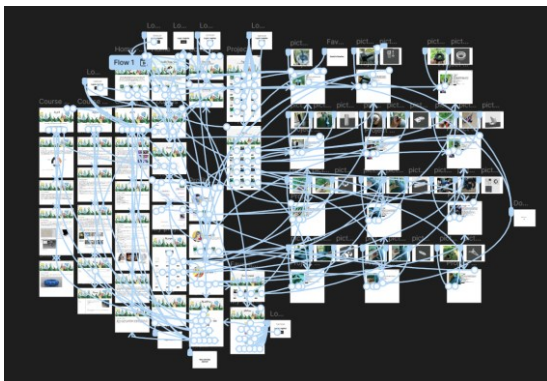


*Note.* Alt-text: This is a screenshot with an avatar of a green bookworm with red glasses; the text "Test user" is next to it.

Then, the platform needs to be finalized; therefore, all the pages need to be connected to each other, and links behind the buttons need to be created; there are many links between these pages. See figure (69) below; the link to this prototype can be found at the end of this chapter.

**Figure 69**

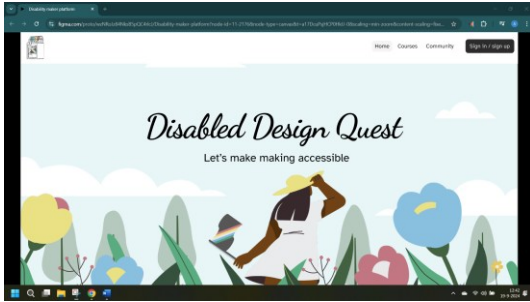
*Prototype links*



*Note.* Alt-text: a black screen with many different screens part of the prototype platform with blue lines between them that show the links.

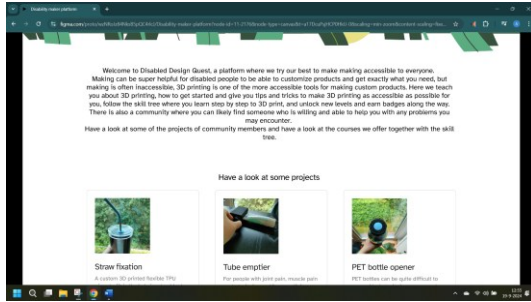
This is then tested, in prototype mode in Figma, to see if all the connections work and how the screens look in full screen to see if the layout is good. Testing the prototype resulted in finding a few problems; on the home page (figure 70), it's not visible that there is content beyond the visual nature scene when you scroll (figure 71), having a little peak of the content can prompt users to scroll to the rest of the content, the decorative part needs to be moved up, the same goes for the courses page (figure 72). The log-in pop-up works well as an overlay over other content (figure 73). There are some broken links, for example, on the messaging page (figure 74), that need to be corrected. On the skill screens (figure 75), there are no buttons to go back and forth to the next or previous skills, and now the user needs to go back to the level page to click the next skill, which doesn't make the experience on the platform very immersive and easy to use, so buttons will need to be added.

**Figure 70**  
Home screen v1



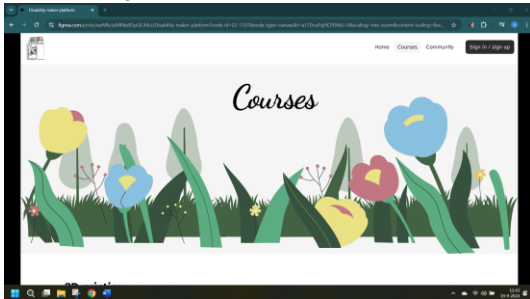
Note. Alt-text: screenshot of a webpage with 'Disabled Design Quest' as the title with 'Let's make making accessible' below it, there is a decorative image with greenery and colourful flowers

**Figure 71**  
Scrolled down the home page v1



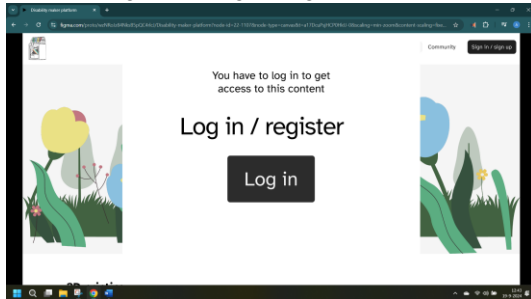
Note. Alt-text: screenshot of the scrolled down home page, illegible text at the top, 3 boxes for 3 projects with pictures

**Figure 72**  
Courses page v1



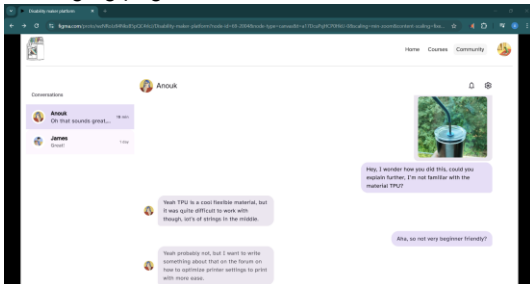
Note. Alt-text: screenshot of a webpage with 'Courses' as the title, there is a decorative image with greenery and colourful flowers

**Figure 73**  
Courses page with Log in/register pop-up



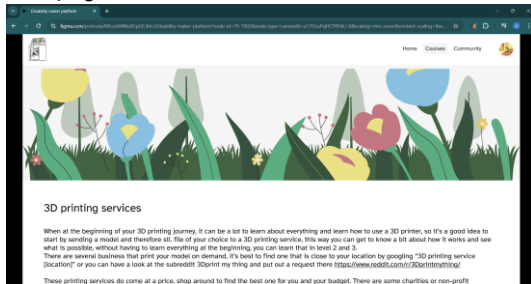
Note. Alt-text: figure 71 with a pop-up screen over it with 'You have to log in to get access to this content' and in big letters 'Log in / register' and below a black button with 'log in' on it.

**Figure 74**  
Messaging page v1



Note. Alt-text: This is a messaging page with conversations on the level. One is opened, and messages back and forth are exchanged, with one message sharing an image of a project.

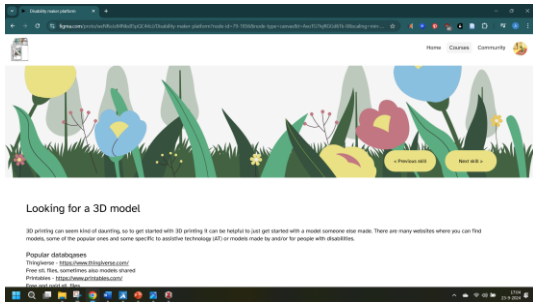
**Figure 75**  
Skill page



Note. Alt-text: a page with a decorative nature scene with flowers at the top and below a title that reads '3D printing services', and below is a detailed text about that topic.

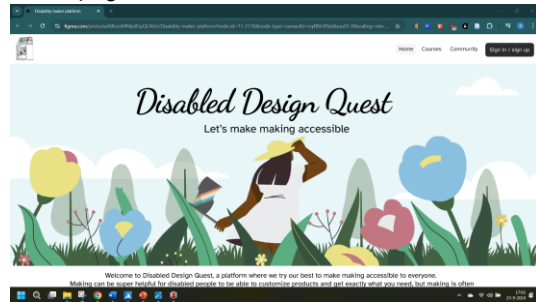
The necessary changes are made to the pages, buttons are added to the skill pages (figure 76), and the pages with scrollable content are changed (figure 77).

**Figure 76**  
Skill screen v2



*Note.* Alt-text: a page with a decorative nature scene with flowers at the top and below a title that reads '3D printing services', and below is a detailed text about that topic. There are 2 yellow buttons that users can use to move back and forth between skills within a level.

**Figure 77**  
Home page v2



*Note.* Alt-text: This is a screenshot of a webpage with 'Disabled Design Quest' as the title and 'Let's make making accessible' below it. Below it is a decorative image with greenery and colourful flowers, and below it is some of the text visible.

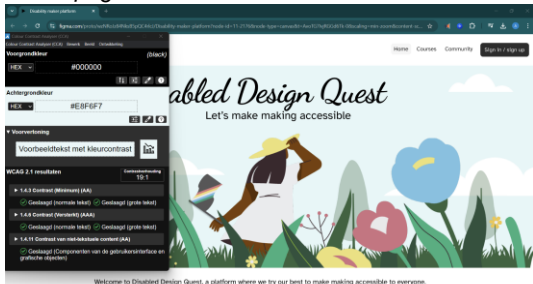
## Screen reader accessibility

Then, it was important to test the accessibility of the platform with a screen reader, and even though Figma does have the option to adapt content to users with screen readers, it is not sufficient. While trying it out, it was discovered that the content on the screen is read in order of the layers and not from top to bottom visually on the page, so this will need to be altered, and that the buttons when read out did not call out the text on the button, but the name given to the button in the layers, this also needs to be altered. There is not specific way to give images an alt-text in Figma, so this was left out until now, but changing the file name seems to be a good way to give the image an alt-text, so this will be implemented as well. This will need to be changed, but the order of layers also determines the visual layout and which pieces are at the front, so some design changes will have to be made to create a more logical order for the screen reader.

## Colour contrast

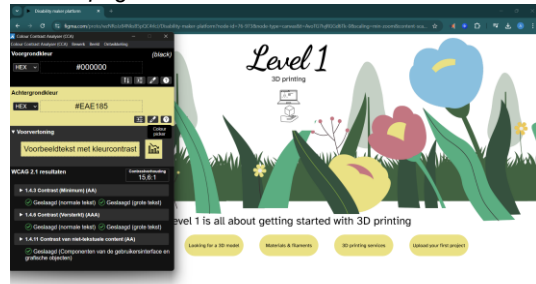
Next, the platform's accessibility is checked in terms of the colour contrast of the text on the background. According to the WCAG, the contrast should be a minimum of 4,5:1 and 3:1 for larger-scale text (Understanding Success Criterion 1.4.3: Contrast (Minimum) | WAI | W3C, n.d.). Several of the pages are checked with a program that analyses the colour contrast (Colour Contrast Analyser (CCA), n.d.) (figure 78-83).

**Figure 78**  
Home page with CCA



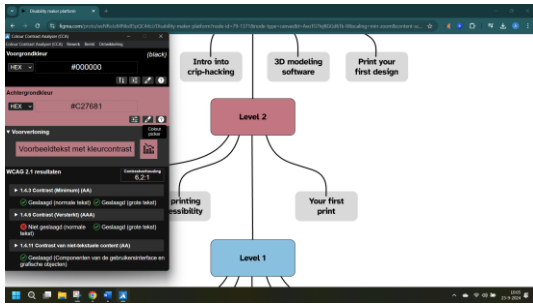
*Note.* Alt-text: The homepage of the DDQ website is shown with a colour contrast analyser overlaid, analysing the text on a light blue background.

**Figure 79**  
Level 1 page with CCA



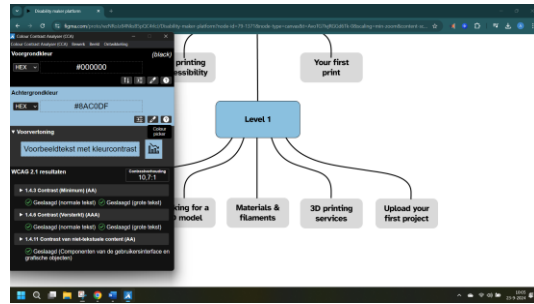
*Note.* Alt-text: The homepage of the DDQ website is shown with a colour contrast analyser overlaid, analysing the text on a light yellow background.

**Figure 80**  
Skill tree level 2 with CCA



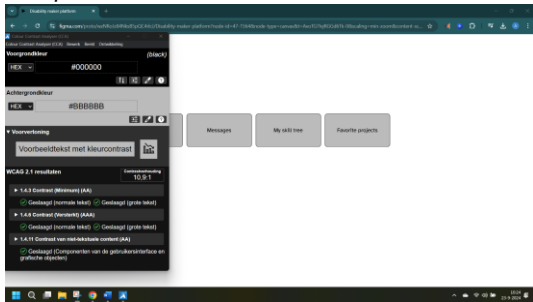
Note. Alt-text: The homepage of the DDQ website is shown with a colour contrast analyser overlaid, analysing the text on a red background.

**Figure 81**  
Skill tree level 1 with CCA



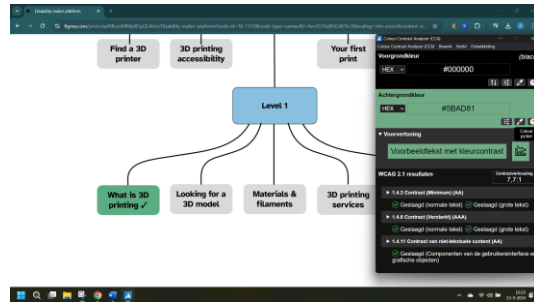
Note. Alt-text: The homepage of the DDQ website is shown with a colour contrast analyser overlaid, analysing the text on a blue background.

**Figure 82**  
Test profile with CCA



Note. Alt-text: The homepage of the DDQ website is shown with a colour contrast analyser overlaid, analysing the text on a light grey background.

**Figure 83**  
Skill tree with fulfilled skill with CCA



Note. Alt-text: The homepage of the DDQ website is shown with a colour contrast analyser overlaid, analysing the text on a light green background.

All the contrast values for the buttons and text on the platform are above the minimum 4,5:1.

## Colour blindness

The colours used at the platform are either just decorative or the information conveyed is also conveyed in other ways. For example, buttons are given another colour than the background to show that it's a button, but this information is also conveyed by a shape around text and the cursor changing when hovering above the content and a screen reader will also identify it as a button, or for example a colour in the skill tree is used to indicate that a skill has been completed, but there is also a checkmark that appears when completed. When hovering, clickable content will be indicated by a mouse change to a hand.

## Further accessibility according to WCAG 2.2 (Web Content Accessibility Guidelines (WCAG) 2.2, 2024)

- Keyboard accessibility, for going through content with a keyboard is unfortunately not possible within Figma
- ARIA landmarks – automatically generated by Figma when the accessibility setting adapting for screen readers is toggled on
- Images of text should be avoided – only in 2 places on the platform is this the case, in one of the images about 3D printing problems and the badges, the image of 3d printing problems has an alt-text, but it mostly refers to the website that it links to, to explain this image further, and the badges all have an alt-text that has the words of the image in it

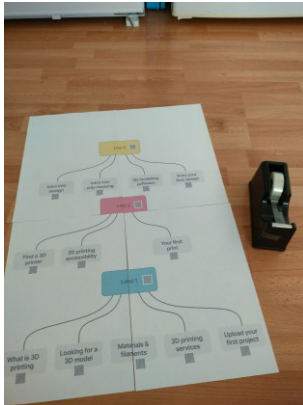
- Revisability of the screen and content and zooming up to 200% should be possible without having to scroll sideways – this is unfortunately not possible in Figma
- Content that appears when hovering over something should remain visible when the cursor is moved – this is unfortunately also not possible in Figma
- The language of the site should be customizable – not possible in Figma
- The content should be presented in secondary education level language – the less common and more complicated terms in the content are explained in the text
- Navigation items should be consistent across pages—yes, the menu items are always in the same order and in the same spot on the page.
- Accessibility guidelines surrounding input are not applicable because input is not possible with the current prototype, such as input fields

### Skill tree conceptualization

The concept consists of two parts the online platform and the print out skill tree. The skill tree provides a clear visual overview of all the different skills they can acquire for each level; users can choose which skill to work on first; they don't have to be done in order. A skill tree has been created for the online platform, but there is also an option for users to print out this skill tree (figure 84-86). The printed out version will offer possibilities that the online one doesn't. Users can hang it in their home and not just be reminded of what they are working on, but also see their progress when they mark this on the poster. The skill tree printout can be hung in the home of the user; they can choose to hang it in a place where people will see it when they come over. Then there is an added interaction when the visitors can ask about it, and if needed offer their help if necessary. The poster becomes tangible, linking the poster with QR codes at each skill and each level to link to the online platform, so the user can scan these with a smartphone to get easy access to the next skill they want to work on. (Ishii, 2007; Koleva et al., 2003). The skill tree is also designed as a cognitive scaffold, something to remind users of what they are working on. They don't have to mentally think about where they are in the process or what is next; it is externalized to either the poster on the online skill tree or the platform (Clark, 1996).

A file needs to be created so the skill tree can be printed. The skill tree was divided into 4 A4 sheets so it could be printed with a standard A4 inject printer, but still be large enough to be legible at a distance.

**Figure 84**  
Skill tree print-out v1



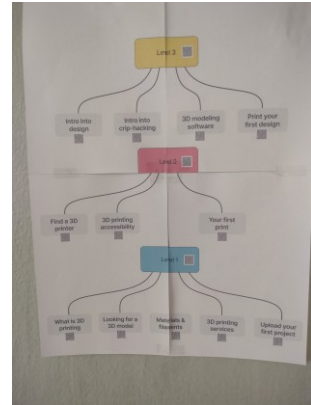
Note. Alt-text: Four A4s are taped together, and the skill tree is spread out over the four pages, all printed in portrait mode. The skill tree is a tree-like structure: at the top is level 3, with several skills like branches under it, and moving down, there is level 2 and level 1, with branches under it.

**Figure 85**  
Skill tree print-out v1 hung up



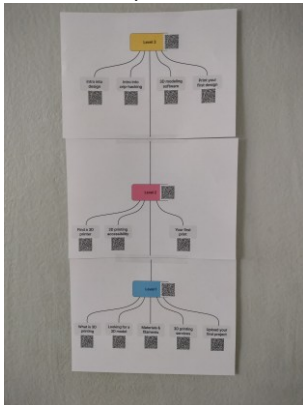
Note. Alt-text: the printed skill tree from figure 84 hung on a wall

**Figure 86**  
Skill tree print-out v1 details



Note. Alt-text: zoomed in on the skill tree

**Figure 87**  
Skill tree v2 print-out



Note. Alt-text: The skill tree is described in 85 and the previous text but now spread out over 3 A4s printed in landscape and hung above each other.

**Figure 88**  
Skill tree print-out v1 hung up



Note. Alt-text: the skill tree as described in figure 88 hung on the wall

When the files were printed, two problems came up; first, the QR codes were too small and were not scannable, so these needed to be enlarged. Secondly, where the text bubbles are spread over 2 pages, the text gets cut off improperly, and it becomes hard to read. Therefore, the text should be moved to either the left or the right so the whole word is on one page. A new file with these improvements was created and printed, where the 3 levels were divided amongst 3 A4 pages, but in landscape instead of portrait, the QR codes were also enlarged. This improved legibility and the QR codes were now scannable (figures 87 and 88).

## Users

The platform's intended target users are people with disabilities who have frustrations with current design and are interested in crip-hacking (or another term describing the same principle), designing, and 3D printing but don't know where to start or feel overwhelmed by the amount of knowledge and terminology that they need to learn to get started.



The persona is an example of what a user could look like. It is based on meeting many disabled people at events held on topics surrounding disability and technology or design. The persona is a combination of several people.

## Persona

### Figure 89

Avatar James



*Note.* Alt-text: a white man wearing a blue turtleneck and a yellow cardigan, with short black hair and red glasses, holding a bouquet of flowers with a bee above it

### James (figure 89) - he/him

30 years old

Physical disability - MS

James struggles a lot with his hands; he gets cramps in them a lot. James is one of the profiles on the platform in the concept there he has achieved level 2 already; his latest project includes a playing cards holder because he likes playing games but has problems holding cards. He found a model for this product online, he has a 3D printer.

## Ideal use scenario

James has MS and has struggled for a while with his hands. he really loves playing games, but he struggles to hold the playing cards like for Uno or cards included in a board game. He has tried playing cards holder, but they were either only suitable for standing on the table or holding in hand and James wanted something that could work for both. He learned about the Disabled Design Quest platform on Reddit a subreddit for disabled people. He was immediately intrigued when he read about the platform. He looked through some of the pages and signed up for a membership. At first, he had a drinking can opener printed by a printing service, and then when working on level 2, he went to a hackerspace and got some help printing a playing cards holder that he found on printables.com. The playing cards holder is great because he can hold it in his hand but also put it down on the table, the only problem is that the slit for the cards is rather narrow, so he can't wait to start working on level 3 so he can learn how to design it himself, he has already seen in the skill tree that level 3 will teach him about 3D modelling and he is very excited to see how that will work. He is also more and more looking around his house and seeing things that he would like to 3D print something for.

## Alternative scenarios

A user learns about Disabled Design Quest and signs up for the platform. They read through all the information, but they don't feel like they need any of the stuff they can find online. They don't even know why they would print this AT; they start looking at other models on Thingiverse and decide they would love to print a dragon figure. They send this to a printing service and get the dragon. They like what they created for them, but they still don't really feel inspired to find other things to create. They read through the other pages and run into the issue that they have to complete all of level 1 before they get access to level 2. So they just click through the pages just to be able to see levels 2 and 3 as well. They like knowing more about 3D printing, but they likely won't use it for 3D printing AT in the future.



A user is at level 2 with 3D printing, and they go to a hackerspace to see about using their 3D printer, when contacting them though, they learn about the inaccessibility of the space, so they go looking for another hackerspace, but they only find ones that are really far away from them, so they decide to look into buying their own 3D printer, they get one of the cheaper printers that are available because of a limited budget. They set up the printer and start their first print, at first, they are really excited because they can start to see the object appear in front of their eyes, but then they get frustrated because the 3D printer has made a mistake, and the layers from halfway have shifted, they look up what to do, but they can't figure out how to fix it, and the fixes people online are recommending they are afraid to do because they don't want to permanently alter the machine. They don't have enough technical knowledge to evaluate if the fix is safe to do. The problems keep persisting and the user decides to sell the 3D printer and quit 3D printing.

### Final concept

The final concept is a website with many features, these are all explained below.

### Logging in/registering

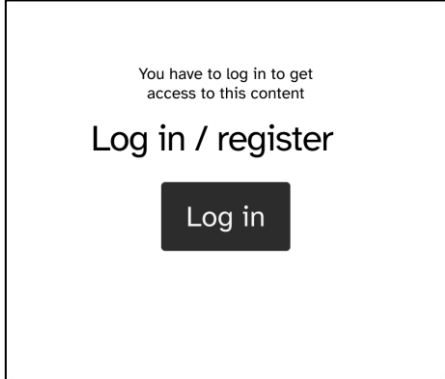
Users can log on to the platform (figure 90) because this can create a feeling of a private community where they can share freely with others and make certain content off-limits for non-members to encourage sharing and community building (figure 91). In the prototype logging in was done by simply clicking the log-in button, but this was conceptualized to be a fully functional members database in the final concept.

**Figure 90**  
*Log-in screen overlay*



*Note.* Alt-text: A white box within large font: Log in / register with below a black button with the text: Log in.

**Figure 91**  
*Off-limits content log-in overlay*

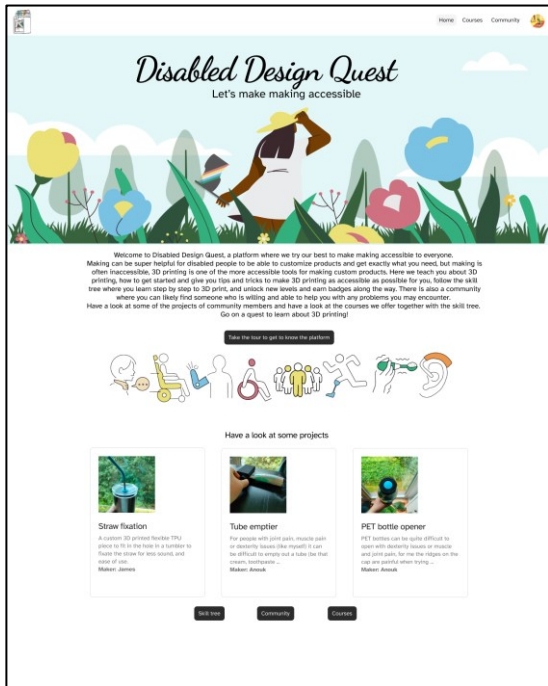


*Note.* Alt-text: A white box with the text: You have to log in to get access to this content and below in large font: Login / register with below a black button with the text: Log in.

### Home screen

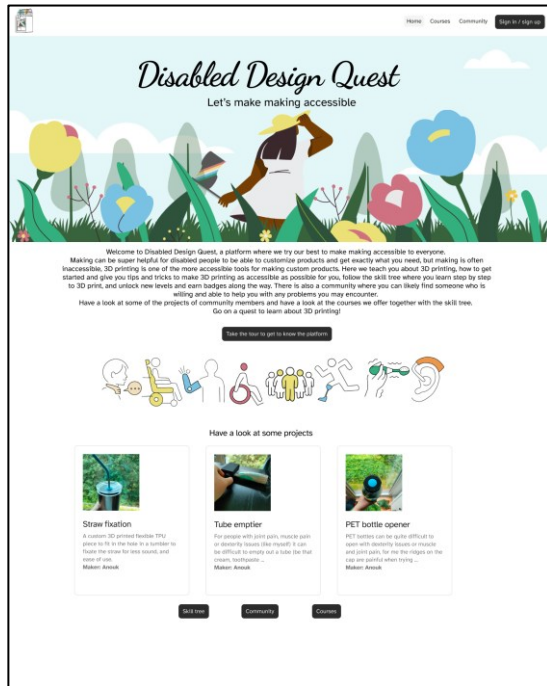
The DDQ prototype has a home page, this homepage is available both when a user is logged in (figure 92) and not logged in (figure 93). The home page provides links to several parts of the website like in the menu up top, to the courses page and the community page, as well as a link to log in or to go to the user's profile. Lower users can take a quick tour, navigate to one of the highlighted projects or use some of the other links below.

**Figure 92**  
Home screen logged in



Note. Alt-text: the home page of the DDQ website with at the top a banner with decorative flowers and a black woman holding a disability pride flag in her hand with the title above reading: Disabled Design Quest. With a sub-title: Let's make making accessible. Below the banner are illegible text and a button, images representing different disabilities and 3 example projects with buttons that lead to other parts of the website. This one is the version that a person has logged in one, so their profile picture is shown in the top right corner.

**Figure 93**  
Home screen logged in



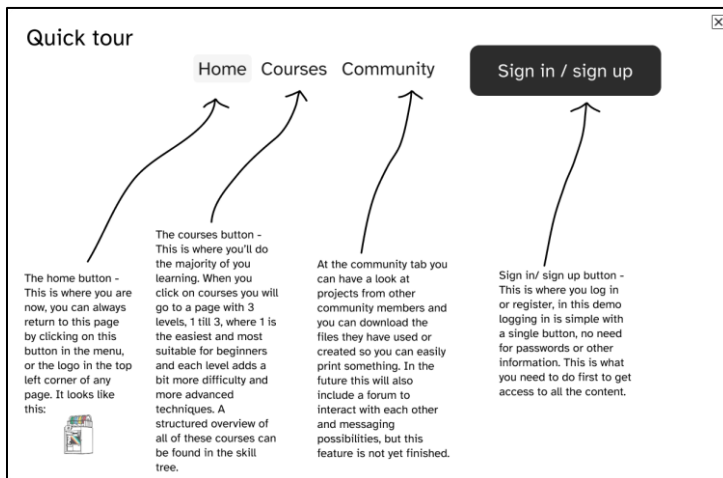
Note. Alt-text: the home page of the DDQ website with at the top a banner with decorative flowers and a black woman holding a disability pride flag in her hand with the title above reading: Disabled Design Quest. With a sub-title: Let's make making accessible. Below the banner are illegible text and a button, images representing different disabilities and 3 example projects with buttons that lead to other parts of the website. This one has the log-in button at the top right.

## Quick tour

On the home screen, there is a button to take a quick tour. This opens an overlay (figure 94) that explains each page of the menu and its entails.

**Figure 94**

Quick tour overlay



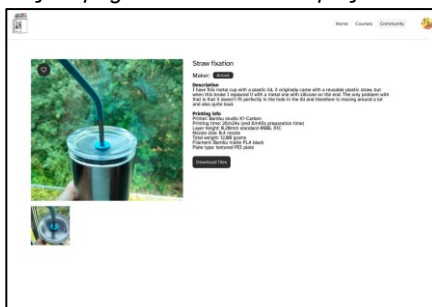
Note. Alt-text: An overlay screen with the menu (home, courses, community, sign in/sign up) with arrows pointing to each explaining what each page is about.

## Projects

Users can share projects they have completed by uploading them to the website (figure 95, 96), this was not prototyped but is part of the concept. For the prototype, example projects were uploaded. Details of these projects can be entered as well as images, video and the 3D model used (figure 97 and 98), and the projects can be saved by favouriting them with the heart icon in the top left corner and a screen with a pop-up to show it has been favourited (figure 99).

**Figure 95**

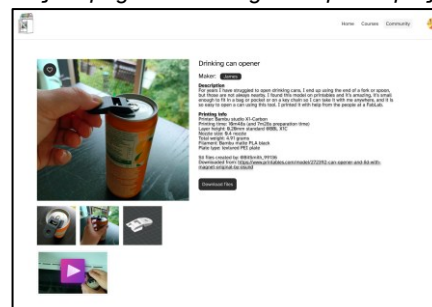
Project page of straw fixation project v1



Note. Alt-text: This is a screenshot from the project page. The main picture shows a cup with a straw in it, with a blue piece holding the straw in place. There is a smaller picture underneath with a close-up of the same cup. The title next to it is 'Straw fixation.' It has the maker's name and text about the project.

**Figure 96**

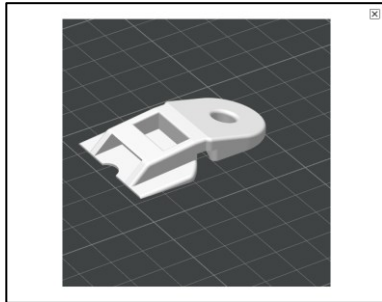
Project page of drinking can opener project v1



Note. Alt-text: This is a screenshot from the project page. The main picture shows a drinking can with a black opener on top of it held by a hand. There are smaller pictures underneath with close-ups of the same drinking can with opener, a picture of the 3D model, and a video of it being used. The title next to it is 'Drinking can opener.' It has the maker's name and text about the project.

**Figure 97**

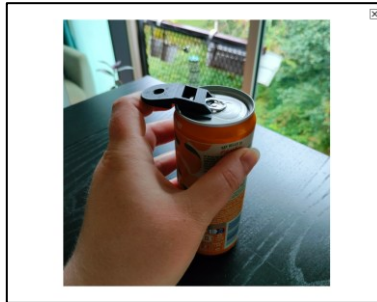
*Detail picture project 3D model*



*Note.* Alt-text: a picture of the 3d model of the drinking can opener

**Figure 98**

*Detail picture project product in use*



*Note.* Alt-text: a close-up of the drinking can opener project

**Figure 99**

*Favourite project screen*



*Note.* Alt-text: a screenshot of a message that reads 'Saved in favourites'

## Community page

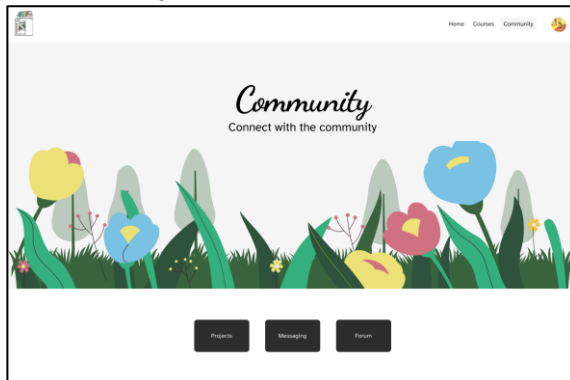
The community page has links to several parts of the website (figure 100). From here, a user can go to the projects page, messaging, or the forum.

## Courses page

The courses page gives a navigational point to each of the levels. There, they can see all the skills under each level (figure 101). The levels were designed to be restricted until the previous one was completed to add an element of gameplay, but this feature was not implemented for the evaluation.

**Figure 100**

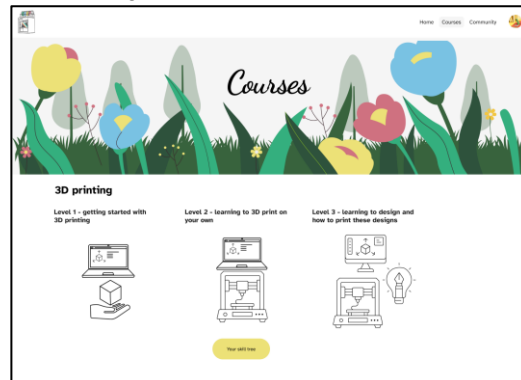
*Community page*



*Note.* Alt-text: a screenshot of the community page with the decorative flowers, grass and trees with 3 buttons: projects, messaging and forum.

**Figure 101**

*Courses page*



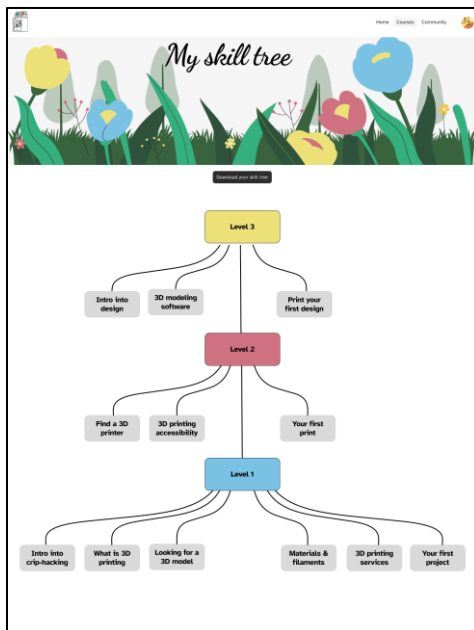
*Note.* Alt-text: a screenshot of the courses page with the decorative flowers, grass and trees with 3 buttons: for levels 1, 2 and 3.

## Skill tree

The concept includes a skill tree where all the different skills under each level are visually displayed. The skill tree can be used; every part is also a button to go to the content of that particular skill. It can also be printed out to be hung in the user's home or workspace (figure 102).

**Figure 102**

*Skill tree*



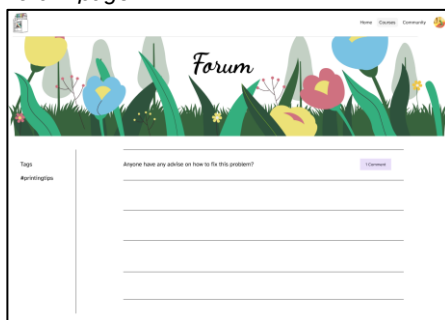
*Note.* Alt-text: a screenshot of the skill tree page with the decorative flowers, grass and trees with a visual overview of the 3 levels and all the skills under each level.

## Forum

The DDQ website's concept includes a forum where users can ask questions, answer them, leave comments, and, therefore, learn from each other. These questions are visible to all users, so rather than private messaging, they are visible to everyone so everyone can learn from them (figures 103 and 104). There is also an option of tagging your questions with hashtags so they are easier to find for other users.

**Figure 103**

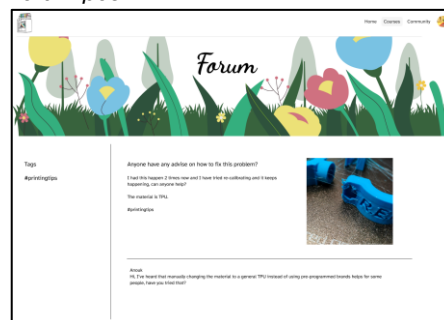
*Forum page*



*Note.* Alt-text: a screenshot of the forum page with the decorative flowers, grass and trees and a list of forum posts.

**Figure 104**

*Forum post*



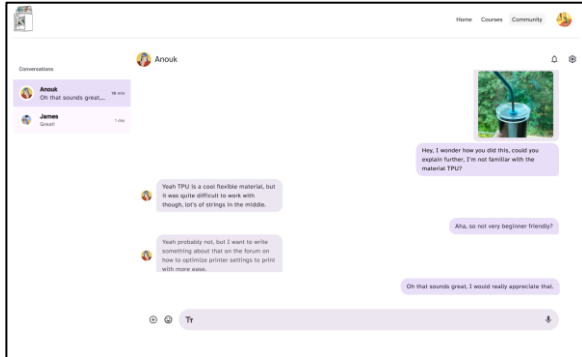
*Note.* Alt-text: a screenshot of the forum page with the decorative flowers, grass and trees and a forum post.

## Messaging

The messaging module in the prototype was created visually to show what it would look like to have 2 messaging chats (figure 105 and 106) and to give an impression of how it would work, but this feature is not interactive and was therefore deleted for the testing prototype, the

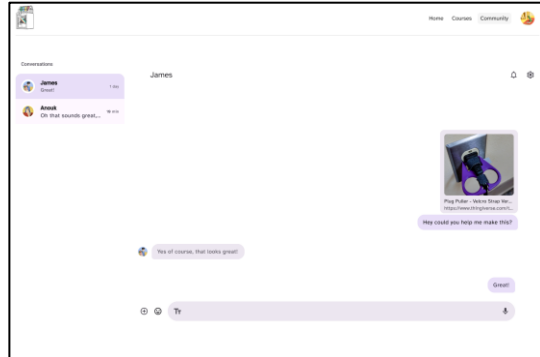
button that leads to messaging was therefore redirected to WhatsApp for evaluation participants to be able to reach out if they had any problems. The messaging feature, as shown below, was not part of the evaluation.

**Figure 105**  
Messaging chat test user - Anouk



Note. Alt-text: a screenshot of the messaging page with messages going back and forth, to a person called Anouk, one having sent an image.

**Figure 106**  
Messaging chat test user - James

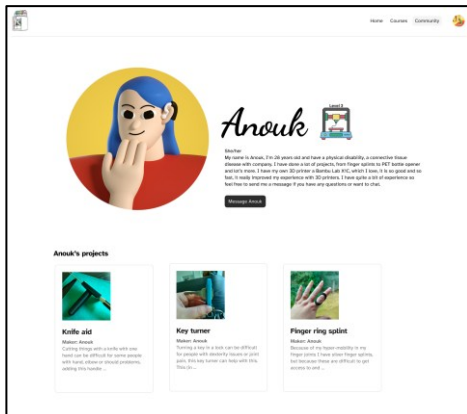


Note. Alt-text: a screenshot of the messaging page with messages going back and forth, to a person called James, one having sent an image.

## Profiles

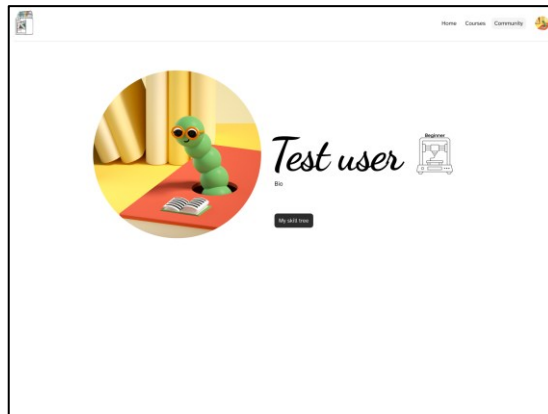
Each member user has a profile where they can choose their profile picture, add any info they want to share and their current level is shown. In the evaluation session, only the profile of Anouk was shown in case anyone wanted to reach out for support (figure 107), and the test user profile for the participants of Activity 2 to use (figure 108). The third profile representing a more experienced other member who has been on the platform for longer, was deleted for the evaluation to make sure there was no confusion because there was no person behind this account (figure 109).

**Figure 107**  
Profile Anouk



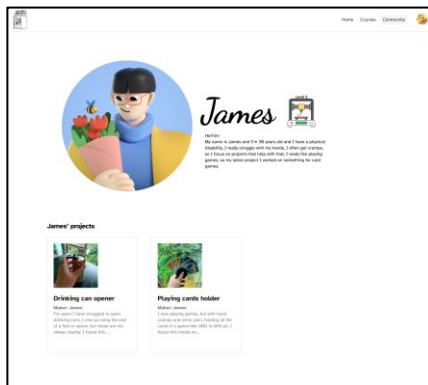
Note. Alt-text: This is a screenshot with an avatar of a white woman with long blue hair and a hearing aid. She is wearing a red shirt. The name Anouk is next to it, and there is an illegible piece of text beneath it and example projects.

**Figure 108**  
Profile test user



Note. Alt-text: This is a screenshot with an avatar of a green bookworm wearing red glasses. Next to it is the word "Test user," and beneath it is an illegible piece of text.

**Figure 109**  
Profile James



Note. Alt-text: This is a screenshot with an avatar of a white man with short hair and red glasses. He is wearing a blue shirt and a yellow cardigan. The name James is next to it, and there is an illegible piece of text beneath it and example projects.

## Prototype for testing

The full interactive prototype can be accessed with the link below. This prototype was used for the evaluation.

<https://www.figma.com/proto/wzNRoJz84NksB5pQC4rlcJ/Disability-maker-platform?node-id=11-2176&node-type=canvas&t=Mf0Vivp5jTxxI0d9-1&scaling=min-zoom&content-scaling=fixed&page-id=0%3A1&starting-point-node-id=11%3A2176&hide-ui=1>



## 9.

## Results activity 2

Activity 2 was a creative learning activity, with disabled participants using the DDQ prototype and 3D printing through a printing service. Two interviews took place, one at the beginning of this activity and one at the end, in between, the participants filled in a diary at least three times. Five disabled people participated in Activity 2; their characteristics can be found in the table (11) below. Participants 1, 2, 4 and 5 completed the activity. However, participant 3 did not complete the activity. The reason for their dropout is unknown, all communication from their side stopped after receiving their 3D-printed model. There are many reasons this could have happened. It could be that filling in the diary and doing the second interview turned out to not be feasible for this participant because the time needed for executing these was higher than expected; other participants also noted that it took more time than expected. It could be that timing the activity at the start of November at the end of quartile 1 and the beginning of quartile 2, was not a good idea since this is a fairly busy time for students. It could be that they had worsening health conditions, or it could be because they weren't satisfied with the 3D print but didn't know how to tell the researcher.

This means that there is less diversity in the participants since this person was the only participant from the 16-25 age group and the only participant with a learning disability. This limits the generalizability of the results to people under 25 and people with a learning disability. The goal of 5 participants was also not met, which means that there is less variety in the information gathered via the diary and second interview. Since Participant 3 did not indicate that they wanted to drop out of the entire activity, the transcript from the first interview with Participant 3 was used.

The participants who did finish the activity created a variety of images and 3D-printed objects; these can be seen in the figures (110-119) below. The ratings of creative confidence and the self-reported changes therein can be found in the table (12) below. Every participant who finished the study reported an increase in creative confidence. Full transcripts of the interviews and the filled-in diaries can be found in Appendix (P).

**Table 11**

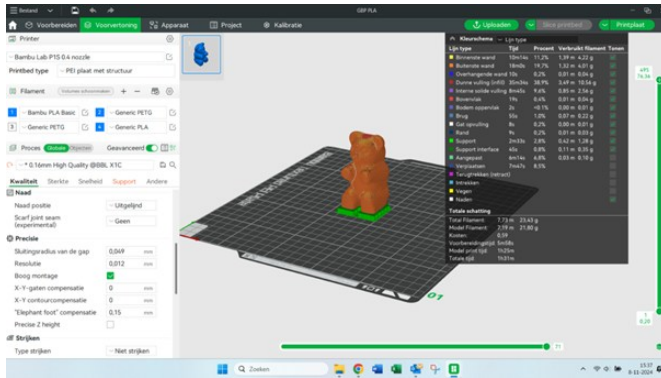
*Participant characteristics*

<b>Participant #</b>	<b>Type of disability</b>	<b>Pronouns</b>	<b>Age group</b>
Participant 1	Physical	He/him	56-65
Participant 2	Physical/sensory	She/her	56-65
Participant 3	Physical & learning	She/they	16-25
Participant 4	Physical	She/her	36-45
Participant 5	Physical	She/her	56-65

*Note.* This table displays the type of disability, the pronouns and age group of each participant

**Figure 110**

*Screenshot participant 1*



Note. Image provided by participant 1. Alt-text: a screenshot of the slicing software of Bambu lab with a model loaded.

**Figure 111**

*Picture 1 Participant 1*



Note. Image provided by participant 1. Alt-text: a dashboard with a large blue gummy bear on there.

**Figure 112**

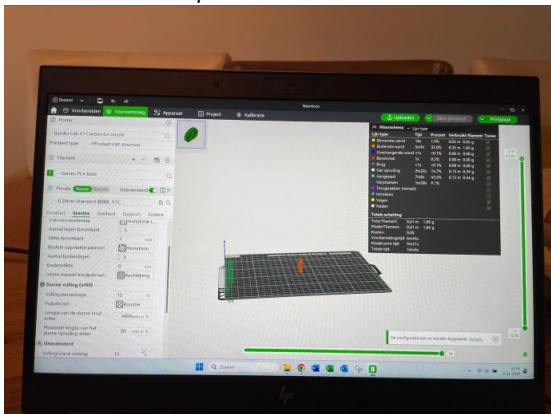
*Picture 2 Participant 1*



Note. Image provided by participant 1. Alt-text: a dashboard with a large blue gummy bear on there, the key can be seen below in the ignition.

**Figure 113**

*Screenshot Participant 2*



Note. Image provided by participant 2. Alt-text: a screenshot of the slicing software of Bambu lab with a model loaded.

**Figure 114**

*Picture Participant 2*



Note. Image provided by participant 2. Alt-text: a key with a cover with an alpha symbol and a key label with the number 56 on it.

**Figure 115**  
Picture 1 Participant 4



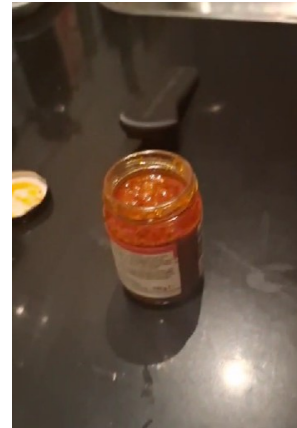
Note. Image provided by participant 4. Alt-text: a close-up picture of the 3D-printed jar opener, with a broken part.

**Figure 116**  
Picture 2 Participant 4



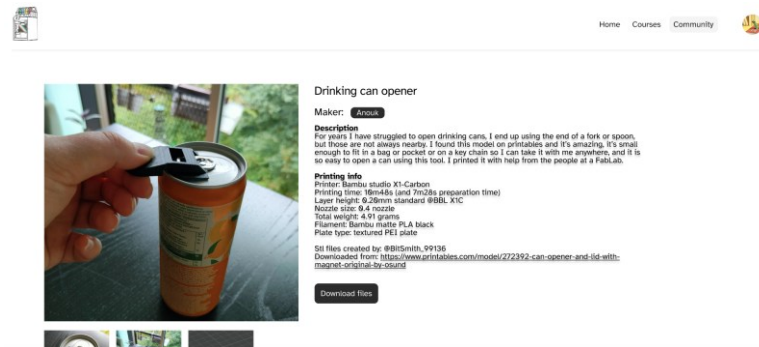
Note. Image provided by participant 4. Alt-text: a white woman holding a jar with one hand and opening the jar with the 3D-printed opener with the other hand.

**Figure 117**  
Picture 3 Participant 4



Note. Image provided by participant 4. Alt-text: an opened jar with the 3D-printed opener next to it.

**Figure 118**  
Screenshot Participant 5



Note. Image provided by Participant 5. Alt-text: a screenshot of the can opener project on the DDQ website.

**Figure 119**  
Picture Participant 5



Note. Image provided by Participant 5. Alt-text: a 3D-printed can opener magnetically attached to a utensil jar.

**Table 12***Participant creativity confidence*

<b>Participant #</b>	<b>Starting score creative confidence</b>	<b>End score creative confidence</b>	<b>Change in creative confidence grade</b>	<b>Seeing change during diary study &amp; self-described change in interview 2</b>	<b>Participant self-perception of ability to adapt products at interview 1</b>	<b>Participant self-perception of ability to adapt products at interview 2</b>
Participant 1	9 (but admitted to overestimating himself, so wanted to change the before to 6)	8-9	Stayed the same or increased by at least 2 points	Increase	Medium	High
Participant 2	7,5	8,5	Increase by 1 point	Increase	Low	Medium
Participant 3	6-7	/		/	Low	/
Participant 4	6-7	7,5	Increase by at least 0,5 point	Slight increase	Low	Medium
Participant 5	6	6	Stayed the same	Slight increase	Low	Medium

Note. This table displays the self-reported creative confidence of the participants through activity 2

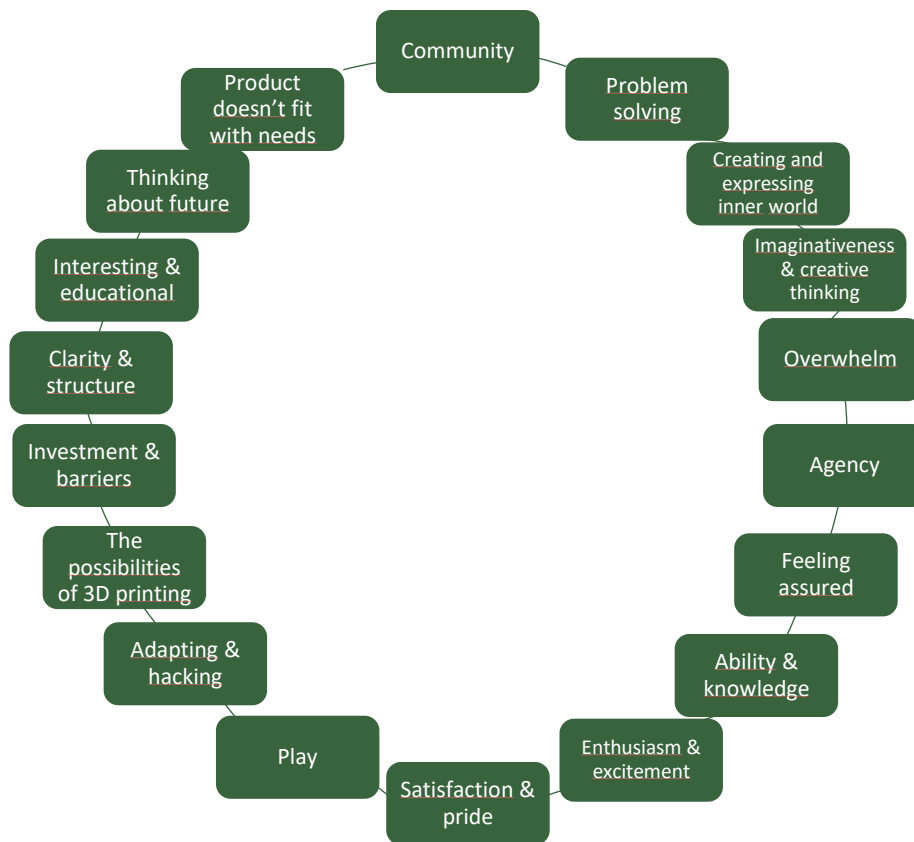
### Thematic analysis

The transcripts of the interviews and the diary entries were analysed using thematic analysis by following the steps outlined by Braun & Clarke: familiarization with data, generation of codes, combining codes into themes, reviewing themes, determining the significance of themes, and reporting findings (2021). This resulted in the identification of 18 themes; an overview of these themes can be found in figure (120) below. The transcripts were coded using a combination of bottom-up and top-down approaches.

The main findings of the thematic analysis are that the disabled participants went through a learning process with positive emotions and difficulties, which they overcame to realize the large variety of possibilities 3D-printing can offer them and their confidence in their capabilities when it comes to making and hacking. Thus, they felt more agency surrounding the design of their products.

**Figure 120**

Themes overview



Note. Alt-text: a circular schematic of all the themes identified in the thematic analysis

### Theme 1: Community

Participants relate learning from others and getting inspiration to creativity. They also mention DDQ as giving the opportunity to get into the 3D printing community, see what others are doing, learn from others, and, in turn, start sharing their own experiences and what they have learned. For some participants, seeing other people adapting or hacking gave them more confidence to be able to do it for themselves.

*Yeah where how do other people, experience it, solve problems and then. I just do it and try it and try it again so you can overcome. [¶ 44 in Transcript interview: 1 participant: 1](#)*

*After I saw all the examples of solutions people share on the different platforms it gives hope that I can really design a bespoke solution by myself [¶ 89 in Diary participant: 2](#)*

*The links, the video's and the projects that were shared and that you would see what was possible and how other people did it, to learn from them. [¶ 31 in Transcript interview: 2 participant: 5](#)*

*It was, yeah, very nice experience and I learnt a lot and I see more possibilities. And. I'm telling other people about it, so yeah. [¶ 86 in Transcript interview: 2 participant: 1](#)*

Participants also mention the need to be offered support from others, as well as being able to accept support as essential in them feeling confident.

*And I have a very hard time, a very hard time asking for help. So I think what I need to be confident is that. People kind of see me and and see what you need instead of me having to ask for help all the time or, like, have to communicate it all the time. And I it makes me more confident. I think if people just see what I need and are like, I'm going to do this right now. [¶ 10 in Transcript interview: 1 participant: 3](#)*

*I kept reading the info and asked for help. [¶ 83 in Diary participant: 2](#)*

*Now I see that, oh, sometimes I need a little bit of help and when I ask help and find help, I can do... I can do the thing. So that's giving me more confidence. So with the the helpdesk and. Trying, trying again and then I think everything new for the first time is hard and then when you. Yeah, do it more often. I trust that it will be easier. Yeah. [¶ 11 in Transcript interview: 2 participant: 2](#)*

*Good, I asked for some help to find the model I needed, but then we found a great product. [10:20 ¶ 62 in Diary participant: 4](#)*

## Theme 2: Problem-solving

Participants described acts of problem-solving as being part of creativity and, when working with the DDQ website when running into issues or displayed problem-solving while thinking about products that frustrated them.

*you go backwards to see from OK, what's what do I need to make it happen? What ... what are the limitations in the in the process but the ... the first step is to think from, well, what what do you want? What do you need? What? What's? Necessary instead of what is possible. [¶ 26 in Transcript interview: 1 participant: 1](#)*

*I think that would feel pretty cool. Like I have this problem and I'm gonna fix it myself. [¶ 68 in Transcript interview:1 participant:3](#)*

*I was. I was. I was. Yeah. Well. Not not that frustrated. I always figure out how to use a thing. How how to use such a product or such a tool in a way that it works but but still? That can be done. That that can be done in many. In many different ways that are better than they are now, so I'm I'm I'm desperately looking for the one thing. [¶ 55 – 57 in Transcript interview: 1 participant: 4](#)*

*Creativity I think is sometimes coming up with a creative solution with limited means, [¶ 22 in Transcript interview:1 participant: 5](#)*

*Because I'm like if you just seal it or you pour some glue in there, it should be good because no water can get in there anymore. [¶ 38 in Transcript interview: 1 participant: 5](#)*

*I have a translation app on my phone and was able to follow everything well. [¶ 22 in Diary participant: 1](#)*

*I think because of sharing all the information, the examples, the youtube films and the websites, all the possibilities. It awakens a feeling of be able to be independent and beining creative. To think about solutions instead of being annoyed about bad design [¶ 93 in Diary participant: 2](#)*

## Theme 3: Creating & expressing inner world

Participants relate creativity to creating things and expressing their inner world, and participants describe creating objects or stories, as well as participating in arts and crafts activities.

*little bit in drawing. Painting. Sculpting wood and stone. [¶ 28 in Transcript interview: 1 participant: 1](#)*

*Creativity in like the sense of creating things [¶ 14 in Transcript interview: 1 participant: 3](#)*

*I think making art is very creative, so any type of art so like actually making things with your hands or. Drawing and even drawing digitally, stuff like that, but also. Dance or singing or so theatre. [¶ 16 in Transcript interview: 1 participant: 3](#)*

*And I'm writing a well. I I started writing an novel as many, many people say they do. But I really did. And so, so, so. Yeah. And that's quite a creative creative thing. I wrote blog posts on on my. My experiences as a person with a physical disability and I try to put some humour in it [¶ 35 in Transcript interview: 1 participant: 4](#)*

*Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to. [¶ 27 in Transcript interview: 1 participant: 4](#)*

*But creativity is, I think, also designing or imagining things to make, for example from a toilet paper roll making a children's craft project, creativity can be in many fields. [¶ 24 in Transcript interview: 1 participant: 5](#)*

*Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not*



only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities. [¶ 12 in Transcript interview: 2 participant: 1](#)

## Theme 4: imaginativeness & creative thinking

Participants describe being creative by thinking creatively or imaging new or out-of-the box ideas.

*thinking out-of-the-box, think in what is possible and not in limitations. But you also need an open mind for it.* [¶ 22 in Transcript interview: 1 participant: 1](#)

*Thinking in solutions, not always be able to make it yourself but, I think in your mind, have the ... It's a kind of thinking. Yeah, when you're open. To new things or new possibilities, that's a part of being creative, I guess.* [¶ 22 in Transcript interview: 1 participant: 2](#)

*coming up with new ideas. So yeah, coming up with new stuff that that hasn't maybe hasn't been before. Yeah, I think like that.* [¶ 14 in Transcript interview: 1 participant: 3](#)

*Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to.* [¶ 27 in Transcript interview: 1 participant: 4](#)

*And then I'm also creative with kids, telling them stories, creativity can also be telling stories, and thinking up these stories.* [¶ 26 in Transcript interview: 1 participant: 5](#)

*Well then I would start designing it in my head and start thinking of how I would want it to be and then I would ask someone I know if that was possible for them to 3D print it for me.* [¶ 17 in Transcript interview: 2 participant: 5](#)

*It's a bit hard to say, I feel like I haven't really had enough experience with 3D printing to really know for sure, but I do think that it has changed something in my thinking, that I don't always have to buy something, but that I can also come up with my own ideas in my head and then the possibility of having that printed, so yeah I guess it did improve a bit.* [¶ 9 in Transcript interview: 2 participant: 5](#)

## Theme 5: overwhelm

Participants describe being presented with the new information from DDQ and learning about 3D printing and getting to know all the options as overwhelming at times.

*For a first acquaintance, actually applying the information is a bit overwhelming.* [¶ 62 in Diary participant: 1](#)

*Find out how is all works is a bit overwhelming* [¶ 67 in Diary participant: 1](#)

*I feel happy that I learned that there are a lot of possibilities, quite overwhelming* [¶ 73 in Diary participant: 2](#)

*...It is a lot. I now know that you need all the information. And everybody needs something different so it is good to know that there are so many possibilities. You just have to choose what fits you. I would like to have a step by step instruction, really for dummies. I think I will get better in doing it after a lot of excersize* [¶ 103 in Diary participant: 2](#)

*when you lack focus (which I did) then it is very overwhelming* [¶ 20 in Diary participant: 4](#)

*Yes, maybe it's even overcomplete sometimes. Stick to the core and then when you want to share additional information then that's fine but maybe link it or something. For a beginner like me, some basic, rather elemental information would do, and then the rest can be linked somehow.* [¶ 50 in Diary participant: 4](#)

*Well it was a lot to take in* [¶ 2 in Transcript interview: 2 participant: 4](#)

## Theme 6: Agency

Participants describe the need to be independent and decide what to do and when to do it, as well as for some participants agency being essential to feeling confident.

*to do the things that I want to do* [¶ 10 in Transcript interview: 1 participant: 1](#)

*Now I know I want to be more independent* [¶ 16 in Transcript interview: 1 participant: 2](#)



*I now know that I can have a lot of influence on making a design fit my wishes* [¶ 37 – 40 in Diary participant: 1](#)

*I think because of sharing all the information, the examples, the youtube films and the websites, all the possibilities. It awakens a feeling of being able to be independent and being creative. To think about solutions instead of being annoyed about bad design* [¶ 93 in Diary participant: 2](#)

*and really a great addition to reducing some of the issues I have and this can also help get some independence back. Then I don't always need to ask my husband to open it for me.* [¶ 71 in Diary participant: 5](#)

*It was much easier to open the can, I didn't have to ask someone for help.* [¶ 128 in Diary participant: 5](#)

*Yes, it makes you sort of ... having control over something that you need or want to be changed and then you don't have to be waiting ... waiting for other people to do something, you can take the initiative and then you can be like "you seem to know an awful lot about this, can you make this idea come to life please?"* [¶ 44 in Transcript interview: 2 participant: 4](#)

## Theme 7: feeling assured

Participants describe that confidence for them is all about feeling assured, being able to have trust, trust in themselves and a sense of self-esteem and trust from others.

*to feel sure in my environment* [¶ 10 in Transcript interview: 1 participant: 1](#)

*The things you you always, can do much more than you think. In first when.* [¶ 46 in Transcript interview: 1 participant: 1](#)

*I think I'm able to do something or tell something about? For example, my work or talking to people.* [¶ 4 in Transcript interview: 1 participant: 2](#)

*Trust in yourself that you can do something and a bit of self-esteem* [¶ 12 in Transcript interview: 1 participant: 5](#)

*It's funny because I've worked with these kinds of materials several weeks ago with using 3D pens. And then I was like "I'm not able to do this" I will just make a big mess, and then it's okay. But now compared with my experiences then, my experience now is much more like, this is the material, this is how I can use it, this is what I need to do, so yeah it helps.* [¶ 34 in Diary participant: 4](#)

*Yeah, I I think I will. Maybe at first be frustrated, but now I have the opportunity to change it and that feels good. So then I can find, or ... I think I will look for another solution so I know now that it isn't that one, but it can be changed and maybe someone else already changed it and I can use that, so I wouldn't have thought about that earlier.* [¶ 15 in Transcript interview: 2 participant: 2](#)

## Theme 8: ability & knowledge

Knowing what you know and what you can do, needing knowledge/ability to feel confident.

*Yeah, you need a kind of skills* [¶ 22 in Transcript interview: 1 participant: 1](#)

*I really feel that this is a thing I am capable of doing so. In general, if if we sort of limit creativity to to writing and playing with words and everything that that has to do with.* [¶ 51 in Transcript interview: 1 participant: 4](#)

*Knowledge about, knowledge about what you're talking about so that you know what you're talking about* [¶ 18 in Transcript interview: 1 participant: 5](#)

*I learned through Disabled Design Quest that a standard 3D design can be accessible to everyone.* [¶ 167 – 170 in Diary participant: 1](#)

*I learned that printing in a certain direction can change the strength in a direction. I also learned that PLA the material that was used for my print is made from plant materials and not from petroleum/crude oil.* [¶ 131 – 133 in Diary participant: 4](#)

*I hadn't thought that all of this would be possible because I hadn't really delved into it yet. So there are more possibilities than I thought, like that you can print with cement and lasers, those techniques I didn't know about before.* [¶ 73 in Diary participant: 5](#)

*At first the the films the the YouTube links so, understanding what 3D printing really means. I knew some things, but yeah, there were so many possibilities, so I was amazed by it. And then, the the platform itself. So with the the links to other websites with*

*the ready made solution. There were so many so. Yeah, that so that there are, so many things already 3D printed. Yeah, that I found that helpful. So yeah.* [¶ 27 in Transcript interview: 2 participant: 2](#)

## Theme 9: enthusiasm & excitement

Participants describe being excited before learning about 3D printing, but they are also even more enthusiastic/excited after beginning to learn and in the interview after having 3D printed something and being eager to learn more.

Wonderful. Wonderful. Yeah, it's it's, it's amazing that it's a whole world of new possibilities. So that's yeah, that would be very nice. [¶ 104 in Transcript interview: 1 participant: 1](#)

Well, I feel very enthusiastic about that [¶ 72 in Transcript interview: 1 participant: 2](#)

So then there are a lot of possibilities so I'm very. Enthusiastic about this because yeah, I can understand that 3D printing can be a solution for this. [¶ 68 – 70 in Transcript interview: 1 participant: 2](#)

I have become very enthusiastic about the complete program. The broad information to come from zero to a 3D design and then the offer to bring this 3D design to a physical end product I have experienced as very positive. [¶ 159 – 162 in Diary participant: 1](#)

From text to design, to order to physical end product gives a kick, which will increase your confidence and make you more enthusiastic. [¶ 158 in Diary participant: 1](#)

I felt enthusiasm to learn more about 3D and its possibilities [¶ 10 in Diary participant: 2](#)

My husband was really excited when I brought it home and I liked what it looked like, it looked like it was going to be perfect for me. [¶ 121 in Diary participant: 4](#)

## Theme 10: satisfaction & pride

Participants describe expecting to feel satisfaction and pride if they were able to adapt products themselves and after their first 3D print they are often satisfied and some feel proud of themselves.

*I will be very proud, but not so confident [laughing]. No, it will be fun to figure out how it works and to see if I can create my very own adjustment to without [serious]. Being forced to call in help or something.* [¶ 109 in Transcript interview: 1 participant: 4](#)

*So then you're being quite creative, and you need a certain creative insight to be able to do this, but if you could, I think that would give a feeling of satisfaction.* [¶ 52 in Transcript interview: 1 participant: 5](#)

*I am very happy with the 3D end result. It stands out just enough to remind me to use the lock but is not distracting while driving due to the nice shape.* [¶ 190 in Diary participant: 1](#)

*I'm glad that I succeeded* [¶ 69 in Diary participant: 2](#)

*I felt intrigued and enthusiastic and also sometimes frustrated, but then very happy. I managed to find something and and yeah, receiving the result that was very nice to see. So thank you.* [¶ 5 in Transcript interview: 2 participant: 2](#)

*Yeah I'm quite happy with it, it's nicely hanging in my kitchen now, I tried it out already. And I was looking at maybe wanting a wider handle to it, like I have with my adapted cutlery, but then when using it I realized that that wouldn't be convenient because now it's nice and small and it works just fine like this and I can hold onto the can and hold the tool onto the can with my pointer finger and this keeps the lip of the can out of the way while drinking which makes it a little easier to drink.* [¶ 7 in Transcript interview: 2 participant: 5](#)

## Theme 11: Play

Participants describe play as being a part of creativity, by playing with words or being able to play with 3D printing while not having to be afraid of breaking something, or at first seeing 3D printing as merely a toy.

Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to. [¶ 27 in Transcript interview: 1 participant: 4](#)

I I really like to play with words and to do everything with words and and sentences and stories [¶ 47 in Transcript interview: 1 participant: 4](#)

At first I only saw it as a toy. Now I see many more possibilities. Without this website I would never have started it on my own [¶ 79 in Diary participant: 1](#)

Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities. [¶ 12 in Transcript interview: 2 participant: 1](#)

Oh yeah, it's it opened a door for me... it just, I thought it was out of my league and and now, while getting the the opportunity to to try it and not "break anything" at the same time. Yeah, that's the the the bump in the road is getting smaller. [¶ 13 in Transcript interview: 2 participant: 2](#)

## Theme 12: adapting & hacking

Many participants describe acts of adapting and hacking when talking about products that didn't fit their needs, as well as during the learning process and in the second interview wanting to adapt or hack products in the future.

And yeah, I find it very. Important being able to create the world around me instead of. Being dependent on solutions other people have thought of, because I'm a logic person and I'm an intelligent person, so I like to yeah, be able to. Adapt all those things for me so. [¶ 72 – 74 in Transcript interview: 1 participant: 2](#)

So you could like if you would for the knife situation if you would add something on to the knife, it might. So then you it's like a material you could use to add something on it. So you could use it like that. I think just as the as the actual material of of making the adaptation. [¶ 64 – 66 in Transcript interview: 1 participant: 3](#)

On a personal level through customization. But also in individual parts and thus make a good contribution to the circular economy. [¶ 81 in Diary participant: 1](#)

I now know that I can have a lot of influence on making a design fit my wishes [¶ 40 in Diary participant: 1](#)

After I saw all the examples of solutions people share on the different platforms it gives hope that I can really design a bespoke solution by myself [¶ 89 in Diary participant: 2](#)

I think I would be hacking, because I feel like hey I can adapt something that will then be more suitable for me or others I knew. It's more like not creating new things, but hacking existing equipment that can improved for a range of disabled people. [¶ 48 in Transcript interview: 2 participant: 4](#)

But we printed it again with different settings and now the tool works well. However, it would be nice if you could adjust the opening of the opener to the thickness of the lid edge. That would be a great challenge to explore with a design specialist. I'd be happy to work on this together with someone more experienced! [¶ 6 in Transcript interview: 2 participant: 4](#)

## Theme 13: The possibilities of 3D printing

Many participants describe both being curious of the possibilities of 3D printing and being surprised at the amount of possibilities of 3D printing and realizing that it was possible for them to 3D print too, without having a 3D printer or having much technical knowledge.

See what's possibilities? Sort of kind of database. For possibilities from people that already. Have found some solutions for it. [¶ 98 in Transcript interview: 1 participant: 1](#)

a whole new world opened up for me [¶ 10 in Diary participant: 1](#)

There are possibilities in shape, material and application. You can choose existing designs, adapt them or create your own design. [¶ 14 in Diary participant: 1](#)

I now see that it is possible for everyone and you don't need to have your own 3D printer [¶ 28 in Diary participant: 1](#)

Good. Disabled Design Quest starts at the basics and also gives you a glimpse of the possibilities for creating your own design [¶ 172 in Diary participant: 1](#)

Positive. By having the result in your hands it becomes real and you see even more possibilities. [¶ 166 in Diary participant: 1](#)

Yes because before I could not imagine the possibilities of bespoke 3D printing [¶ 91 in Diary participant: 2](#)  
Yes, otherwise I would not have the courage to find out how 3D printing works. By sharing information, the examples, the weblinks to readymade solutions, to printerpossibilities etc. [¶ 153 – 156 in Diary participant: 2](#)

Yes, because I got the opportunity to try the 3D printer guided by the website. Guiding my through all the parts of 3D printing. First the examples, the different kinds of 3D printing, then what material possibilities and then the testing and printing [¶ 161 – 164 in Diary participant: 2](#)

3D printing can be quite useful and I can get some benefits from it in this way, for my issues. Especially when the type of product I'm looking for isn't available in a store then to be able to print them like this seems really useful [¶ 71 in Diary participant: 5](#)

## Theme 14: Investment & barriers

In interview 1, participants described certain barriers to 3D printing, like not having a 3D printer or not having the knowledge. During the learning process, participants also discovered that they had to invest time, patience, and focus and that certain barriers had to be overcome, like computer problems, struggling with terminology, and learning something new being difficult.

*Yeah, but. I have too many creativities. So I have to limit it for. Everything is. Nice. It's interesting is, but it all takes time, so you have to make choices in what time you have and where you want to spend it on. But I'm very curious in the new techniques.* [¶ 31 – 32 in Transcript interview: 1 participant: 1](#)

*I think when you want something? You have to “verdiepen” [said in Dutch, they mean to delve deeper]. You have to make the the next step to to make it your own.* [¶ 40 – 42 in Transcript interview: 1 participant: 1](#)

*we don't have a 3D printer.* [¶ 64 in Transcript interview: 1 participant: 2](#)

*Take a deep breath and read everything calmly. It all works, but it takes quite a lot of time the first time.* [¶ 87 in Diary participant: 1](#)

*I would never have tried it without this platform* [¶ 101 in Diary participant: 2](#)

*At first I struggled but that is because everything is new to me. After a couple of times it's getting better* [¶ 107 in Diary participant: 2](#)

*Yes but I needed some time and courage to try it* [¶ 168 in Diary participant: 2](#)

*Yeah, if I had loads of time and energy to do so, yeah. I think it's fun to see if you can ... using a design tool to be creative and to figure out and to explore what works or not.* [¶ 26 in Transcript interview: 2 participant: 4](#)

*Yes, like I said earlier, you have to practice and practice. But it is fun to do.* [¶ 36 in Transcript interview: 2 participant: 4](#)

*No not really, although I didn't do the parts with the software. Yeah, that was too complicated, so I chose one of the projects that were on the site which had all the details already, then I just had to choose a color.* [¶ 33 – 35 in Transcript interview: 2 participant: 5](#)

## Theme 15: Clarity & structure

Many participants describe liking the clear structure of DDQ, which provides a clear path forward, but some struggle with the absence of explicit instruction or the language being English or technical.

*Menu is clear and has several options.* [¶ 4 in Diary participant: 1](#)

The website provides a good structure [¶ 16 in Diary participant: 1](#)

The text is English, partly technical and sometimes has long sentences. This cost me some extra effort to understand it well. [¶ 18 in Diary participant: 1](#)

In the beginning you provide an explanation of the abbreviations and later on you do not explain them anymore. [¶ 59 in Diary participant: 1](#)

A supplement in the form of a basic step-by-step plan can provide just that support to make the threshold or introduction easier. [¶ 62 in Diary participant: 1](#)

Good information taught from general to specific. You can also easily look back if you continue at a different time. [¶ 97 in Diary participant: 1](#)

...It is a lot. I now know that you need all the information. And everybody needs something different so it is good to know that there are so many possibilities. You just have to choose what fits you. I would like to have a step by step instruction, really for dummies. I think I will get better in doing it after a lot of exercise [¶ 103 in Diary participant: 2](#)

but I really like that it is well structured and has a step-by-step learning approach and I really like that. [¶ 12 in Diary participant: 4](#)

I still haven't printed anything but, yeah I think that I would be confident in trying so, after reading all the materials and watching the videos, because it is very clearly and elaborately described, what you need to do and what the materials are and what you need to know in working with them [¶ 26 in Diary participant: 4](#)

Yes, I think there could have been more of a division into categories, so like assistive technology, for physical disabilities, kitchen products etc. Yeah, like more divided into categories. Yeah so you can click like kitchen tools [¶ 19 – 25 in Transcript interview: 2 participant: 5](#)

## Theme 16: Interesting & educational

Participants describe the content on DDQ as interesting and educational, they feel like they learned about 3D printing and can use this knowledge in the future because it changed the way they think about it.

Very interesting [¶ 4 in Diary participant: 1](#)

It took me a little longer, but the subject and information given are challenging enough to persevere. [¶ 24 in Diary participant: 1](#)

Well, when it broke when I first tried using it and we decided to print it again, but now on it's side so it would be stronger because of the direction of the printing, we also increase the infill to 60%. This time it was heavier and strong enough and it worked really well for me. [¶ 129 in Diary participant: 4](#)

I just browsed through the website and watched some of the content and see hey this is interesting. [¶ 6 in Diary participant: 4](#)

At first not that much because I already knew a little bit, but then I opened links and started to delve in further I did learn things. [¶ 12 in Diary participant: 5](#)

After being interested in one of the projects on the website, I ordered an item. [¶ 63 in Diary participant: 5](#)  
I thought it was way out of my reach and now I see oh, when you, see other solutions you can... they share all the information and you can use that. And that's very interesting. [¶ 7 in Transcript interview: 2 participant: 2](#)

For me, it's the example projects, because then it kind of forms you ideas into practical stuff. [¶ 38 in Transcript interview: 2 participant: 4](#)

## Theme 17: Thinking about the future

Many participants are relating what they have learned to a change in their mindset and seeing more possibilities to apply the gained knowledge to other areas of their lives and planning to adapt/hack products in the future or 3D print again.

Thanks for this opportunity, it was very educational and I will definitely delve further into this in the future. I have the whole as a very positive experience :-)  
[¶ 191 in Diary participant: 1](#)

Still positive and I will follow the follow-up courses for my own design [¶ 75 in Diary participant: 1](#)

Yes, I would make it larger or more square. And I would like to make changes in the figure. Now it is a Greek letter [¶ 134 in Diary participant: 2](#)

Well, I'm not going to be 3D printing myself, but I am thinking like, if I ever run into an issue in the future and think I would need some kind of assistive product, then I would start thinking about the possibilities that something can be made that could help me. And I would think of a 3D printer to print this. My husband has also gotten more interested in 3D printed throughout this process and is considering looking into it for after he retires. Then maybe he could make things for me, but I also know others who have a 3D printer, so I would consider asking them if they could make something for me, if needed. [¶ 77 in Diary participant: 5](#)

At first I thought I might want a bigger handle, but after using it I realized that I liked to leave it on there and hold it with one hand, then I'm not bothered by the little clip that is on the can while drinking. So it's actually good the way it is. [¶ 130 in Diary participant: 5](#)

I think I would be hacking, because I feel like hey I can adapt something that will then be more suitable for me or others I knew. It's more like not creating new things, but hacking existing equipment that can improved for a range of disabled people. [¶ 48 in Transcript interview: 2 participant: 4](#)

Well then I would start designing it in my head and start thinking of how I would want it to be and then I would ask someone I know if that was possible for them to 3D print it for me. [¶ 17 in Transcript interview: 2 participant: 5](#)

## Theme 18: Product doesn't fit with needs

Participants describe some of the problems they currently have with products, because these products don't fit with their needs, they want to change this, but don't always know how, for have an idea for how but don't know how to put it into practice.

*The mouse isn't. And good for the left hand design. Yeah, so.* [¶ 68 in Transcript interview: 1 participant: 1](#)

*With cooking and stuff. So using a knife to like put make things very like cut things very small, like big things is fine, but like getting it very small because I can't put as much pressure on my hands to like I can't pull down as much with one hand. So I have to use both hands to push down. So that was something something that would be a lot if that would change like how you would hold a knife or I think.* [¶ 40 in Transcript interview: 1 participant: 3](#)

*One, it's the. It's the cooking hob. It's the cooking hob. I'm very frustrated by because before I had this one. I had another one and all those those. Touch. How do you call them? Those touch screen buttons? How do you call them those those touch screen button they were, they were exactly. In the middle of the of the thing they were, they were in front in the middle of the thing and all those. How do you call it English? All those push dingy thingies, all those keys they were, they were. Exactly under my fingers when I grab the the. The the kitchen top the kitchen top to be to be secure and to stand secure. There are always under my fingers, so I was constantly touching those those buttons. So constantly when I was cooking I put off the stove and I put it on again and put it off and put it on and put it off and put it so that was. Kind of a frustration and it was a hell of a job to find another one that's not. That's designed in such a way that I have room to put my hands on. So. So, yeah, that's the thing. I thought, OK, I did this for for many, many years now. Now I'm. I'm sort of. Well, I'm fed up with it. Let's, let's get another one. And still it is better because they are. These are sliders, but it's very hard to find a decent.* [¶ 63 – 75 in Transcript interview: 1 participant: 4](#)

*I struggle with finding the right key for differ locks* [¶ 67 in Diary participant: 2](#)

# 10.

## Discussion

With the results of the activities and the analysis of the presented data from the previous chapters, the research questions can be answered, first the sub-questions will be answered and then the main research question.

### **RQ1a. How may a hacking activity by disabled people to design for justice be supported?**

Disabled people can effectively hack a small household appliance with the support of designers and makers and guidance from a researcher, but they need more guidance through the design process to be able to do it effectively by themselves, even with the support of designers and makers they didn't really know where to start and how to approach the hacking. Therefore a toolkit is to be designed to support disabled people to be able to hack independently. The data from Activity 1 was used to formulate the requirements for this toolkit. These were divided into 3 themes (atmosphere, design process and tools), and for each theme, there are want and need requirements, the want requirements being optional and the need requirements more essential.

The requirements are:

#### **Atmosphere**

**Needs:** Atmosphere of disability pride, diversity, equity and inclusion. As accessible as possible to disabled people.

**Wants:** Explores the atmosphere of access intimacy. Invites the designer into the disabled world instead of the other way around. Foster interdependence without negatively affecting the disabled person.

#### **Design process**

**Needs:** The toolkit must guide the users through the process and offer tools and resources along the way. Supporting crip hacking with the possibility of bringing professionals in, but the process is disabled person-led. Guidance towards crip hacking instead of completely new designs as a first step.

**Wants:** Something physical for embodied interaction.

#### **Tools**

**Needs:** Include in the process the introduction/getting to know the creative materials.

**Wants:** The toolkit should include a collection of creative materials, including additional materials such as a crochet hook, LEGO dots for texture, or braille. Design justice principles could be helpful, but they should be integrated into the toolkit and process more, either by always showing them (on a poster or something like it) or by integrating them into the design process.

Several ideation sessions took place. The resulting ideas were compared to the requirements. The needs requirements had a weight of 2, and the wants requirements had a weight of 1. The scores for each idea were added up. A combination of a few of the highest-scoring ideas was chosen to conceptualise further into the DDQ concept. This concept was prototyped in Figma and used by disabled people in Activity 2.



### **RQ1b. How does a creative learning activity impact the creative confidence of disabled people who are non-designers?**

The results of activity 2 show that all participants who completed it showed an increase in their creative confidence, either in the grade they gave themselves or in their self-described feeling of having increased creative confidence.

To get to this point the participants went through a creative learning process supported by the prototype of Disabled Design Quest. The participants generally define confidence as feeling assured, having agency, and having the knowledge and ability to do something. Creativity is defined by the participants as imaginativeness and creative thinking, creating and expressing their inner world and problem-solving. Many participants describe participating in creative activities as being about play, for example, playing with words playing in theatre, making music or creating physical objects.

At the beginning of Activity 2, the participants expressed their excitement and enthusiasm to learn about 3D printing. They talked about how products didn't work for them and already displayed problem-solving skills. The participants give themselves about average grades for their self-perceived creative confidence, around a 6-7, except for Participant 1, who gives himself a 9, but does discover through the learning process that he overestimated himself. Most participants say that they don't feel like they are practically capable of adapting/hacking the products that don't work for them. Some also say that trying/learning about a new creative activity takes a certain amount of investment, like they don't have a 3D printer, or they don't have the knowledge required to do the activity or don't have the time to invest in it to learn.

The participants wrote a diary about their experience learning to 3D print and using DDQ. Many participants describe facing multiple barriers, like the English language of the prototype website, technical language in the text or computer problems. As well as having to make investments like time or focus on learning to 3D print. Many participants feel overwhelmed with the amount of information and the possibilities 3D printing offers. They overcome this overwhelm by finding the information interesting and educational and being excited and enthusiastic to learn more and asking for help. When the participants started learning about 3D printing, they started to see the possibilities, being inspired by other people's work, and being able to ask for help. They started seeing that they also could 3D print even if they didn't have a 3D printer and had limited knowledge and experience. They started to see how they could adapt or hack products that didn't work for them and that they could have agency over the design of the products they use.

When the participants reflected after receiving their requested 3D print, they often felt satisfaction and pride, although Participant 4 needed a second version but was satisfied after that. The participants recognized that they now knew more about what was possible with 3D printing and started thinking of future use of the knowledge gained and how they could apply it to other areas or how they could adapt/hack other products that don't fit their needs. Participants mentioned that the DDQ website helped them learn because it had a clear structure and was a clear path forward to learning, some struggled with the long sentences and recommended having text in two columns and repeating explanations of abbreviations. Overall, all participants agreed that the website helped them get further and learn more easily than they would have without it, and this increased their confidence in being creative in making or adapting/hacking.

A pattern in the learning process that can be seen is, at first, there is excitement to learn something new but overwhelmed with the information and possibilities, some barriers and problems, but the information is interesting & educational enough to make the participants want to pursue it further. Then they get to the practical part, where they get to print and receive the 3D print; they feel satisfaction with it and excitement to try and do more in the future with their increased confidence.

### **RQ1. How may the creative confidence in hacking and making of disabled people be supported?**

At the beginning of this thesis project, literature research was conducted on background themes like disability, ableism, design, making, and crip-hacking. Some design methods for more inclusive design were described, and some toolkits were described to get a sense of the problem space and solutions that had already been proposed to see if any gaps needed to be filled. This highlighted the need to recognise and support the agency of disabled people over their products by supporting creativity and confidence.

The concept took shape through the requirements from Activity 1 and became a toolkit named Disabled Design Quest, a website with a community of like-minded disabled makers of different skill levels. Makers can share their projects and ask others for help via private messages or the forum. The toolkit contains lessons in the form of skills visually represented in a skill tree. Novice disabled makers can learn step-by-step about the process and technical language surrounding 3D printing. This toolkit was prototyped in Figma, accessibility guidelines were taken into account, and the website was tested and improved according to these guidelines.

Disabled people used this prototype during Activity 2; they wrote about their experience in a diary, and interviews were done both at the start and at the end to give insight into the participant's change in creative confidence. All the participants who finished the activity reported an increase in creative confidence. The participants related this increase to several parts of the DDQ website, such as the step-by-step instructions, learning about the possibilities and seeing other people's 3D printing projects, which gave them more confidence in their capacity to make and hack themselves. The participants also derived confidence from the satisfaction and pride they felt after successfully printing their first 3D model. They were able to play with this technology in a safe environment, not having to be afraid to break anything. According to the participants, the website was clear, interesting and educational. They were already thinking about what to do with these acquired skills, 3D printing in the future, thinking about circularity with a repair café, talking with others about what they learned and wanting to share the knowledge widely. The participants also talked about some projects they were thinking of doing, adapting products to fit better with their needs or creating new products. The participants were able to increase their creative confidence in making and hacking so they could take back agency.

### **Implications & recommendations for future research**

With the results of this research, more insight can be gained about the possibilities of using a website with educational information and community elements that can be suitable to increase the creative confidence of disabled people in hacking/making. In the future, this type of toolkit should be explored further by creating a prototype that includes all the functions and has a longer study duration to be able to evaluate the impact of this type of

website on the creative confidence of disabled people long term. This could, for example, be done with a more quantitative study where the toolkit is spread through disability forums and online disability communities to a diverse community of disabled people and get insight into the impact of this type of toolkit over the duration of months to a year. To ensure the impact can be maintained in different disabled people over a longer duration.

This prototype should also be thoroughly evaluated by web accessibility experts as well as by disabled people. The plan initially was to include a more extensive accessibility evaluation in this thesis research but this turned out to be not feasible with the time and monetary limitations. However, it was also determined that this type of evaluation deserves its own thorough evaluation as a separate study dedicated to evaluating the full accessibility of the website. The website was designed with accessibility guidelines in mind. Some parts were tested, for example, the colour contrast for colour-blind people and the webpages were tested using a screen reader to evaluate the suitability for use by people who use screen readers to access websites. This was done as part of the conceptualization and prototyping process and does not render a thorough accessibility evaluation unnecessary in a future study. This smaller evaluation as part of the conceptualization can be found in Chapter 8.

## Limitations

This thesis project also has some limitations: the wider problem space and the lack of solutions for it, limited application of design justice, sub-optimal execution of thematic analysis, a non-educator creating educational content, the concept won't work for every disabled person, and lastly, the diversity of the participants in Activities 1 and 2.

## Problem space

The problem space addressed in this thesis cannot be solved in its entirety with a website. Nonetheless, this work aims to be a step in the direction of enabling disabled people to take back agency over their AT, but systematic change is still needed.

The concept focuses on 3D printing as the main making tool for now which is limited in scale for what can be created and therefore limits applicability. In future iterations of the toolkit this could be expanded to include other maker tools and skills.

## Design justice

Even though I intended to follow the principles of Design Justice for this thesis project, I didn't adhere to all of them. I will go through each principle one by one to explain how I followed or didn't follow it.

'1. We use design to sustain, heal, and empower our communities, as well as to seek liberation from exploitative and oppressive systems' (*Read the Principles*, n.d.) → I followed this principle, my concept DDQ includes giving disabled people the opportunity to take the power and decide what kind of AT or other tools they want to use, they are free from someone else deciding what kind of AT they need or have a right to and they have options of repairing/reprinting parts when they get damaged, not having to wait for someone else, they can take back their agency.

'2. We center the voices of those who are directly impacted by the outcomes of the design process' (*Read the Principles*, n.d.) → yes, throughout this thesis project, I have centred and recentred the community that could be impacted by the outcomes of the design process.

'3. We prioritize design's impact on the community over the intentions of the designer' (*Read the Principles*, n.d.) → I would like to think so, but I cannot be sure because of course as a disabled designer I would like to think I prioritise the impact on the disabled community, but I cannot be sure that that is free of bias because at the end of the day I am still a designer.

'4. We view change as emergent from an accountable, accessible, and collaborative process, rather than as a point at the end of a process' (*Read the Principles*, n.d.) → yes and no, I did include the target group in my research at 2 points directly and at other points indirectly by including works by disabled people, but in the end, it is my thesis project and it wasn't truly collaborative. With how the thesis project is set up, this is not possible; it has to be an individual project and can, therefore, not be truly collaborative.

'5. We see the role of the designer as a facilitator rather than an expert' (*Read the Principles*, n.d.) → no, I did not follow this principle, unfortunately, it was not possible for me to do this, since it is my thesis project and the initiative for this assignment and goals came from me, not from a community initiative.

'6. We believe that everyone is an expert based on their own lived experience and that we all have unique and brilliant contributions to bring to a design process' (*Read the Principles*, n.d.) → yes, throughout the process I tried to value the experience of the disabled participants and disabled writers and creators equal or even more than some literature sources written about disabled people because, in the end, this project was about the disabled community and supporting them into being more confident in their making and hacking.

'7. We share design knowledge and tools with our communities' (*Read the Principles*, n.d.) → yes, that was the whole goal of the DDQ concept, to share knowledge and tools from the design world and maker movement with the disabled community.

'8. We work towards sustainable, community-led and -controlled outcomes' (*Read the Principles*, n.d.) → no, this effort was not community-led or community-controlled, even though I am part of the disabled community I am not part of the target group for my concept because I am a designer, therefore I don't see this project as community-led or controlled.

'9. We work towards non-exploitative solutions that reconnect us to the earth and to each other' (*Read the Principles*, n.d.) → yes and no, 3D printing is not the most sustainable practice, with a lot of plastic and a big electricity slurping machine. But the focus is on making and hacking which can be sustainable practices of repairing and adapting technology to be functional for longer.

'10. Before seeking new design solutions, we look for what is already working at the community level. We honor and uplift traditional, Indigenous, and local knowledge and practices' (*Read the Principles*, n.d.) → Yes, I started by looking at crip-hacking, online communities etc. and put this together with design knowledge and experience with 3D printing to form the concept.

## **Thematic analysis**

The thematic analysis was done by the same person who carried out the interviews, which can result in some personal biases from the researcher to be reflected upon the analysis. The focus could have been skewed toward the questions that were asked. Furthermore, the participants were all family, friends or acquaintances of the researcher; this relates heavily to

the restrictions in budget and time constraints but could have had some impact on the outcomes objectivity.

### **Educational content**

I am not an educator and have written the educational content on DDQ to the best of my ability, but this is not what I am trained in. Therefore, the impact of this content might have been limited by the sub-optimal content and presentation. The content might have been written in too much “technical” language or using too much discipline-specific language. I found out through the feedback in activity 2 that I wrote too long sentences and more academic writing than I thought I did.

### **Limited participation**

Even though I tried to design the DDQ website in the most inclusive way possible, some people will be excluded. Some people might have certain disabilities that are not sufficiently accommodated in my design. This should be solvable by developing the website further and having another evaluation with a more diverse disabled participant group.

The content might not include anything to make skills more accessible to certain disabilities. This is also where the community comes in in my concept. I had some gaps in accessibility for certain disabilities because I couldn't find information online and I didn't have personal experience with them, but this is where people can share when they have figured out how to make something work.

The website currently was developed with all text in English. This did create a barrier for some Dutch participants who didn't feel like they had sufficient English skills and had to use translation apps to use the website. In future development, a version of the website in different languages would be beneficial.

### **Diversity of participants**

The diversity of participants in Activity 2 specifically was limited: 4 participants with a physical disability, one with an additional learning disability and one with a sensory or physical disability. This is not a very diverse group in terms of types of disabilities. The generalizability of this study is, therefore, also low; these people are not representative of all disabled people, and this is something that can be implemented for future research.

# 11.

## Conclusion

This research project was about increasing the creative confidence of disabled people to be able to participate in the maker movement and feel more agency over the design of the products they use. This was researched by setting up the research question: RQ1. How may the creative confidence in hacking and making of disabled people be supported? RQ1a. How may a hacking activity by disabled people to design for justice be supported? RQ1b. How does a creative learning activity impact the creative confidence of disabled people who are non-designers? To answer these research questions, a mini-hackathon, a creative hacking activity with disabled participants, was conducted. This activity resulted in the formulation of requirements for a toolkit that supports disabled people in learning how to make and hack and through doing that, increase their creative confidence. This toolkit was further conceptualized and prototyped as the DDQ website. The impact of this website was determined in Activity 2, a creative learning activity where disabled people did pre-use and post-use interviews and filled in a diary while they used the DDQ website. The filled-in diaries and transcripts from the interviews were analysed with a thematic analysis, which resulted in 18 themes, which can be found in Chapter 8. These themes were then used to answer the research questions.

The participants defined creativity as creating and expressing the inner world and/or imaginativeness & creative thinking and/or play. Confidence was defined as feeling assured, having the knowledge and/or ability and having agency. At the beginning of the use of DDQ participants reported feeling excited to learn something new, then overwhelmed by the information and amount of possibilities, struggled with some barriers like language and computer problems, but overcame these because they found it interesting and educational enough to pursue it further, as well as by asking support from the community, and DDQ provided a clear path forward. Then they displayed problem-solving and started to feel more assured about their ability and knowledge when seeing other people in the community doing it and seeing all the possibilities 3D printing has to offer. They started to see the benefits of having agency over the design of products they use by being able to adapt/hack them to fit better with their needs. All participants who completed the activity eventually were satisfied with their print, and many felt a sense of pride over their ability to create something and started thinking about the future of what they could do with this new knowledge and skill. All of these participants experienced an increase in their self-reported creative confidence during the 2 weeks of use and attributed this to the use of DDQ.

I wrote this thesis wanting to show that disabled people are capable of amazing things; they are creative. They are makers, hackers or designers; they may need some help getting started and a community to support them, but this doesn't mean it's not worth including disabled people in research and design. Even with limited time and budget, I've been able to set up research that included the participation of disabled people and created an accessible toolkit to support disabled people on their maker journey. This thesis outlines the development of a maker/hacker toolkit that can be used in future research, both to inspire researchers and designers to collaborate with disabled people in their process and to show that a toolkit like DDQ can increase creative confidence in disabled people so they can participate in the maker movement, which ultimately I hope will lead to better assistive technology and more inclusive design and research.

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## Appendix A – Informed consent form and information sheet activity 1

# Information sheet Activity 1: mini hackathon – Hacking household products with and for disabled people

I'm currently working on my Master graduation assignment i.e. thesis. The topic of my thesis is Disabled-abled design interconnection – Bridging the gap between informal designers and professional designers with a toolkit based in design justice and crip hacking. Design justice is a set of principles to create design that does the disabled community justice and creates a more equitable inclusive design process and thereby more inclusive designed objects. Crip hacking is a description for the activities that disabled people take part in where they make adaptations/changes to products or use these products other than intended. These 2 concepts I want to use to bring together professional designers and informal designers (disabled people), because everyone designs their life and many disabled people partake in crip hacking practices which falls under informal design. All of this I want to bring together in a practical toolkit that can help in this process of connection, but to do this I first need to understand what how people hack and how this can best be supported, that's why I am doing these research activities.

### **Purpose of the study**

The purpose of the study is to learn more about the process of hacking products with and for disabled people to gain a better understanding how this process can be best supported.

### **Procedure for withdrawal**

If at any point you would like to withdraw your participation from the study you can either let me know during the event, or send me an email at [a.noordeloos@student.utwente.nl](mailto:a.noordeloos@student.utwente.nl) or you can contact my supervisor at [c.zaga@utwente.nl](mailto:c.zaga@utwente.nl) after I graduate.

### **Parts of the hackathon & the data I will collect**

Welcome/introduction – no data will be collected from you here

Diversity Equity & Inclusion (DE&I) talk – I will note down/record any questions people ask, I do this to get a general idea of your views on DE&I, I may use this in my thesis and/or colloquium if relevant, this will always be anonymously. This data will be stored securely on the University of Twente SurfDrive.

Hacking activity – anything you create, write/draw will be collected by me and can be used in my research to learn more about how people hack, if I use it in my thesis it will anonymously. I may also take some pictures while you are working, if these are used in my thesis or presentation your face will be blurred. This data will be saved either physically (anything physical you create) or online on a secure University of Twente SurfDrive

Presenting your results & process – this will be recorded, transcribed and anonymised. I use this to learn more about how you came to the result you did and why you made certain decisions. This data will be stored securely on the University of Twente SurfDrive.

Casual chat with each other – nothing will be recorded, I will write about any observations I made during this time and I can add these to my thesis and/or presentation if relevant. This will be anonymous. This data will be stored securely on the University of Twente SurfDrive.

### **Personal information**

Certain personal information (like your name, email address, age-group, pronouns, disability (if it applies)) have been collected through the sign-up form, this information is needed to give demographic background to my study and be used for communication with you, your personal information will not be in my thesis or colloquium, demographic background will only be used anonymously. The input from the sign-up form will be temporarily saved on the Onedrive cloud until all responses are collected and then it will be saved on a secure University of Twente SurfDrive account, it will not be share outside of the research team.

You can at any point request access to the information that I have of you and you can request rectifications if you feel you were misrepresented. You also have the right to have your personal information erased. Any of the data collected will not be share with anyone outside of the research team.

## **Informed Consent for Activity 1: Mini-hackathon – Hacking household products with and for disabled people**

*'I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described in the aforementioned information brochure "Information sheet mini hackathon – Hacking household products with and for disabled people"*

*I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.*

*My questions have been answered to my satisfaction. I agree of my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time.*

*If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission. If I request further information about the research, now or in the future, I may contact Anouk Noordeloos ([a.noordeloos@student.utwente.nl](mailto:a.noordeloos@student.utwente.nl)) or after her graduation her supervisor: [c.zaga@utwente.nl](mailto:c.zaga@utwente.nl) )*

*If you have any complaints about this research, please direct them to the Secretary of the Natural Sciences and Engineering Sciences Ethics Committee at the University of Twente, P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 5607; email: [a.m.klijnsstra@utwente.nl](mailto:a.m.klijnsstra@utwente.nl)).*

Signed in duplicate:

.....  
Name subject

.....  
Signature

*I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.'*

.....  
Name researcher

.....  
Signature

## Appendix B – Microsoft Forms sign-up form Activity 1

### Sign up for the mini-hackathon

#### Event information

I'm currently working on my MSc thesis and I need your help! I want to support an inclusive design process, using crip hacking and design justice. To learn more about how people hack I'm organizing a mini hardware hackathon together with the DE&I team of the UT, on the 3rd of May 13:45-18:00 at the Design Lab @INFORM at the University of Twente, where you will hack small household products and present your results and process at the end of the event. I'm looking for disabled people, makers, designers, researchers or others interested in the topic. What's in it for you: a fun event that could broaden your horizon and experience with a mini-hackathon in a multi-disciplinary team. Tea & coffee will be provided.

#### Event schedule:

13:30 - 13:45 Walk-in  
13:45 - 14:00 Introduction  
14:00 - 14:15 DE&I talk  
14:15 - 17:00 Hacking activity  
17:00 - 17:30 Sharing findings and process  
17:30 - 18:00 Casual chat with each other  
18:00 End of Event

#### Accessibility information:

- Wheelchair-accessible entrance (with ramp) & space access
- Wheelchair-accessible toilet
- Wheelchair-accessible parking is available at the guest parking of the Gallery at the Hengelosestraat (this is also where the accessible entrance is), you have to call in at the barrier and tell them you'll be visiting the Design Lab and need accessible parking.
- Signs will be posted from the entrance to the event space
- Space for breast-feeding/pumping available upon request
- Quiet space available upon request
- Breaks can be taken at any moment
- Support people also welcome
- Service animals welcome
- We will be using live transcription software during the plenary parts of the mini-hackathon
- Attending the hackathon online is not possible, but if you already have experience with (crip)hacking, you can partake in the interviews that take place after the event (send me an email at a.noordeloos@student.utwente.nl to sign-up for that if you cannot partake in the mini-hackathon)
- Covid or other infectious disease precautions (like masking and distancing) are no longer in use at the UT and because it's a relatively public place we cannot mandate mask-wearing
- Please let me know if you have any other accessibility needs
- You can let me know about your accessibility needs at question 8 on the sign-up form

\* Required

1. First and last name \*

2. Email address \*

3. What are your preferred pronouns? \*

- She/her
- He/him
- They/them
- Other

4. Age group \*

- Under 16 (you can unfortunately not partake)
- 16-25
- 26-35
- 36-45
- 46-55
- 56-65
- 65+

5. How would you describe yourself? (you can check more than one box) \*

- Maker (rapid prototyping skills, other creative skills in art, drawing etc.)
- Designer
- Researcher
- Scientist
- Other

6. Do you identify as disabled? \*

- Yes
- No

7. Would you like to talk about your disability within your group? \*

- Yes, I would like to give my group information about my disability and they can ask me questions about it to inform the design/hacking (I am still in control as to how much I share)
- No, I would rather give insight into general disability but I don't want to discuss my specific disability/condition
- Other

8. Do you have a preference for a specific appliance to work on? \*

- Hand blender/stick blender
- Bread toaster
- Electric water kettle
- Panini/waffle/toastie maker
- Blender
- No preference

9. What accessibility needs do you have?

- Wheelchair accessible entrance & space
- Wheelchair accessible parking
- Accessible toilet
- Quiet space
- Breast-feeding/pumping space
- Need to bring a support person
- Need to bring service animal
- Live captioning of the plenary parts of the session
- Other

10. Do you have any questions or remarks?

---

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

 Microsoft Forms

## Appendix C – Message via MIRO to participants after sign-up

Dear [Participant name],

Thank you for signing up for the mini-hackathon! The event will take place on the 3rd of May, to create the groups for the hacking activity you get access to this Miro board, your name has been added to the board, you can drag your name into a certain group, you can pick the product you want to work on, but do try to complete groups first, so join a group that already has someone else in it, taking diversity into account (a group needs at least one disabled person, one maker and one designer/researcher). You will receive an extra email closer to the event with a reminder and with some tips for participation. Please let me know if you have any questions and see you there!

Kind regards, Anouk

## Appendix D – Expectations and experience form activity 1

Name:

### Mini-Hackathon questionnaire

What are your current expectations/experiences with designing/researching/making for and with disabled people?

What are your expectations of this event?

Any other remarks:

**Please circle which one applies:**

Would you be open to having a one-on-one interview to discuss your answers further? **Yes/No**

Can I approach you at a later stage in my project to give feedback on my design? **Yes/No**

Would you like to see the end result of my research? **Yes/No**



## Appendix E – Activity 1: mini-hackathon event schedule

Times	What	Data collection	Where	Who
<b>13:00-13:30</b>	Setting up the room, putting table numbers on each table, setting up beamer with presentation, setting up signs to the event room	No data collection	Event room, route to the event room from entrances	Me
<b>13:30-13:45</b>	Walk-in. Filling in the expectations and experience form. Signing the informed consent form.	Small questionnaire filled in with expectations and experience (see Appendix H) Observing participants how they interact with each other, the way they talk about the activity and people with disabilities	Event room & route to event room	Me + 1 support person (helping with accessibility issues)
<b>13:45-14:00</b>	Presentation at the front, introducing topic, schedule of the day	Observing participants, recording any questions that the participants pose	Event room	Me + 1 support person at the table in case someone is late
<b>14:00-14:15</b> Was the planning but didn't end up happening so instead I gave a talk about DE&I at the UT	DE&I talk	Observing participants, recording any questions that the participants pose and how they act during the talk	Event room	Sterre
<b>14:15-14:30</b>	Design justice principles, instructions prototyping	Observing participants, recording any questions that the participants pose and how they act during the talk	Event room	Me

<b>14:30-17:00</b>	Hacking activity, the participants get a small electrical appliance, walking around the tables, seeing if they have any questions. Coffee and tea can be requested	Observing participants, asking them questions about how they approach things, listening in on their process	Event room	Me + 1 support person that can help with questions about materials/tools etc.
<b>17:00-17:30</b>	Presenting findings, each group goes to the front and explains their concept and process, afterwards groups can ask each other questions and I also ask them questions	Observing how they talk about their hacked object, people with disabilities etc. Observing how the audience reacts to what the presenting group says Asking questions to the presenting groups, recording presentations and Q&A to record their answers.	Event room	Me
<b>17:30-18:00</b>	Casual chats with coffee and tea	Observing participants how they interact with each other, the way they talk about the activity and people with disabilities	Event room	Me + 1 support person
<b>18:00-18:30</b>	Clearing everything	No data collection	Event room & route to event room	Me + 2 support people

## Appendix F – Email with tips to disabled participants

Subject: Mini-hackathon: Reminder & tips from a disabled person to a disabled person

Dear participant,

The mini-hackathon is coming up quickly, I hope to see you Friday!

I saw on the sign-up form you identify as disabled and want to talk about your disability within your hackathon group. As a disabled person myself I have a few tips to make sure your experience during this hackathon is a positive one.

1. You have the control on what to share, always. You can decide what you want to share where do you draw the boundary, what is too private to share and what are you okay with sharing. It can be good to think about this beforehand, this makes it easier in the moment when a question comes up you don't want to answer.
2. You can only represent yourself, you don't represent all disabled people and nobody can ask you to do that. You can share your opinions, your needs, your preferences, and if you know of anyone else's you can of course share, but your answers shouldn't be generalized for all disabled people, each disabled person is unique but there are experiences that are universal amongst disabled people.
3. Think about how you like to be referred to, most disabled people use the term disabled to describe themselves, but others have a preference for handicapped or another term, and you can have a preference for identity-first language (disabled person) or person-first language (person with a disability), you can let your group know what your preference is. But when we're talking about all disabled people as a group, I usually stick with the one that most disabled people and disabled activists prefer which is disabled people.
4. If there is anything you need that I or your group hasn't thought of, please let me and your group know. If you let me know before the event I can make accommodations for you. If there are for example communication needs during the mini-hackathon (ie. need for articulation) or you would like your group to know about things they can help you with, please let the group know.
5. You deserve to be there, this project and thereby this mini-hackathon is rooted in design justice and disability justice, you are equal to other participants while centring the disabled experience.

During the mini-hackathon I will ask you to sign an informed consent form, I've added that as an attachment to this email so you can already read through it beforehand if you want.

I hope the hackathon will be a fun and nice experience for you and all the other participants, see you there!

Kind regards,

Anouk

## Appendix G – Email with tips for working with disabled people to non-disabled people

Subject: Mini-hackathon: Reminder & tips on working with disabled people

Dear participant,

The mini-hackathon is coming up quickly, I hope to see you Friday!

In your sign-up form you did not identify as disabled, but you will be working with disabled people during the mini-hackathon, this email will provide you with some tips on how to make this collaboration go smoothly.

1. The disabled person is in control of what they share, always. They can decide not to share certain things and draw certain boundaries, you have to respect them.
2. Don't expect a disabled person to speak on behalf of all disabled people, they can represent themselves and maybe some others they know, but they cannot represent all disabled people and the disabled participant's opinions, needs or preferences should not be generalized for the entire disabled community, every disabled person is different. There are some universal experiences amongst disabled people like ableism, but still the individuals experience of this cannot be generalized to every disabled person.
3. In general I use the term -disabled people- to refer to disabled people as a group because from most disabled people I know and disabled activist prefer the term disabled people but individual disabled people might prefer a different term, or might prefer person-first language (people with disabilities) you can ask them what they prefer and respect whatever they tell you. The same goes for pronouns.
4. If a disabled participant asks for your help, ask them how they would like to be helped, be honest about what you can and cannot do, and if you can help a disabled person in the way they want to be helped. If you offer help and a disabled person declines, you have to respect that, don't force your help on them, even if you mean well.
5. Be aware the disabled people deserve to be there, the same way that you do, but this project is about centring the disabled experience and rooted in design justice and disability justice. You may want to look these things up if you are unfamiliar. And as general advise, try to seek out disabled activists and disabled people online and in real-life, this can broaden your horizon and get a better understanding of the people around you, disabled people are everywhere and deserve to be here just as much as anyone else.

During the mini-hackathon I will ask you to sign an informed consent form, I've added that as an attachment to this email so you can already read through it beforehand if you want.

I hope the hackathon will be a fun and nice experience for you and all the other participants, see you there!

Kind regards,

Anouk

## Appendix H- Design Justice principles cards

Images and text from: (*Read the Principles*, n.d.)



### Design Justice Network Principles

Design mediates so much of our realities and has tremendous impact on our lives, yet very few of us participate in design processes. In particular, the people who are most adversely affected by design decisions—about visual culture, new technologies, the planning of our communities, or the structure of our political and economic systems—tend to have the least influence on those decisions and how they are made. Design justice rethinks design processes, centers people who are normally marginalized by design, and uses collaborative, creative practices to address the deepest challenges our communities face.

Read more at <https://designjustice.org/>



We use design to **sustain, heal, and empower** our communities, as well as to seek liberation from exploitative and oppressive systems.



We **center the voices of those who are directly impacted** by the outcomes of the design process.



We **prioritize design's impact on the community** over the intentions of the designer.



We view **change as emergent from an accountable, accessible, and collaborative process**, rather than as a point at the end of a process.



We see the role of the **designer as a facilitator rather than an expert**.



We believe that **everyone is an expert based on their own lived experience**, and that we all have unique and brilliant contributions to bring to a design process.



We share **design knowledge and tools** with our communities.



We work towards **sustainable, community-led and controlled** outcomes.



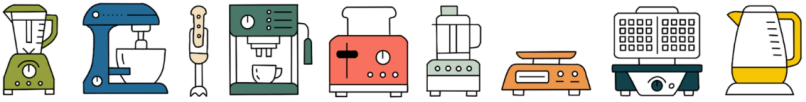
We work towards **non-exploitative solutions** that reconnect us to the earth and to each other




Before seeking new design solutions, **we look for what is already working** at the community level. We honor and uplift traditional, indigenous, and local knowledge and practices



# Appendix I – Activity 1 PowerPoint presentation




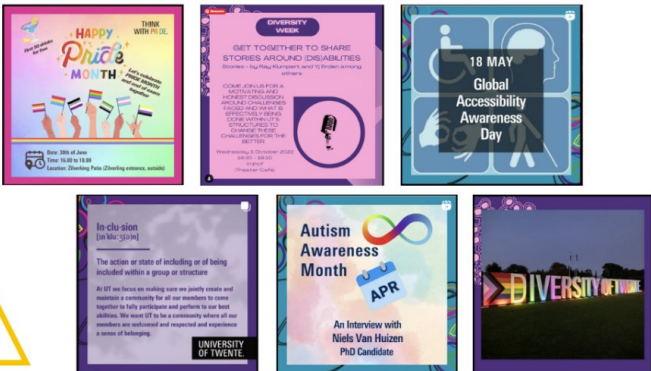
## Mini-hackathon



### Schedule

- Introduction
- DE&I UT talk
- Design Justice & crimp hacking
- Prototyping & inspiration
- Start mini-hackathon
- Presenting results
- Casual chat

### DE&I UT



From: (Understanding Success Criterion 1.4.3: Contrast (Minimum) | WAI | W3C on Instagram, n.d.)

## Design Justice & crip hacking

- Design Justice Network
- Principles
- Crip hacking



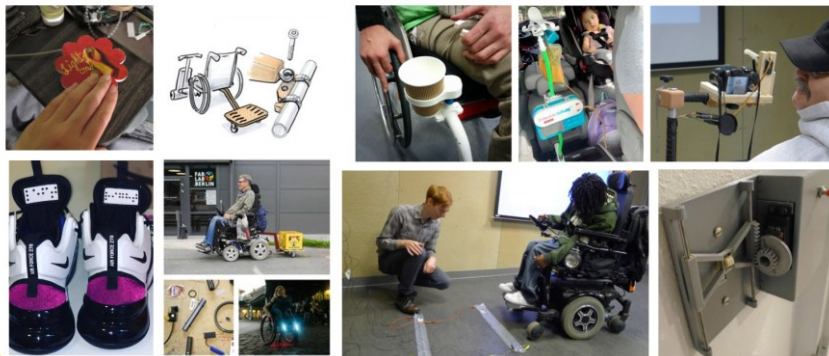
From: (*Read the Principles*, n.d.)

## Cardboard prototyping



From: (Quirky, 2014)

## Arduino & crip hacking inspiration

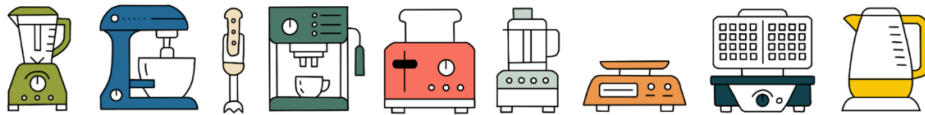


From (left to right, first row first then second row): (michaelmcallister9, 2011), (heise online, 2017), (*3D Printable Hackcess Handy Holder by Evavoo*, n.d.), (*FreeArm*, n.d.), (joelovesnetneutrality, 2011), (Braille Code Inc., n.d.), (heise online, 2017), (michaelmcallister9, 2011), (alanmerritt, n.d.)

Consent forms &  
experience/expectations form



Let's hack!



## Appendix J - Questions activity 1 process

- Can you walk us through the steps you took from first ideas to what you just presented?
- Did having a disabled person on the team change the decisions you made?
- What techniques, tools or methods did you use?
- How is the hacked product an improvement upon the original in terms of accessibility and usability for disabled people?
- What does this new design mean to you?
- What materials did you use, which were helpful?
- What do you think or hope it will mean for possible future users (if it were to get made) of this product? And how it would impact them?
- What did you learn or what insights have you gained from this experience?
- Did this experience change your perspective on designing with disabled people?

## Appendix K – transcript Activity 1: mini-hackathon

**Researcher:** Welcome to the mini-hackathon! So, uhm, I will show you the schedule. First I will give a little introduction, I will talk a little bit about the DE&I at the University, the Diversity, Equity and inclusion team, they were supposed to give a little talk here via a video, unfortunately that didn't happen, so we are going to do it without them, so I'm going to give a little introduction and tell you something about that.

[Participant 5 walks in]

**Researcher:** Hi welcome!

**Participant 5:** Is this for the hackathon?

**Researcher:** Yes, come join us. We just started so.

[Participant 5 sits down]

**Researcher:** So after that I will talk a little bit about design justice and crip hacking, then I will show some things about prototyping and inspiration and then we can start the hackathon, and then after that I ask that you present to the others what you have done, what the result is, tell something about it. And after that we can have a little casual chat and have some tea.

Okay, as I said, unfortunately the DE&I team couldn't be here today, but I did want to share a little bit about what they do here at the university, so the DE&I team stands for Diversity, Equity and inclusion, they do a lot of things, they organize several events, on pride month, autism awareness, they have organized during diversity week many events about accessibility, inclusivity. Yeah, they try to go against the discriminatory things that are going in the world. They are doing really great things here at the UT, which is why I wanted to involve them, also to show a little bit of background here at the UT work is being done on these kinds of topics.

Okay, then for my thesis one of the main themes is Design Justice and crip hacking, so I wanted to explain a little bit about what that is. Design Justice is a framework developed by the Design Justice Network to create a more equitable design process and make it more inclusive, they have come up with 10 principles, I put those on the tables, so during the hackathon you can read through those and take it as a guideline on how to be more inclusive in your design. Then crip-hacking is another very important And then Crip Hacking is another very important topic in my thesis, and Crip Hacking comes from the derogatory term Cripple for disabled people, which we don't use anymore. But a lot of disabled people are reclaiming the term and making it their own.

And one of these things is Crip Hacking, which means that disabled people are hacking products and making it their own and making it more usable for their lives and their disability. And so I kind of wanted to use that as a connecting method between designer and disabled person.

And today will consist of partly cardboard prototyping and some other forms of prototyping. So I thought I would give a little introductory video on that, if it will work. Well, that's great, it doesn't work. Basically, it's about how you can make cardboard prototypes by using different techniques, such as scoring on one side to make bends. And you can make all sorts of shapes and colors and yeah, that.

Then I have here some inspiration, some projects that are done already to give you some kind of ideas. So, for example, you have in the left top button, you have a big button that is used for controlling the lights at a distance. And then there is some sort of cart that is attached to the back of a wheelchair so they can carry a beer crate. [pointing to images on the ppt] A 3D printed cup holder, a phone mount that is used for a feeding tube pump, some kind of stand for a photography camera that can also be used with a little switch that's placed next to the thigh so he can control it without using his hands. And then the shoes are actually with little dots.

So it's Braille to make sure the person knows which is left and which is right. And the electric wheelchair with the strips is also to control the lights. When he rolls over it, they turn on or off.

And this one in the corner is to control a light switch remotely. And these are more kind of simple ideas that you can already, they already exist in the world. For example, there's an organization that provides free 3D printing models for a lot of these things.

So there's like an object to help you type if you have some dexterity issues or to open bottles, to pull plug out of socket or to open the faucet. Yeah, a lots of things are possible. And these are the kind of ideas we're kind of looking at.

And a lot of these are designed by disabled people for their own use or for others in the community. Okay. A lot of you already signed the consent forms, but not everyone [hands informed consent forms to all participants who don't have one yet] If you could please fill this in.

And then I also have a form asking kind of what you've already done around this whole thing, your experience or if you have any, what are your expectations are?

**Participant 4:** Do you have a pen?

**Researcher:** Yes [hands participant 4 a pen and puts more out on the table so the participants can fill out the experience and expectations form and the informed consent forms]

**Researcher:** Are you all done? [participants nod] Okay, then we can start the hackathon.

Over here [points to a table with several creative materials and a Design Lab cart with pens, post-it's etc.], I have a bunch of materials. So we have cardboard, we have paper for sketching. Here's lots of pens and post-its and other creative materials. But I've also included some specific things like this [pick up the sticker "gems"] you can use for braille or texture or things like that. Or to create a button. So, yeah, lots of things to use.

You can use everything. And in my mind, we're going to have two teams. One on the water kettle and one on the toaster. But if you're like, it's just all going to work together [participants all joined one table and a few people where late/couldn't make it so it was a smaller group than expected], that's also a possibility.

**Participant 4:** [speaking to participant 1] I think you wanted to go for the kettle right?

**Participant 1:** Yes, I would like that.

**Participant 6:** So we can make anything we want? [further sound inaudible]

**Researcher:** Oh, yeah, you can just take the kettle and you can design something around that, you can put things on the kettle or make a whole new one, you're free to do what you want, as long as it is still related to the themes I just discussed and around the water kettle or toaster.

**Participant 6:** so what about that one? [pointing to the toaster]

**Researcher:** Yeah, so we have a water kettle and we have a toaster. So you can choose if you want to have two teams, and either of you have one or you can all work together and choose one.

**Participant 5:** Can we do both?

**Participant 4:** Yeah sure, if you want.

**Participant 6:** more materials!

**All:** Yeah, yeah, yeah.

**Researcher:** There you go. [Hands participants the toaster]

**Participant 3:** In our toaster at home, the bread jumped so high, it fell off the table. Maybe we can hack it into, like, that the toaster puts it on your plate.

**Researcher:** You don't have to put your hand up, you can just say what you want [towards a participant who raised their hand to speak]

**Participant 5:** Do you have a soldering iron?

**Researcher:** I don't have it here, but there is an electronics lab here at the Design Lab.

**Participant 5:** Yeah, it's pretty practical if you work with electronics.

**Researcher:** Yes, but since it is here at the UT, it is mandatory to do a safety course before you can use that.

**Participant 5:** I can do that.

**Researcher:** Yes, but they only do them at certain times. That's more the problem.

**Participant 2:** Where do you get the...

**Researcher:** We do have Arduino stuff, which you can use without soldering.

**Participant 6:** Oh, we can actually do... Okay, so let's do that.

[Participants seem to be unsure what materials are available]

**Researcher:** I can also just put the materials here, if you would rather do that.

**Participant 6:** Yeah.

**Researcher:** Whatever you want.

**Participant 6:** This is completely new to me, I don't even know how to start.

**Participant 4:** Yeah, where do we start?

**Researcher:** Well, my idea would be that someone with a disability here kind of explains how one of these is an issue for them. That would be my guess.

**Participant 6:** Ah, yeah, so what part of that we could solve, so to say.

**Researcher:** That would be my initial idea. But if that doesn't work, you can try looking up what other people have issues with these appliances. Or, you know, something like that.

[it stays silent]

**Researcher:** If you want, I can demonstrate what an issue is for me with these. Would also be okay, but yeah.

**Participant 2:** So how long was it?

**Researcher:** Huh?

**Participant 2:** Till how late did we have?

**Researcher:** You have until like 5.30 and then afterwards it was half an hour for chatting. But, you know, we can continue working if you want, that's fine.

**Participant 3:** How fast can you program?

**Participant 2:** Yeah.

**Participant 5:** What kind of a disability do you all have?

**Researcher:** Yeah, that would be great to start with. [Tries to move an obstacle out of the way] My disability is that I'm not very strong [laughing]

**Participant 5:** Is it a disability or it's just that you're not very strong?

**Researcher:** No [laughing], I do actually have a disability. The wheelchair is not just an accessory.

**Participant 5:** Alright.

**Researcher:** No, I have a connective tissue disorder, so I dislocate my joints and get a lot of injuries. Also, I'm very clumsy. I just cut myself before we even started.

**Participant 6:** If you don't mind me asking, because you're walking around now, but I guess in some situations it's...

**Researcher:** Yeah, it's mostly for a long distance or like days or something like that. But short distances, usually inside the house I usually walk. Also, it's a lot easier because houses aren't very accessible.

**Participant 6:** Especially for that thing [points to the wheelchair and handbike], I can imagine.

**Researcher:** Yeah, and also here [on the University campus] it's not always very accessible.

**Participant 6:** mmm, okay.

**Researcher:** But usually when I'm in a group I won't get up and walk, because people start asking questions, why are you walking, and now it's fine because we're talking about it, it's the topic here. But, I mean, if I'm just following a class, usually I'll stay in the wheelchair because it's just easier. But I can technically walk, yeah.

**Participant 6:** Okay, okay, thank you.

**Researcher:** But the degree varies a lot. So it's still great to have that one.

**Participant 6:** Are we going in a circle?

**Researcher:** Yeah, sure.

**Participant 2:** Autism and ADHD.

**Participant 6:** Okay.

**Participant 5:** Autism. I'm missing a thumb. Broke my femur. Broke a lot of other ones, too.

**Participant 6:** You have to remind me what the femur is again.

**Participant 5:** [in Dutch] Bovenbeen.

**Participant 6:** Ah okay, yeah.

**Participant 5:** It's a tough bone to break.

**All:** Yeah

**Participant 5:** And I did it!

**Researcher:** Quite an achievement.

**Participant 5:** Autism. Asperger. A little ADHD, I think. Dyslexia.

**Researcher:** Oh yeah, that reminds me, I'm also dyslexic. That was kind of like, so normal to me. Yeah.

**Participant 1:** I'm not disabled, but today I'm here as a designer.

**Researcher:** Yeah, great.

**Participant 6:** I also didn't fill in that I was disabled, but I don't hear with my right ear, as far as disabilities go. I wouldn't even call myself a designer, to be honest. But it sounded interesting.

**Researcher:** Yeah, that's totally fine. Everyone is welcome.

**Participant 4:** Yeah, I have a connective tissue disorder as well. In a slightly different way. So I wear braces to support my joints. And I take it easy on my joints.

**Researcher:** Mm-hm

**Participant 4:** Because I don't like when they dislocate. It's rather inconvenient. I also have a number of reading and writing disabilities. That pile up and work themselves out in the ways they do. Basically, I often say that I have a chronic pain and chronic fatigue, symptom package. Because the technical names of things don't really help myself or others understand, how I move through the world.

**Researcher:** Mm-hm

**Participant 3:** Yeah, I have arthritis. But I'm on medication. Which is why it's not really a problem at the moment. I don't really identify as disabled. So I'm also here as a designer.

**Researcher:** Oh yeah, and I have a lot of things that are falling under the connective tissue range. So I also have asthma. And I also have some other weird things. I have a nerve injury in this arm. Yeah. A bunch of things that I just put under the big umbrella of connective tissue disorder. I'm not sure what exactly falls under it. What doesn't.

**Participant 4:** Yeah exactly.

**Participant 5:** Also I'm here because I wanted to show people that even if you miss parts of your body and can't walk and such. You can still do a lot.

**All:** mm-hm

**Participant 5:** And I really like how much I actually can. Because I was always afraid to lose my thumb. That's the main thing which you use if you make things.

**Researcher:** Yeah.

**Participant 5:** And I actually don't really find it a problem. It's really interesting that you can just if you lose something your brain just is like yeah, I can do anything else still, so why not do that? It's pretty interesting.

**Participant 6:** I think your brain actually reuses the part that you might have used for controlling your thumb and then it starts using it for something else where you might get better at other things.

**Participant 5:** I still have my left hand, so I don't know.

**Participant 6:** Yeah so there you go.

**Researcher:** Yeah, I think especially disabled people are very good at adapting to a lot of different environments and situations.

**All:** Yeah, mm-hm.

**Researcher:** And also I have gotten extremely good at moving through the world in a wheelchair where it's like, that's not a skill everyone has. It's harder than it looks. And I think it's pretty cool. You also acquire new skills and you learn to do things differently than you did before but you can still do cool things. I'm doing my masters. If I think of a disabled person in academia, I think that's very hard. And I mean it is. I'm not saying it's easy. It is kind of cool to be like, yeah, we can still do things and do them well.

**Participant 5:** I also have a workplace now that's also really nice. I'm building a lot of things.

**Participant 6:** What kind of stuff do you make?

**Participant 5:** Now I'm building an engine.

**Participant 6 and 1:** Wow. That's really nice.



**Participant 5:** I was like, oh well, this looks doable, let's do it.

**Participant 6:** A cool project to start.

**Participant 5:** Yeah

**Researcher:** [trying to redirect the conversation to the hacking of the household appliances] Okay, so the trouble that I have with a water kettle is that it's usually too heavy to lift for me. And then especially to pour something and to balance that while it's full, while it's hot.

**Participant 4:** Yeah

**Researcher:** Yeah, not loving that. And yeah, it's not my favorite, so often I will only fill it to the minimum so that it's not too heavy. But even then, yeah, I have dislocated my wrist before while pouring this. It's not good. So I don't love this system.

**Participant 6:** Also when filling it, I imagine it's a problem.

**Researcher:** Yeah, but that's a little easier because you're holding it upright, you're not doing like this. [makes a pouring motion with the kettle] This movement is very hard. You can hold it with two hands, if it's not hot.

**Participant 4:** Yeah

**Researcher:** That's not necessarily a problem, it's more like when it is boiling hot. Yeah, this is the only part that doesn't get hot [pointing to the handle], like this usually also gets hot [points to the metal outer casing of the water kettle].

**Participant 6:** Ah, yeah, I get it

**Researcher:** So then it becomes a little more tricky.

**Participant 4:** Yeah, and then there is the danger factor, of boiling water.

**Researcher:** Yeah, exactly.

**Participant 4:** It makes me angsty

**Researcher:** Yeah, exactly. So yeah, that's definitely an appliance I have trouble with.

**Researcher:** [Picking up the toaster] This one I have less trouble with, but then again I also chose it [bought it for myself] because it is very easy to do this. But I've had one in the past where this is very difficult to push down or at least to get it to actually stay down.

**Participant 6:** mm-hm

**Researcher:** But this one is that it's a little too deep, so when your bread is a little short, you have to carefully pinch it and it's hot.

**Participant 6:** Even when it's done.

**Participant 4:** Yeah, ooh exactly

**Researcher:** So I don't love that about it. The main problem for me is it's hot, it's dangerous, and it's difficult and then it becomes a little risky.

**Participant 4:** Yeah especially if you have short bread.

**Researcher:** Yeah, I don't eat the regular normal sliced bread. I like those loaves and those are only this high. And then it's like, it just doesn't stick out.

**Participant 3:** You should have had my toaster, it just shoots on the floor [laughing]

**All:** [laughing]

**Participant 3:** No need to get it out.

**Participant 4:** Then you have another problem.

**Participant 3:** Yes, but not this problem.

**Researcher:** Then I'll get like startled by the bread [laughing].

**Participant 3:** One time it just shot in the dish water [laughing].

**Researcher:** Oh my god [laughing].

**Participant 3:** Then I had to make breakfast again.

**Researcher:** That's also a problem, yeah.

**Participant 6:** Sorry, that's already maybe a continuing question, but we're supposed to now try and make something that's going to make these specifically usable. Because for example, like you're saying, a solution would be to have a toaster where it actually flies up high enough, let's say. But that's not what we're trying to do. We're trying to adapt these.

**Researcher:** Yeah

**Participant 4:** Also, unless it flips it and then magically lands on top, we either have toast over here in the jam or butter or dish water, or it falls right back in.

**All:** yeah

**Participant 4:** And you still have the problem. I'm not babysitting my toaster more than I have to.

**Participant 1:** But I also think he [participant 6] was asking to do with the form and stuff, like if it can change.

**Participant 6:** Yeah to what extent can we make changes?

**Researcher:** Yeah, I mean, you could build out of cardboard a whole new shaped toaster. You don't have to do anything with this [pointing to the toaster on the table], but inspiration that's totally fine.

**Participant 3:** Does anybody else have problems with either of these two?

**Participant 4:** I recognize both problems. Especially because my sense of temperature is a little strange, so things will either feel really hot when they don't actually hurt me, or I won't sense that it could cause injury, and that's also not great. So the toaster one, also the fact that it won't always lock in.

**Researcher:** Yeah, exactly.

**Participant 4:** That's so frustrating

**Researcher:** This one is okay, this one does work, but a lot of them don't. It's also an issue.

**Participant 4:** And for the kettle, I never fill my kettle full, but at work the kettle does get filled full because lots of people want to drink tea and then I'm always like... [demonstrates the struggle of lifting the kettle]. So I just ask my coworkers to pour me a cup of tea, but you don't always have coworkers around.

**All:** Yeah

**Participant 4:** I have fantastic coworkers, but not everyone wants to always be waiting for someone else to make a cup of tea to make their own cup of tea.

**Participant 1:** And I think also maybe if you want to just make a cup of tea with your friends also, you should also be able to do that.

**Participant 4:** Yeah, yeah

**Researcher:** mm-hm

**Participant 1:** Anything else?

**Researcher:** [to participant 2] I think maybe you forget that either of these are done. You forget that they're... I often... he's my husband, so I often ask him to make me a cup of tea and then I have to be like, [Participant 2], it's been done for like 10 minutes.

**Participant 1:** Yeah

**Researcher:** Can you please make me a cup of tea? So I think he, because of ADHD and stuff, he gets distracted and then doesn't know that these things are done because they don't have a bleep or alarm or whatever. Maybe that's from another angle, something we could look at [researcher tries to include non-physical disabilities into the mix].

**Researcher:** [to participant 2] Yeah. Right?

**Participant 2:** mmm

**Researcher:** [to participant 2] You don't see it as an issue because I am your alarm.

**Participant 5:** Why don't you just make it lighter?

**Researcher:** Yeah, I think that's an issue because it needs insulation and stuff to not be massively hot.

**Participant 5:** For a stupid idea. What if you just put a few helium balloons on it? Just to make it a little bit lighter.

**Participant 6:** I love that idea

**All:** laughing

**Participant 1:** I actually saw a video with backpackers. They just put a balloon over their backpack so it's like lighter.

**Participant 5:** You need a big balloon in a light backpack, but you know.

**Participant 3:** The first thing that comes to my mind is those lemonade jugs where you just have a little tap on the bottom.

**Participant 6:** oh yeah

**Participant 2:** That's awesome.

**Participant 6:** You could also have it be elevated and then you can just fill your cup.

**Researcher:** Okay. Maybe you can do some idea sketching or something, here's some paper and pens

**Participant 6:** We've barely started and we already have a solution [laughing]

**Participant 3:** If you have a little hose to fill it.

**Participant 5:** what if you just heat the cup? Water in the cup, the water in the cup I mean.

**Participant 6:** I've also seen some fancy kitchens with what's that called? Can I have that one? It sounds really bad to suggest that as a solution, because you would need to have a really nice kitchen.

**Participant 2:** Sometimes making custom things is more expensive than something like that.

**Participant 6:** That's also true.

**Participant 2:** A bit of hard balance. Choosing an existing product which is maybe not completely suitable, but that's much more cheaper than designing something yourself. It can sometimes also be more reliable.

**Participant 1:** I feel like there already is those water dispensers pour down, but I guess the issue is again like how do you put the water in those.

**Participant 6:** And it's also up higher than again.

**Participant 1:** Yeah, and like maybe you need more water.

**Participant 6:** Yeah, for the toast, I can imagine that but with the water.

**Participant 1:** It could be an in-place thing, maybe, that is connected to the water already.

**Researcher:** Would you like some tea participant 3?

**Participant 3:** Yes please. For anyone that wants coffee; you can go to the desk at the design lab and ask for the card, and they will give it to you, and you'll have to give it back to them obviously, but then you can get a cup of coffee and tea, but the tea out of the machine isn't very good, so I brought some boiling water and tea bags and you're free to use that as well.

**Participant 5:** You know what I don't like about tea is how long it stays hot.

**Researcher:** Yeah.

**Participant 5:** My mouth is completely, extremely sensitive to heat. If it's more than 40, 60 degrees, I burn my mouth so bad.

**Researcher:** So maybe it would be great if you could adjust the temperature.

**Participant 5:** Yeah, but tea needs to be made at a very hot temperature to be tasty.

**Researcher:** Yeah, not all teas. I think the herbal tea has to be quite high, but the other teas need actually a lower temperature than 100 degrees.

**Participant 5:** What if, what if... Heatsink. Heatsink. Okay? I mean fins.

**Participant 2:** Hmm.

**Participant 6:** And then the cup heats up or what?

**Participant 5:** Yeah, no tea cools down faster.

**Participant 6:** Yeah, yeah, yeah. Yeah, like a cup where you can decide how fast it cools down a bit.

**Participant 5:** You know what? I should really make this one. Whatever. Yeah. I found a pretty good idea to just put some kind of tap here indeed.

**Participant 4:** Yeah.

**Participant 1:** That's really good. And what kind of gesture would be best? Like a sink? What's the easiest?

**Participant 4:** Not sure.

**Participant 1:** Because there was like this one thing that I showed.

**Participant 3:** You have the tap for the sink, and it has a very long handle.

**Participant 4:** Yeah. You see, people don't want to touch anything hot. So if you want a lot of hot water then you might burn yourself.

**Participant 5:** A button!

**Participant 1:** Would we want to still have the lifting option?

**Participant 3:** I think the lifting option would be nice if you want to fill it.

**Participant 5:** The problem is that you have the tap up here [on the water kettle], but then the water has to go up. What I'm trying to do is to close the top completely, so the steam has to go up and then the water will come out of the tap, but that tap sits higher up the kettle, otherwise you can't put a cup under it.

**Participant 3:** You could also put it on a platform.

**Participant 1:** Where did you want to put the tap then?

**Participant 6:** The tap really up high, right? You said something about the steam pushing up the water.

**Participant 5:** I find a good idea to just do it below, but then elevate it a bit.

**Participant 6:** We just put it on a few legs, let's say, so you could still put it on the bottom, let gravity do the work

**Participant 1:** Kind of like this? And then this is like a cup [pointing to her drawing]

**Participant 6:** Yeah, and then even if you have a pot you want to fill, you could maybe take this out.

**Participant 1:** You could adjust it, maybe.

**Participant 6:** Yeah, because I feel like if you're going to pour boiling water... I mean, it depends on how fancy you want to make it, but would you want to detect if there's anything standing there? For example, these [coffee] machines won't pour anything if there's not a cup in there.

**Participant 1:** Yeah.

**Participant 5:** We're actually just making some sort of coffee machine idea, but with tea.

**Participant 6:** Just for the boiling water at this point even, I suppose.

**Participant 1:** Yeah, because... And how is it with things like pots for you? [to researcher] Is it easy to fill up and then use it, or how do you normally do it? Because I usually do it in my kettle and then pour.

**Researcher:** I think for me there's a weight limit. Up to a certain point it's fine, but after the 1.7 liter or something, when it comes to 2 kilos or something, that becomes heavy if you have to carry it. Balance it, not spill it.

**Participant 5:** And those passive exo-skeletons, have you tried one of those?

**Researcher:** No, I have not tried one of those.

**Participant 2:** Couldn't convince her.

**Researcher:** No, because the stress on my joints is still there. That doesn't take it away. It makes it maybe slightly less, but...

**Participant 1:** But then, yeah, this would make sense maybe. It's like a more standing thing, and you could adjust the part underneath the tap to put a pot.

**Researcher:** Yeah, because I do have one of those lemonade taps that has a handle on the top, so you could just carry it. And then maybe one on the side for stabilizing if it's tall. But I think that would be great.

**Participant 1:** And for you, I was asking, but I think you heard, with the tap what kind of gesture would be the easiest to pour the water?

**Researcher:** Mm, I don't know, I think my lemonade tap has one of those that you just flip up and down. I think that's most convenient. Or a tap side to side, something like that. I wouldn't do a knob that you have to turn, but other than that, I don't think it really matters that much to me.

**Participant 3:** Like participant 4 said, we don't want to accidentally turn it on. We need some kind of locking mechanism.

**Participant 6:** Yeah, if you make it only on the button press, so you don't accidentally have it standing open while you're adding water.

**Researcher:** Yeah, that could also be a good idea.

**Participant 6:** I don't know if buttons are maybe annoying or not.

**Researcher:** Depends a bit. I think if you press it and it stays open, or you press it and it dispenses one cup automatically, if you keep pressing it, that's usually when I have issues.

**Participant 6:** Yeah, because that was going to be my first idea to keep pressing it, but I can imagine that's maybe not so convenient. There's just some way to make sure that once you get the water in, that it doesn't just stream out again, because you forgot. Depending on how digital this thing is, if you have an on-switch to start the boiling, you could probably also have some kind of mechanism close to tap.

**Participant 3:** Or you could have a detachable tap.

**Participant 6:** And then it...

**Participant 3:** So you don't accidentally knock it, but you can take the tap off and then reconnect it.

**Researcher:** Or maybe the tap is in the stand underneath, and you just add a tank on top. That automatically closes.

**Participant 1:** Yeah, that's also possible. But do you need to lift the water up to do that?

**Researcher:** No, I mean you have the stand where it's on, and there you have the tap. And in coffee machines, like in the Senseo, you have a tank, and that has a little press one way, I don't know.

**Participant 4:** Valve thing

**Researcher:** Yeah, valve, so when you put it on, it can get water out of it, but it doesn't fall out.

**Participant 6:** hm okay.

**Researcher:** So maybe something like that. Then you could just fill it and then pop it back on there, and then it won't open accidentally.

**Participant 1:** So would you have the tap underneath them? Like underneath the stand? Like if this is the legs, would it be here?

**Researcher:** Yeah, something like that. Well, to the front probably, so that you can easily put something under. That would be my idea, but...

**Participant 1:** Yeah, I'm not doing the best sketch.

**Participant 5:** What about tools? Tools?

**Researcher:** What do you mean?

**Participant 5:** Can you use those?

**Researcher and participant 4:** It depends.

**Participant 5:** Battery power drill, you need to keep pressing the button for it to reel.

**Participant 4:** Yes, but...

**Participant 5:** Hammer?

**Researcher:** Well, I think I can only do the electric drill when it's more for like screwing in screws, not an actual drill, because those are too heavy. But I think because the button is quite ergonomic, as long as it's not more than 30 seconds or something, that's fine. But a button on some object is a lot harder to press than doing like this [shows movement for pressing drill button]

**Participant 5:** It must be really annoying to not be able to have ideas, but not actually be able to make them.

**Researcher:** Well, that's why I have a very clever husband, who can do most things [laughing]

**Participant 6:** You said for example a button like this is more annoying, but if there's a button you can press down on your kitchen counter, it's more next to you.

**Participant 4:** I find that when I'm pulling a trigger, I'm using the muscles when I'm pushing a button and I'm putting stress on the joint. If I can put an activity on my muscles instead of my joints, I will. But those are then different, because most people just use their joints for things.

**Researcher:** Yeah, especially in the center of Enschede, there's this store, they have this platform lift. It's not like a normal elevator, and you have to keep pressing the button, otherwise it stops. And it takes quite a while to get upstairs, so usually I start pressing it with the side of my hand, because the finger, it just like... this happens [shows hyperextension of finger] and that's no good.

**Participant 6:** That's what you struggle with usually, that's what hurts.

**Researcher:** Indeed, when you pull something that's more of an active motion, and just pressing a button is usually just more like a joint.

**Participant 6:** Yeah, that makes a lot of sense.

**Participant 4:** I'll do my knuckle, because then this joint, I can apply more pressure for longer than this. Especially when my nails are too long, and then you get that extra fulcrum point.

**Participant 1:** That's interesting, I didn't know about that. That's good that we discussed it. Stress on the joints.

**Participant 5:** We're all about joints, that's all we need.

**Participant 6:** And in my head, the feeling is still quite a hard part. You now have to get a full water tank, and somehow lift it onto a little platform on top of your kitchen counter.

**Researcher:** Yeah, what I've always said is, it would be great if it just had a little hose on the side, that you can just plug into the faucet, put the faucet on, let it fill, and then just pull it back, and then it's full. That would be amazing, but I haven't seen a product anywhere that does that. Otherwise I would have bought it.

**Participant 3:** You can have a hose on a tap right?

**Participant 6:** That's what I was thinking before.

**Participant 3:** There are kitchen taps that you can just pull out.

**Researcher:** Yes, but usually they don't go very far, then you still have to move it right next to the sink.

**Participant 6:** It's more for cleaning out the sink.

**Researcher:** You would have to keep it right next to your sink then. Which is possible, but...

**Participant 4:** You would also need the water turning on mechanism to be on the thing, because otherwise you're trying to hold it in the kettle there, and then you're trying to reach over to the sink, and then you're like... [laughing]

**Researcher:** Yeah that's also a good point [laughing]

**Participant 4:** And then it's still a two-person job, and if there's a two-person job, then I'm just getting the other person to do it.

**Participant 1:** So I can just have some kind of hose somewhere.

**Researcher:** Yeah, I think that would be great.

**Participant 6:** And technically it should work, right? For one person, if you connect the hose, and maybe have another...

**Researcher:** Yeah, I think that hose should just be connected to the...

**Participant 4:** It should stick and stay. If it's connected to the tank, that would be great, because then you don't have to hold on to that. If the hose is just part of the tank.

**Participant 6:** I was imagining if it's connected to the tap, you can screw it on or something, and you have another...

**Participant 4:** Yeah, that could also be, but in some way you can connect it, so you don't have to hold it in the thing.

**Participant 1:** It's kind of like vacuum cleaners and the plug. Yeah, something like that. It just pulls back in.

**Participant 5:** And dislocation... Not good connective tissue. Has it something to do with the muscles? Is it also better if there's more muscles that keep it together?

**Researcher:** To some degree, yes. Your muscles can take over part of the joint, but not fully. They're not made for that. They're made for active support, and not for passive, just carrying the joint. It can help, but it doesn't solve the issue.

**Participant 5:** What if you just have some sort of thing around your arm with a joint built in?

**Participant 4:** A support brace?

**Participant 5:** Exactly, that's what I was looking for. A support brace built in joint place.

**Participant 4:** So, you can get the ones that prevent... I'm not going to do it because it sucks, but some people can, and I too, also can hyperextend the joint, and you'll have things that will stop you from hyperextending. The thing is, they're sort of super uncomfortable.

**Researcher:** yes

**Participant 4:** I prefer the soft ones. Also, I can clean them on my own, especially in the summer.

**Researcher:** They're very uncomfortable, and very bulky, and they don't go well under clothes. They don't work well when you...

**Participant 4:** They're never cute!

**Researcher:** that too!

**Participant 6:** How much do you feel like they actually impact positively? Do they actually stop what they're trying to stop?

**Researcher:** For me, I can imagine there's something physically stopping my joint from overextending that would help, but that doesn't take away the load that is put on the joint. It doesn't take that over.

**Participant 6:** yeah it stops the hyperextension

**Researcher:** Somehow, the joint isn't overridden. It's still there. It still has the function. So, for me, that's not worth it, just to not overextend.

**Participant 4:** I wear them when I'm going to be out all day.

**Participant 6:** Is there most risk?

**Participant 4:** Not most risk. A lot of my hyperextensions happen when I'm just distracted, because I'm less aware of where my body is. It just stops me from overextending. They are itchy and hot, so if I'm just at home, I'm not going to wear them. If I'm out all day, I'll wear them.

**Participant 6:** Not a suitable long-term solution?

**Researcher:** Not for things that you have to do all the time. I think also a lot of braces are used, especially by physical therapists, recommended to only be used part of the time, not 100% of the time. There's some debate around that, but I can definitely see the benefits of both, especially because they're often uncomfortable and they don't support you in the way that you would like it. It's not like having a prosthetic that does everything for you. It's just a little bit of support and a little bit of limitation in the range of motion. That's it.

**Participant 4:** It'll never make me function like if I had normal joints. It prevents me from being injured more, but it doesn't make it than normal.

**Participant 6:** Because it just stops the most extreme forms of damage from happening. Like you say, it's still stress on your joints.

**Participant 4:** It'll prevent me from dislocating something.

**Researcher:** Even that it doesn't do for me.

**Participant 4:** Different joints. For me, it will stop a dislocation, but the phase is up to a dislocation, so it will still hurt. I still need to watch out. It doesn't magically fix things. It just supports me in doing the things that I want to do.

**Researcher:** Also, there's a lot of extra stress on our joints because the supportive stuff that's supposed to be there doesn't work well. The muscles are working harder, therefore often hurt because they're overworked. This helps just 10% maybe. It doesn't fix the issue. I'm not all of a sudden hulk and can do anything. No. That would be great.

**Researcher:** So you can walk with crutches? Crutches!

**Researcher:** Yes, I could technically walk with crutches. I've done that a lot. But this joint and this joint and this joint [points to shoulder, wrists, elbows] use so much more that I couldn't keep up with that. The wheelchair for me is a lot better because I can just swoop around and there's no problem. Some problem, but less. [Researcher tries to redirect to the object] If we're talking about something like this, I don't see any type of brace or support or anything like that all of a sudden make me able to lift 10 kilos. It's just not happening.

**Participant 4:** Also, I already find it inconvenient to grab the oven glove and take stuff out of the oven.

**Researcher:** Do you want to put on an exoskeleton to make a cup of tea?

**Participant 4:** No. Because if it's inconvenient, even if I know I should use the supports, I'm not going to because I just want it done. It's already annoying to grab the oven gloves to get something out of the oven.

**Participant 3:** You take stuff out of the oven with your bare hands? [laughing]

**Participant 4:** I've seen housemates do that. I don't do that because I'm not an idiot. But people do do that. The step to grab the tool and the cost of doing it without the tool, that's an equation and we all play it every day.

**Researcher:** I worked on a case with a woman that was blind and we were helping her also in the kitchen. She had one of those devices that you can put on the edge of your cup and then it will beep once the level is to that. It can help you when you're pouring a cup of tea because it will let you know the cup is full. She said, that thing, I don't use it. I just put it in my sink and I hear it overflow and then I grab the cup. Even something like that that we could think is super useful, she was like, no, I don't use that because the battery runs out and I forget to put a new one in. She's like, by that time I've already filled my cup. It's not necessary anymore.

**Participant 1:** I saw an example the other day. It was from an Instagram account of this couple and one of them is blind and he often struggles with hitting his head on the cupboard.

**Participant 3:** I can understand that one.

**Participant 1:** So what he did, you know those birthday cards, when you open them, they sing. You just put one in the cupboard so when it opens, you hear something. Such a small but efficient solution.

**Researcher:** [to participant 2] Maybe we should do that at home, then you'll close the doors.

**Participant 3:** Is it annoying enough? You just let the battery run out.

**Researcher:** He also waits until the alarm stops beeping and I'm like, it's driving me insane.

**Participant 2:** It will stop in a minute. If I'm hyper-focused, I will also not hear the sounds anymore. Batteries are...

**Participant 5:** I don't know if you need to replace them. I have a measuring device, a caliper! The caliper is a digital device. It's a bit more accurate, but the problem is that it has a battery. It's annoying. I always go back to an analogue device so I can measure things. It's convenient to have analogue devices because they work and do their job. That's nice.

**Participant 3:** I was at the Dutch Design Week, and I saw someone had also designed these cups that had a hole in it, so when you're blind you can put your finger over the hole to close and then you can feel the water level when it's full. That was so interesting.

**Researcher:** It doesn't work when it's tea probably.

**Participant 4 and 6:** Yeah

**Participant 3:** Yeah it was for water, cold water. Different solutions have to be found.

**Researcher:** This is my water cup. This is my tea cup. But yeah, it's built into the thing, which I think is what is missing from a lot of these things. We have these jars with vegetables and stuff that are really hard to open unless you buy the expensive ones. I have a tool for that and I do use it a lot because it's the only way I'm going to get it open. But I love it much better when it's just in the jar itself. It has the easy lid from HAK, which sucks that only they can use that. It's in the thing itself, which is so much better than having to use another tool which you have to get.

**Participant 4:** Then it works when it's a temporary thing. So I always know that it's going to be a hassle to open a jar. But if I'm at a friend's house, it's not like all their jars are adapted to my janky joints. But if the things just work, they work for everyone. Which is useful.

**Researcher:** Yeah, exactly. When I went camping, the stuff that I needed wasn't all of a sudden... I didn't bring the extra tools to be able to open the things because you don't think about that. And then you're like, luckily I have friends around that can open stuff for me. But it's much better if it's all in one thing and you don't have to have all these extra things around. Yeah, that's a good point.

**Participant 4:** Because you also already have enough extra things.

**Researcher:** When we go on vacation, there's an extra bag of my medical stuff. I don't need extra tools on top of that.

**Participant 4:** Yeah

**Participant 6:** So how do we go forward?

**Participant 1:** I think this is my visualisation of what we talked about. I can try to explain. We can have a side hose thing. Maybe it can also be collapsible, like into the tank.

**Researcher:** Oh yeah, that would also be great.

**Participant 1:** That you can combine with the sink to get the water in. I guess it would be a standing thing with a stand. And I guess if you want to pour something maybe in front of it is a small stool.

**Researcher:** Or a drip tray in case it drips afterwards.

**Participant 1:** Oh yeah, that's also a good one.

**Participant 3:** Now that we're doing all this it's very far off from the original which I think is fine. But now it reminds me of an espresso machine. Because my boyfriend is really into coffee. He always says, for an espresso machine I'm gonna get a much better one so you can also get tea from it. I have a water boiler, it's fine. It reminds me of this because it's connected to the tap and it's on a higher level so you can just push a button and then have it. So I guess I'm wondering if we are on track, are we now just redesigning a coffee machine for tea or do we want to make a whole new thing.

**Researcher:** Yeah I can understand you saying, basically we just made an existing product I could also see that you're like maybe we should get a little more creative and think of something that doesn't exist.

**Participant 3:** That would also be fine. I'm just trying to say that there are a lot of products out there and just because the water boiler doesn't work for you maybe there's a different product that does the same thing. But it does usually come at a cost. An espresso machine is much more expensive. You can get these [water kettles] for 5 euros probably not this exact one. There are kettles for 5 euros but there are no espresso machines for 5 euros.

**Participant 3:** Is that something that should be taken into consideration?

**Researcher:** Yeah, maybe that should be taken into account because a lot of disabled people don't have a lot of income. So if it is a really premium product that might not fit the requirements of the target group.

**Participant 3 and 4:** yeah



**Participant 4:** And if you have to buy specialized appliances for all the appliances or a large percentage of the appliances an individual would own.

**Researcher:** I would be like oh this is much more usable I will spend a little bit extra but if that thing costs 300 euros I would be like well, that's a bit excessive. So I do get the point. Maybe there's a simpler solution? I don't know, I'll leave that up to you.

**Participant 4:** We're designing and we're not hacking.

**Participant 3:** Yeah, exactly.

**Participant 4:** Right?

**Participant 3:** Yeah.

**Participant 4:** And we have that thing in front of us and I don't think we're going to drill a hole in it.

**Participant 2:** No.

**Participant 4:** So then maybe that is like a constraint because life is having constraints and working through them. So.

**Participant 6:** For example, it would be that we try and turn that button on there into like a trigger.

**Participant 4:** Which button?

**Participant 6:** This button [pushes on the button on the water kettle] So it's instead of pushing, you can pull on. That would be like hacking it.

**Participant 6:** What you mean, I think, right? So this one or this one or.

**Participant 4:** So I don't think that top of the button, is it a button?

**Participant 3:** Yeah, for the lid, to open it.

**Participant 4:** Oh, I thought the button on the top of the lid was the button.

**Researcher:** No, that's to close it because this gets hot.

**Participant 4:** oh, I get it

**Participant 3:** But it's not hot when...

**Participant 4:** Yeah.

**Participant 3:** When you fill it then it's cold.

**Participant 4:** What if you're doing back to back to back heating up the kettle, you know?

**Participant 3:** I mean, it happened to me burning my fingers because all the people were drinking tea and left nothing for me.

**Participant 4:** Yeah, see? It's very reasonable. Because when I look at this thing, it's not the top button. We've got gravity, the bottom button. I actually like the on off.

**Researcher:** Yeah, this one is fine.

**Participant 1:** Because it's like low enough.

**Participant 6:** It's almost like pulling, right?

**Participant 4:** It's also like. Yeah. You just click it. And it's very, very light.

**Participant 6:** Instead of pushing it like this, you can.

**Participant 4:** Yeah, I can sort of use my pinkies, the one on top that can also happen. So it's not. But I think it's the one handle thing and the fact that I can't really put my hand there [on the opposite side from the handle], because then I'm going to burn my hand.

**Participant 6:** So for example, the second handle, just having like two so you can pour. I don't know.

**Participant 3:** Like a sippy cup

**Participant 4:** Like a sippy cup [laughing]

**Participant 6:** I'm really just like, what can we do to this thing specifically to make it better?

**Participant 3:** And then you pour it over your hand.

**Participant 4:** Yeah

**Participant 3:** What if you put two on this side, you can.

**Participant 4:** But then how do I see what I'm doing, right? Because if I'm going like this.

**Participant 6:** Use a mirror

**Participant 4:** Yeah, like I'm going to put a mirror in my kitchen so that I can make a cup of tea. [laughing]

**Participant 6:** I don't know [laughing]

**Participant 4:** This, this is also like ergonomically weird, especially if it's heavy. [demonstrates the pouring with 2 hands on the sides of the kettle] OK, well, like that, like this is already holding, especially this wrist that I wouldn't want to put weight on. Um, I don't think it's going to get better if there's handles, because then it's even farther apart, like really this is more doable.

**Participant 1:** Like a suitcase almost

**Participant 5:** How about you using a rope? On top, so like you just.

**Participant 6:** Just like hold it like it's standing.

**Participant 1:** But the balance is quite important with this, right? So the rope might be a bit...

**Participant 6:** Yeah, but you would have one rope to hold. There's still another hand to.

**Participant 1:** Yeah.

**Participant 6:** Kind of push it to pour out or something? Or how did you imagine it?

**Participant 5:** Yeah, but maybe like a rope as a handle that you can just... Hold it like this and then you can.



**Participant 6:** Yeah, yeah, that makes sense. I mean, that does allow you to hold it with two hands and see what you're doing. But imagine, yeah. So imagine there's one long kind of handle or maybe like a rope. So you could still kind of see what you're doing.

**Participant 4:** I don't know if the rope is going to rest against this and then I have to touch something hard to get to it.

**Participant 6:** Let's say it's like a plastic handle that goes over.

**Participant 4:** OK, but then when I'm refilling it.

**Participant 6:** You can fold it to the back. It's like a loose. It's a loose moving thing.

**Participant 4:** So for me, like this box is here because I do want to be able to see what I'm pouring into, right? Because I would not like to spill boiling water everywhere. Here, the ergonomics are pretty OK. Here, like by the time I've turned things to see enough, less strong than normal. I don't think this rope is going to solve my ergonomics and I can already feel my shoulder doing that.

**Participant 3:** But do you sit down when you pour tea? I don't think it gets better if I'm standing.

**Participant 3:** I feel like you can see over it better.

**Participant 4:** It's a little better.

**Participant 3:** Put it like this. You can stand at a countertop.

**Participant 4:** Yeah but it's not countertop height.

**Participant 3:** You can stand at a countertop over there.

**Participant 6:** You know those old teapots where you have to hold the lid so it doesn't fall off?

**Participant 4:** Yeah.

**Participant 6:** Imagine that is like a bit higher and a bit stronger. It's like a handle so you can pour it. I feel like you could see, I don't know. I feel like you could see what you're doing. Still have two hands actually to hold the weight. So it's like you have a handle here. You can hold some weight. I don't know how nice this is for you. Maybe it's better also standing. But then if you can hold the weight like this and then still pour. I don't know if it would help, but I liked your rope idea. You could give your second hand a bit of an opportunity to help out.

**Participant 2:** You can also have like a small pump inside and just pump the hot water outside.

**Participant 6:** And you can just hold.

**Participant 2:** There's a tube. Yeah, then you only have to move the tube.

**Participant 6:** Ah, yeah, that's also.

**Participant 3:** So where do you put a pump?

**Participant 2:** Here

**Participant 3:** There's a pump going in at the top and then there is a tube?

**Participant 2:** Yeah, you need the food safety one.

**Participant 6:** That's also a good one. Yeah.

**Participant 2:** In case you can't point it to your cup.

**Participant 5:** What if ... If we just have a closed top and instead of a pump, you use the steam generated by the heat.

**Participant 2:** Yeah, that's also how the Senseo machines work. You have like a small tube where water goes through and one valve. So that the water cannot flow back. But then the water in the loop gets heated because it cannot flow back. It will go out of the nozzle. So you get a kind of senseo machine.

**Participant 5:** To be honest, I just thought. I just thought that we were just going to make stuff from these machines. I didn't even think about the fact that we must make it more ergonomic?

**Researcher:** Accessible?

**Participant 5:** Yeah, accessible or something like that. So I didn't even think about it. Well, making stuff from other stuff. I like that. I don't know what to do now. I didn't see this coming.

**Researcher:** Well, I think there is great ideas going around. So you could just jump in if you have. You had the rope idea, which is like a great idea.

**Participant 4:** Do you have an idea of how you would want to attach it?

**Participant 3:** Where do you want the rope? You can just put the rope on.

**Researcher:** Oh, yeah, it doesn't have to be functional. You can make a prototype and if you want to pretend like there is a pump at the bottom, that's fine.

**Participant 4:** But then the rope will be the tube.

**Researcher:** Yeah, yeah, that's totally fine.

**Participant 2:** Also, completely over-engineered. You just have like a water gun or something shooting hot water. You say, here, water in this cup.

**Researcher:** Like a glue gun, but then from hot water.

**Participant 2:** Yeah, from the other side of the room.

**Participant 3:** That sounds amazing.

**Participant 2:** You just need to calibrate it right.

**Participant 4:** Yeah. And everyone loves calibrating their home appliances.

**Participant 5:** Let's see how this works [attempts to cut the rope and attach the rope to the kettle] I'm left-handed and these are not lefthanded scissors.

**Researcher:** participant 2, maybe you can cut it. I don't know if they have left-handed scissors.

**Participant 1:** That's is actually a good point, why don't they have left-handed scissors.

**Participant 5:** At first I didn't think there was a difference, but there definitely is.

**Researcher:** Oh, yeah, that looks great. [Participant 5 demonstrates his idea] Oh, wow, that's an awesome idea.

**Participant 1:** And I think here you could use some physics knowledge to make it like as little.

**Participant 3:** You can also use the cutting mat if you want.

**Participant 1:** It's surprisingly stable.

**Participant 4:** Yeah. Damn.

**Participant 1:** But it's also empty.

**Participant 4:** Yeah, but if it were full, it would not be attached with just.

**Participant 6:** Is it better like a loose rope or would it be the same way this handle is like, it's a solid thing, but maybe it can rotate a bit or.

**Participant 4:** the loose handle is...

**Participant 5:** The reason why I have this in the middle is so you can hold like this, hold it like this, whatever you want.

**Participant 3:** This is nice.

**Researcher:** [to participant 3 and 4] Yeah, thank you for the redirect because this is more hacking. That was a good point.

**Participant 1:** So we're mainly focusing on the kettle.

**Participant 4:** Yeah.

**Researcher:** Also, I think there's more issues with the kettle. I think a toaster, you could find one that would probably fit your needs because there's a lot of variety. And, you know, you can have the jumping toast situation or you can have the can barely get your toast out situation, whichever one works for you.

**Participant 3 and 4:** Yeah, yeah.

**Participant 3:** Yeah like the little ovens, toaster oven.

**Researcher:** Yeah, so I think there's more, there's more possibilities there with existing products. And this is this is a lot easier to hack because not much exists already.

**Participant 4:** You could use kids chopstick, you know they are attached together. And then you just pick out your. It's amazing.

**Researcher:** Yeah, well, actually, I've seen a toaster that had that like on the side, like one of those, like giant tweezers/thongs, yeah. And I thought that's great, but it was too expensive.

**Participant 5:** Where is the tap here.

**Participant 6:** You want to test it?

**Participant 5:** Yeah I think it's done, it's a perfect appliance, let's test it.

**Participant 3:** You also attach it to the handle.

**Participant 5:** Could be but then it might lean like this.

**Participant 3:** Because then it could even be usable, if the rope is not in the water/steam. You can test it and just turn it on.

**Participant 5:** hm?

**Participant 3:** You can test it, fill it with water to see what it will do.

**Participant 1:** but the rope is now inside. So I don't know what happens.

**Participant 3:** No, but if you attach the ropes to the handle itself, like near the top and then you tape it stuck and fill it with water to see if it actually feels lighter.

**Participant 1:** I think this is probably like a bit weirder to balance than on the top.

**Participant 3:** But we could try.

**Participant 4:** Yeah

**Participant 3:** We could fill it and see what it does.

**Participant 2:** You need the center of gravity is probably around here. And then if you have something here connected to attach ropes to.

**Participant 1:** You could have it like here and then like.

**Researcher:** Mm hmm.

**Participant 6:** There's like a smallest point there, right?

**Participant 2:** It's a prototype it doesn't have to work straight away.

**Participant 5:** I'm going to do it.

**Participant 3:** We don't have to turn it on, but we can just...

**Participant 5:** Can I walk all the way with this in my hand?

**Participant 6:** Yeah, we can go for a coffee break. Or a hot chocolate break if people want.

**Participant 2:** [to participant 5] I'm not sure... I will bring it and come back.

**Participant 5:** Okay

**Participant 6:** It also works. I'm going to grab my phone and come back.

**Participant 3:** All right.

**Participant 4:** I'm going to grab some mugs to we can test the pouring.

**Participant 3:** Yeah, so we're not just pouring water on the table [laughing]

**Participant 2:** I didn't fill it all the way

**Participant 5:** You need at least one 1,7 Liter to test if it really works. Let's see if it works.

**Participant 4:** Yep.

**Participant 5:** You should also test if it works for you.

**Participant 3:** But you can use... Is it easier?

**Participant 5:** It's easier. It's on this arm. It's sliding. It's sliding, but it's easy to fix. It's a bit difficult on this arm. Because this one is stretched. But it's just... it is dividing the load. That's the advantage.

**Participant 3:** Maybe if you make the strings shorter. Or the ropes shorter. Then you don't have to put your arm up so high. Is it ergonomic?

**Participant 5:** So much more! You need to try it.

**Participant 4:** Yeah, sure.

**Participant 5:** Is it better?

**Participant 4:** Maybe? Yeah. I think this is much better.

**Participant 3:** Who would have thought, rope.

**Researcher:** I think I'm going to keep it like this and use it at home.

**Participant 3:** No, you should.

**Participant 5:** I knew it was a good idea.

**Participant 4:** I'll try it standing.

**Researcher:** Yeah, this cup is almost full. So maybe try that one.

**Participant 3:** Maybe we can pour it back in.

**Participant 1:** Maybe don't do it now. Because the thing might move.

**Researcher:** Be careful. There is a phone there.

**Participant 4:** That phone is waterproof. These days. If I can buy waterproof electronics. I will buy waterproof electronics.

**Researcher:** Good point. They don't make waterproof laptops as far as I'm aware.

**Participant 4:** Not yet.

**Researcher:** I would need that. My previous one died because of tea.

**Participant 4:** Do you want to try it

**Researcher:** Yeah sure. I think for me... I would like it slightly more forward. More in the center of gravity. But the idea itself is great.

**Participant 3:** We can attach it to this part [points to the side of the kettle]

**Participant 1:** It could be one of those wraps. They are really small. But then they can.

**Participant 4:** Macrame your kettle.

**Participant 1:** No no, but they can flex. And then they are really holding it.

**Researcher:** Something like that would be great.

**Participant 5:** How light is it?

**Participant 1:** How light?

**Participant 5:** What time.

**Participant 1:** It's 7 past 3.

**Participant 3:** You can just crochet a solution.

**Researcher:** oh yeah

**Participant 3:** You always need a crochet hook. Wherever you go [all laughing]

**Participant 2:** Well we have rope.

**Participant 4:** Exactly. What do you want?

**Researcher:** This is like macrame stuff. I think.

**Participant 4:** Macrame-on

**Researcher:** You just always carry a crochet hook?

**Participant 3:** You don't!?! [laughing]

**Researcher:** No? Actually some people are using it to close buttons on their shirt because they have dexterity issues. They use a crochet hook.

**Participant 3:** Oh that's smart. No, I just had it in my bag. Are you all just going to watch me crochet?

**Researcher:** I was just curious if it was going to work.

**Participant 3:** Obviously it will work. Who wants a new outfit?

**Researcher:** Yeah sure, you'll be working on that for a while I think.

**Participant 3:** Yeah, I'm working on a summer outfit at home but I can make a band. What size do you want the band to be? [Separate conversation going on at the other side of the table]

**Participant 2:** [to participant 5] Have you also hacked stuff at home? To make it more convenient for yourself? Because you're at the Tkkkr lab as well, so I was wondering if you did some more hacking at home as well? To make your life more convenient?

**Participant 5:** Uhm, not at home, because I'm... I'm trying to... keep things... at the workshop. Otherwise it becomes a mess at home. My room wasn't ideal. There was a lot of parts and not that much room left.

**Participant 2:** [sarcastic] I don't recognize that at all [laughing]

**Participant 5:** In the end I just went to a workshop. Because it's possible here. I don't have that many hobbies anymore. I don't like to walk anymore. I used to be able to walk. But it's coming back. I'm going to... Roessing. I think it's going to be good there. My knee has some issues, but...

**Participant 2:** Yeah we also want to go to the Tkkkr space sometimes, but the stairs is a bit of a problem

**Participant 5:** It's not... easy now. But I'm not a hacker. I'm a maker. So it makes it a bit easier. Because you need to be downstairs most of the time.

**Participant 2:** [explaining to participant 3 and 4 what the tkkr lab is] There is just like a... hackerspace at the... industry area. Close to the... Close to the... Grolsh Veste basically. Grolsh Veste? Grolsh factory.

**Participant 5:** It's great.

**Participant 2:** They have so many tools. A lot of cities have life hack spaces. But I don't come there too often. Too busy in life. We can also look... at... different products we can do. Or if somebody else has... like a certain problem in their lives. Like, oh this is very annoying. I wish this was easier. Might also be able to think about that.

**Participant 5:** I have no idea. What are we even allowed to use?

**Researcher:** What do you mean?

**Participant 5:** There is some things... What are the things we can do stuff with it?

**Researcher:** Yeah, all of those things [points to all the materials available in the room]

**Participant 5:** Okay, I'm just going to look around.

**Researcher:** Oh look, it's becoming something. [referring to the crochet handle participant 3 is working on]

**Participant 3:** It will take a long time.

**Participant 4:** Working out the crochet.

**Researcher:** So is it the ideal material or not?

**Participant 3:** I have the same material at home, but it's much thinner. I'm making a top out of. But it's really annoying because they unravel and then they get stuck. It's annoying. It's all we have. I didn't think we were going to be crocheting.

**Participant 1:** That's okay, that's fair

**Researcher:** Not on my list of things we're going to need.

**Participant 3:** It's probably easier to just put some tape around it.

**Researcher:** We're using the skills that we have, so I love it.

**Participant 4:** You always go with what you got. Go with what you know, you know.

**Researcher:** I don't know how to crochet, so I wouldn't have known how to even get materials for it.

**Participant 3:** It's really easy. I say having done it for 10 years. It is easy.

**Participant 4:** For me it just, I hate counting.

**Participant 3:** Just don't do it. Let it become whatever you want. It's the magic of crochet. You can go any direction you want. You can do anything you want. That's why I hate knitting. I don't use the freedom, but it's there. I could use it. If I wanted to, I could. That's important.

**Researcher:** I think I would have too many wrist issues with crocheting.

**Participant 3:** Yes, definitely. But some people use tennis balls to put the crochet hook in.

**Participant 1:** I think that's an issue for everyone. At some point, they get...

**Participant 3:** You cannot make a living out of crocheting. You will murder your wrists.

**Researcher:** But see, my wrists are already murdered, so I'm not sure it's a good hobby in that case.

**Participant 4:** Yeah, probably not

**Participant 1:** Yeah

**Participant 3:** Maybe if you use a tennis ball. Maybe. Don't use cotton. Use acrylic yarn. It's easier.

**Researcher:** What would I do with the stuff I make? I don't like acrylic... anything.

**Participant 3:** I made coasters. Than the material doesn't really matter. Just don't use them for... things you take out of the oven. Because they will melt.

**Researcher:** Yeah, we had wool coasters, and I put something that was a little too hot on there and it also melted, so it's a bit sad.

**Participant 2:** Oh yeah, that one.

**Researcher:** It's very pretty, very aesthetic, and now it's not very aesthetic anymore. We're going back to the cheap cork ones.

**Participant 2:** How far was it possible to use the workshop?

**Researcher:** Well, usually there's nobody there, but you need a card. I have one, but I couldn't ask everyone to go do the safety tour before this.

**Participant 3:** Just give them your card.

**Researcher:** Yeah, but I don't think they're going to like that.

**Participant 4:** I think that's illegal

**Participant 3:** You can take mine, I don't go to school here anymore. They can't expel me.

**Researcher:** [to participant 2] No, but what would you like to do in there?

**Participant 3:** [to participant 4] You never got one?

**Participant 4:** No I didn't think I would need it

**Participant 2:** I was wondering about our options that we have to produce something because making something would also be nice. We're a bit constrained with time, but that was the entire challenge.

**Participant 1:** I do have a card, but not with me also, but I also never used it.

**Participant 4:** Yeah, I was like oh, go get your card, and I was like I don't think I'm going to use it. And then I graduated, and I didn't end up needing it, so I stand by my decision to not.

**Researcher:** I do have one, and I did use it once, or twice.

**Participant 2:** usually we just go to the hackerspace. They don't have safety regulations or almost nothing.

**Researcher:** Oh, there is one. If you go do the downstairs stuff, there has to be someone there in case you saw your arm off.

**Participant 2:** Yeah.

**Participant 4:** That feels reasonable.

**Researcher:** But it is annoying when there's nobody there, I have to come and just sit there while he's sawing stuff.

**Participant 2:** It's a bit of a late night group. I'm a bit of an early morning person

**Participant 4:** But late enough night and early enough morning.

**Participant 2:** It's not close enough. Usually around 4 o'clock they are gone.

**Participant 3:** This could be a great ergonomic handle. Much thicker [referring to the handle she is crocheting] Easier on the hands.

**Participant 1:** Maybe for this part?

**Participant 3:** Yeah, because it will take way too long for the whole thing.

**Researcher:** I'm impressed how fast it's already going.

**Participant 3:** I think I missed a stitch

**Participant 4:** My worry about that is that steam goes up.

**Participant 1:** Yeah, this will definitely get wet.

**Participant 4:** What?

**Researcher:** If it's normally on the outside this is just a prototype, this will probably not work, but if it were a real product that would probably work.

**Participant 4:** Or it's a very large keychain.

**Participant 3:** You're going to want a water kettle as a keychain? [laughing]

**Participant 3:** So convenient.

**Participant 4:** You're not going to lose it.

**Participant 3:** What, the water kettle? Or the key?

**Participant 4:** The key!

**Researcher:** Oh, that's like in one of those shops where they have the key on this ladle and then you're walking around the shop with the ladle. Just so you don't lose the key.

**Participant 3:** Let's do that with a water kettle, why not?

**Participant 1:** It's like tote bags with shopping bags, do you have to adjust how you hold it in any way? I'm asking because I sometimes...

**Participant 4:** I always put them over my shoulder and my elbows. I also just do groceries inconveniently frequently to never have to carry home that much.

**Researcher:** Yeah, we order it online and have it delivered, and he [participant 2] is always home when it's delivered. So he can put it away. It's a six pack of one and a half liter bottles I cannot carry.

**Participant 3:** Why do you buy bottled water?

**Researcher:** Yeah, he [participant 2] drinks sparkling water, so he orders those.

**Participant 3:** You should have a soda stream.

**Researcher:** Yeah, he had a soda stream, but it was too much of a bother with all the what are they called? The gas things.

**Participant 2:** Yeah, I started refilling them myself with dry ice. And then I figured out it was kind of dangerous to do.

**Participant 3:** But you hacked it.

**Participant 2:** Yeah, I just screwed the top off. It was like, oh, I need so many grams of CO<sub>2</sub> in there. But the problem was because it gets so cold, it damages the cylinder as well. So there was a risk that it would explode.

[Break]

**Participant 3:** Maybe I should start thinking of a plan before I continue this.

**Researcher:** That might be helpful.

**Participant 3:** It's a nice handle, right?

**Researcher:** Yeah, that looks good.

**Participant 3:** Does it feel ergonomic?

**Participant 4:** Excellent.

**Participant 1:** Do you want to try it with this or something? Like maybe put it like here?

**Researcher:** I would honestly... Oh, okay. I would honestly put it slightly lower because I think if it's that high then... Yeah, I think then it will start twisting and stuff.

**Participant 1:** That one is probably better. She has a vision, I think.

**Participant 3 and 4:** Yeah.

**Participant 1:** But you are from industrial design then

**Participant 3:** mm-hm

**Researcher:** Me too.

**Participant 1:** We have quite some things in common, but also quite some that are different.

**Participant 3 and 4:** Yeah

**Participant 3:** The masters, a lot of it is the same, I can hardly tell the difference sometimes.

**Participant 1:** We don't do a lot with like physical objects. So like I feel like my design thinking with these is not as practical sometimes. It's like, okay, conceptually this could work, but I'm not thinking, okay, this is like the best thing for manufacturing purposes or whatever, you know?

**Researcher:** But I mean...

**Participant 3:** For manufacturing it's also not... I now work as a product design engineer at MicroKnit. And now I do have to think about manufacturing and I don't know anything. I have to relearn everything. Because they actually have to be made now, the products that I design.

**Researcher:** Yeah, I think I know some basics for manufacturing, but when I'm designing something there's still a lot you can't take into account because there's so many things and like, oh, this material acts like this, slightly different than like this one. So I'm not sure we do know all of that. I mean, I have like a basic understanding how something is made, but not when I'm designing something. I'm like, oh, this is how it would be manufactured, or I need to change this so that it can be manufactured. This is not that far.

**Participant 5:** I'm going to go home soon, okay?

**Researcher:** Yes, of course, okay, thank you for joining!

**Participant 2:** We will probably see each other at the Tkkr space

**Participant 5:** Yeah sure

**All:** Bye

**Researcher:** Wow, it looks great, [Participant 3].

**Participant 1:** It's getting quite big

**Researcher:** Yeah, I think you could have stopped a while ago, but you know, it's fine.

**Participant 3:** Just say when.

**Researcher:** I think this is already good. You're going above expectations.

**Participant 4:** Do you know what part you are crocheting?

**Participant 3:** Yeah this is the part, this is the handle, it goes like here on top.

**Participant 4:** Ah, ooh.

**Researcher:** Can you still put like that little small part on the other side? Because then I think it's good like this.

**Participant 4:** Yeah, I wanted to make it also on this side.

**Researcher:** I think then it's good.

**Participant 1:** I think there are a lot of like knotting techniques and stuff that you can get from like camping, fishing, something that's like stable. You could have it like around. You could also put something here to keep the rope in place maybe.

**Participant 3:** Amazing

**Participant 1:** Do you know what they are doing there? [some people are doing things in the hallway with an electric wheelchair without a wheelchair user]

**Participant 4:** Ghost Rider Wheelchair Edition.

**Participant 2:** It's a self-driving wheelchair

**Researcher:** And how does it know where to go?

**Participant 2:** I think it has a camera.

**Participant 1:** I think that could go either way

**Participant 4:** Yeah I don't know...

**Participant 3:** Self-driving?

**Researcher:** I don't know if I want it to self-drive.

**Participant 3:** Yeah, it's like if my legs would decide where I was going.

**Researcher:** Yeah.

**Participant 3:** I would like my head to decide where I'm going

**Researcher:** I mean, if it was connected to my brain and I could just be like we're going forward, that might be nice.

**Participant 3:** My legs are connected to my brain.

**Researcher:** Yeah, I know. But I mean, like in a wheelchair, like that might be nice, but I don't know. But if it just goes on its own, how do I tell it where to go?

**Participant 3:** Yeah, you don't you just go. Someone else tells it to go somewhere. What if your wheelchair gets hacked and then you just go somewhere? [laughing]

**Researcher:** Yeah, you drive over a cliff.

**Participant 3:** Okay, I was not thinking that. I was thinking more like marketing, go into the store, but sure.

**Participant 2:** Oh, basically you also have those pacemakers that are also wireless. I'm sometimes wondering, like, I'm kind of scared that somebody would hack it and like disable it or something.

**Participant 4:** No, so members of the US government aren't allowed to have those ones because it's too hackable and too risky. So like they have to go get different pacemakers.

**Researcher:** Oh, wow.

**Participant 4:** Because they're like the likelihood of like blackmailing is too much. Like you do this or I turn off your pacemaker, which is like not blackmail. That's extortion. That's a threat.

**Participant 3:** It's really dangerous, but also very funny. It's just so weird you do this or I will turn off your pacemaker. I mean, it would not be funny if it happened to you.

**Participant 4:** No.

**Participant 2:** The future will be crazy.

**Participant 1:** Are you going to check it out [the self-driving wheelchair of Ability-Tech]

**Researcher:** I'm going to check it out. Well, I also have to go to the bathroom.

**Participant 2:** It's kind of in your research area.



**Researcher:** Yeah

**Participant 4:** Also in the way.

**Researcher:** You want to come?

Participant 1: I'll join.

[coffee/bathroom break & chat with Ability Tech]

**Participant 6:** Oh wow, did you just put that together?

**Participant 3:** Yes.

**Participant 6:** Wow. Oh, that's a very good, so fast. Perfect. And do we have a way to attach it?

**Participant 3:** Well, I was thinking of making a band around it, but that's too much to crochet now.

**Participant 6:** Yes, but just something very tight around here.

**Participant 3:** I was thinking maybe we could just like tape, a kind of band around it. And then put a kind of loop on it or something, where it goes through.

**Participant 6:** Do we have more rope? Yes

**Participant 3:** Yes, we have more rope.

**Participant 6:** I think a very simple and very tight knot around here should be enough. Then you can just tie this, right?

**Participant 3:** Yes.

**Participant 6:** This looks good. I'm going to cut a piece in between.

**Participant 3:** I think we're a bit past the goal of this hackathon

**Participant 6:** Yes, a little and I can't stay for much longer but I did find it really interesting to experience this.

**Participant 3:** Yes

**Participant 6:** We have to make sure this is tight enough.

**Participant 3:** Nice and ergonomic.

**Participant 1:** And what do we have here?

**Participant 3:** I'm trying to attach the band to the top of the handle.

**Participant 1:** I feel like it could also be like those, you know, like a grocery bag. Like it's kind of like shaped in, kind of like this is the bag. But they have like these type of connections. Like these are all ropes. So it could be like around it.

**Participant 6:** Ah, it's like a net. And you just let it sit in there. Yes, that makes all the sense.

**Participant 1:** I don't know if it would affect the end part. That's the only thing. Because it's like uncomfortable.

**Participant 3:** I think this could work. Right?

**Participant 6:** This should be, because as long as it's tight enough that it won't go over this thing, which it won't, I think. Because that allows it also to put the circle back a little bit more in the center. Yeah, we need to somehow get it attached to it.

**Participant 1:** [walking around the materials] I love that she has gemstones.

**Participant 3:** Yeah [laughing]

**Participant 3:** Are we allowed to do this even if the researcher isn't here?

**Participant 6:** No observations are being done right now, it's okay.

**Participant 4:** [comes back in the room] Ah, the crochet kettle. The crochet kettle handle thing.

**Participant 6:** Oh, and it's turning into loose. I think for the idea it's...

**Researcher:** [comes back in the room] Ah, it's looking great.

**Participant 1:** Did you imagine this as the outcome?

**Researcher:** No, no. I really had like many ideas in my mind of like cardboard being stuck to these things and stuff like that. And maybe like buttons and stuff added. But this is not what I thought. But it's great.

**Participant 6:** Someone better take this home.

**Researcher:** Yeah, I love it.

[participant 2 comes back in the room]

**Participant 6:** Was this just like a random...

**Participant 2:** Yeah.

**Participant 4:** Coincidence?

**Researcher:** Yeah, coincidence.

**Participant 2:** I got distracted, I was like that's a wheelchair.

**Participant 6:** Are you in the wrong room? Or yeah, I think you should be in here. Yeah.

**Participant 1:** [to participant 6] What did you study then?

**Participant 6:** I studied Atlas. Yeah, you because you said you were a designer, right?

**Participant 1:** Oh yeah, we did interaction technology.

**Participant 6:** Okay, okay.

**Researcher:** And we did IDE. Well, I'm still, almost done. But yeah.

**Participant 6:** But the interaction technology is the master's.

**Participant 1:** Yeah, but that's also the master's.

**Researcher:** Yeah, industrial design engineering.

**Participant 6:** This is the follow-up master's on the... because there's also industrial design engineering bachelor's

**Researcher:** Yes, yes. It's both called the same, yeah.

**Participant 1:** Interaction technology is like the... Like not necessarily a continuation, but it's like with create.



**Participant 6:** Yeah, that's what I was thinking about also. Okay, that makes a lot of sense. Yeah. I think Atlas always gets compared to create.

**Participant 1:** Yeah? Yeah, I don't know if it's correct, but... I didn't do create, but I think it's even broader than I said.

**Participant 4:** Yeah.

**Participant 6:** Okay, okay. But it's a very like all-rounding bit of everything, right?

**Participant 1:** Yeah.

**Participant 4:** A little bit of everything.

**Participant 1:** You need to turn it maybe? Yeah.

**Researcher:** Almost.

**Participant 1:** I think this might pop off. Maybe...

**Participant 6:** Yeah, in theory if you twist something into it.

**Researcher:** Yeah, maybe if you put some tape over it. Or maybe the plastic tape is a little stronger.

**Participant 6:** I think it should hold.

**Researcher:** Yeah, it does hold.

**Participant 1:** It does hold. Also when you...

**Participant 6:** Oh, that's a good question.

**Participant 4:** It actually looks really good. Yeah, you know? It looks...

**Researcher:** I love it.

**Participant 1:** I feel like it's also a bit lighter because of the... That's more distributed. Do you want to try?

**Participant 4:** Yeah.

**Participant 6:** I don't know if this is a new idea, like putting an extra handle on the kettle, but it's...

**Participant 1:** I mean... I haven't seen... An extra handle? No, no, that's...

**Participant 4:** Oh, if we... Yeah. Well, it's also like you don't have to reinvent the wheel.

**Participant 6:** You just gotta make it work.

**Researcher:** You're completely right. Oh, you already had a cup. Okay.

**Participant 3:** Maybe you should try with more water. So it's more heavy.

**Participant 6:** Yeah. A 2.0 version.

**Participant 3:** But okay, if you... Because if you're... I mean, if you're at your job, it's filled completely to the top. To the max line. And then we can see if... it's still useful for you.

**Participant 1:** It might pop off.

**Participant 4:** It's pretty on there.

**Participant 1:** Okay.

**Participant 6:** This is the only spot it could slip off. So if that doesn't look sketchy, then...

**Participant 3:** Can we get some more water?

**Participant 6:** And maybe we can maybe take this part out.

**Participant 4:** Here's the crochet kettle [hands the kettle to participant 1]

**Participant 1:** I think we can leave that on for now, no?

**Participant 3:** Yeah. Well, I guess you can take it off.

**Participant 6:** We can keep it, but maybe we could...

**Participant 4:** The secondary handle?

**Participant 3:** There was this smaller...

**Participant 1:** Oh, this one.

**Participant 3:** The original one. Oh, okay. That's what you meant.

**Researcher:** Yeah. Great.

**Participant 3:** Good thing I always have a crochet hook with me.

**Participant 4:** Yeah

**Researcher:** Super helpful.

**Participant 3:** I don't. But it was just... In my bag. My mom moved a couple of months ago. So she's finding all of my old stuff. And there was one crochet hook. Living there. So I'll take it home. But I forgot to take it out of my bag. Now it comes in handy. Serendipity, you know?

**Participant 4:** Yeah. Very convenient.

**Participant 1:** It's very full

**Participant 4:** Okay. Well, we'll see.

**Participant 3:** This is what you want to test.

**Participant 4:** Yeah.

**Participant 3:** If it's still usable when it's filled all the way. Is it?

**Participant 4:** Pretty doable!

**Participant 6:** Commercialize it.

**Researcher:** Can you do it again so I can take a video?

**Participant 4:** Yeah sure.

**Participant 1:** I'm going to try to find that video of the backpack by the way, I'm going to show you.

**Researcher:** Oh, it still works.

**Participant 4:** Yeah.

**Researcher:** Pretty nice.

**Participant 4:** I like that. Nice. Yeah, also this is nicer to carry than this. For like, in front of the... Cap. Yeah.

**Participant 1:** Yeah.

**Researcher:** Cool.

**Participant 4:** Excellent crochet.

**Participant 3:** Oh yeah. Feels much lighter.

**Participant 1:** Anything else?

**Participant 4:** Are we done?

**Researcher:** I think so.

**Participant 3:** Should we present? This is it.

**Researcher:** I do have some questions that I would like to ask you about it, so we could do that now. Yeah. Let me look up the questions.

**Participant 3:** We could also braid another band here.

**Researcher:** Yeah.

**Participant 1:** I think you're just looking for an excuse to crochet more.

**Participant 3:** I said braiding, not crochet [laughing]

**Participant 1:** Okay, okay [laughing]

**Participant 3:** But I could.

**Researcher:** Let's see. First of all, I kind of want to say that I think it's really awesome what you did here. I never expected this, but it's great. And I think it was really cool that you got all different kinds of ideas from very sophisticated to more like the hacking thing that I... [laughing] Participant 3 is just continuing to crochet. And yeah, I think it's really great that you put in this effort and like really came together to make something cool. And yeah, I just really appreciate it.

**Participant 3:** No problem. What did you expect? Because you said I didn't expect an outcome like this.

**Researcher:** I didn't expect you to bring a crochet hook. So by definition, this was unexpected. [laughing]

**Participant 3:** But you knew me

**Researcher:** That is true, but still. No, but like I... Yeah, I don't know. I assumed we were going more cardboard. But this is great, actually. So it doesn't really matter what I expected. I think the result is awesome.

**Participant 3:** Yeah okay, but I was just curious because before I came here I didn't really know what to expect, and still the first few minutes I was here I still didn't really know, because you put on the sheet what are your expectations.

**Researcher:** Yeah, no, but yeah, that was also my intention because I didn't want to steer it too far into one thing. Like, obviously, I already steered it because I chose the appliance. I chose the materials provided and all of that. And I didn't want to then also decide what you were going to do. And I think you wanted a little bit more guidance than I was initially planning to give. But it worked out fine. So that was, yeah.

**Participant 3:** Okay

**Researcher:** I think it was a good result. And I mean, I can really use this in my thesis to be like, yeah, so sometimes we go very much first into thinking of products that already exist and things that we are used to. And then we kind of went more creative and more like low-tech and more practical, probably.

**Participant 3:** I think the biggest difference is the first one we were trying to redesign the product.

**Participant 1:** And the second one is just hacking.

**Participant 3:** Yeah, exactly. More hacking. This is just what you have and how to make it work for this user situation.

**Researcher:** And I think that's actually great that you showed that often this is the intention that we learned how to go about this. And then this is kind of off the normal path, which in a lot of situations is actually better because this is immediately usable. It's something that you could make like manufacturers an add-on so that everyone can buy a cheap kettle and just add something on top of it, make it super usable, low-tech, pretty cheap. That's an amazing solution. And it's actually quite simple. So, yeah, I love it.

**Participant 1:** I also think it's like it depends on how you frame the question in a way. Because that's also like initially we were like, OK, can we do a different design? And then we ended up designing something more different. But if the design constraint is already, OK, let's come up with a solution that this person can do with the stuff they have already at home, I think that already makes it more like hacking than design.

**Participant 4:** I was also a little bit confused in the beginning when you said you could use these appliances but you don't have to use them you can design something different. But then I think that's why I went to redesigning rather than hacking.

**Researcher:** Yeah, but my intention eventually is that I want to make a toolkit where designers can work together with disabled people to also redesign things. So this is not necessarily wrong because that could also be an outcome if they are completely redesigning something. And I don't want the toolkit just to be all individual solutions. I do want them to be a little more broader, a little more applicable to more people. And I think this could also be that. But when you focus heavily on like, no, it has to be this thing and only these materials, then, yeah, I think in practicality used by designers, that probably wouldn't be the use case. It's more like that I want to use crib hacking as kind of like a way of communicating. Like it's something that disabled people know and that designers kind of are familiar with and kind of share something. And by this, this is not the end result. Then this is just a way to show like how the user would like a solution to work, how they would use it, how they intend to see this happen. And I think this could be manufactured into a product that could be like a bigger, you know. How do you say, mass produced, like that could be this. So, yeah, I don't know. I'm a bit struggling like in between somewhere where I do want crib hacking to be the focus. But also, this [redesign] isn't wrong.

**Participant 1:** You know, you can go with like a kind of like co-design methodology. Yeah.

**Researcher:** Yeah. That's kind of what I want. Like this should be like a first step. And then you go through a process of more professionalizing a design.

**Participant 4:** Yeah.

**Participant 1:** Yeah.

**Researcher:** I would see it as a co-design activity. Indeed.

**Participant 1:** Yeah.

**Participant 4:** Yeah and I think we were learning through that process.

**Researcher:** Yeah, exactly.

**Participant 4:** Like I, we articulated like the button pushy thing. Me, I know, prefer triggers to buttons.

**Researcher:** Yeah.

**Participant 4:** But I wasn't going to sit down and be like, I prefer buttons to triggers and handles that are at least 36 millimetres. Like that just doesn't happen.

**Researcher:** Yeah, exactly. That's the intention.

**Participant 4:** Like you're pulling stuff out and then I'm like, oh, yeah, no, you don't know that because your joints function. Right.

**Researcher:** Exactly.

**Participant 4:** Why does that work better for me?

**Participant 1:** You know, like, and that's also the embodied interaction part because like you have something physical.

**Researcher:** Yeah, exactly. That's why I wanted something physical. So you like can demonstrate like, oh, this is the issue like this.

**Participant 1:** Yes

**Researcher:** And you can also as a person, like I sometimes don't even know I'm doing things weird, but I'm doing them weird compared with like participant 2, for example. Like I would complain that he would leave the tap, like he would use hot water on the tap, but then he wouldn't run cold after.

**Participant 1:** Yeah

**Researcher:** And he was like, why is it a problem? And I was like, I don't even know why. I burn my hand, but I'm like not on the water because it's not that hot. But I found out that I lean my arm on the tap and then open it.

**Participant 4:** ooh, okay

**Participant 1:** Ah

**Researcher:** And the tap obviously is metal. So that's very hot if you've run hot water for a while. And I was like, I didn't even realize I was doing that. So like that kind of like getting out of your mind and kind of going into your product kind of can solve those kind of issues of like, why? Why actually do I do that or explain like, oh, yeah, I do this in a different way than you would. But like why and how can we make that better? Yeah, I think that's kind of what I'm trying to conceptualize.

**Participant 1:** And I think that's eventually hopefully would help to have like better guidelines around like accessibility.

**Researcher:** Yeah.

**Participant 1:** Yeah. Otherwise, it's like more theoretical, conceptual in some sense.

**Researcher:** Yeah. And I think also that's a lot of problems with accessibility regulations right now. Like you have to be able to measure it and like almost certificate it, which makes it a lot more, you know, too straightforward.

**Participant 1:** yeah

**Researcher:** Whereas inclusivity cannot be measured by how tall the tables are. And yes, it is part of that. But there's so much more to it. Like when you say like, oh, the handle has to move in this way or that can help. But that doesn't mean that someone all of a sudden is like super welcome in that space.

**Participant 4:** Also, then you have to like write down all the rules. The guidelines I work off of are like there's new updates and there's versions, but they're not new by any means. But they're still like, does that apply to this?

**Researcher:** Yeah

**Participant 4:** Does that not apply to this? It sort of should, but doesn't really. And does that then actually help people? What I find is also a problem is that people think that all the solutions are invented or discovered. And it's like, no, we just need to sit down and think about it and interact with people who are already doing it. But like, there isn't necessarily a good answer written down.

**Researcher:** Yeah, exactly. And it's sometimes a lot more like going into the conversations that you discover things that you couldn't if you just followed a guideline and a few checkboxes. That doesn't cover like actually creating accessible and inclusive designs.

**Participant 1:** It's kind of double. On the one hand, it helps to have guidelines for people getting into it. But once they have the guidelines, they're like, OK, we don't need to talk to people.

**Researcher:** Yeah. And that's why I want to make a toolkit that kind of needs co-design and needs that collaboration. Because otherwise, I don't think it's going to work. I can make a list of things that you need to think about. But do you truly understand them from a list? I don't know.

**Participant 1:** Maybe it should be in the guidelines, like the guideline of how the process should go. Not just like, OK, these should be the features. But like, OK, this is how you... I mean, kind of like your thesis, your outcome of the toolkit.

**Participant 4:** Yeah. So I think our things are very different. Also, because I'm like, we can't test every single thing to go out there on disabled folks.

**Researcher:** I know.

**Participant 4:** I think that's a little disrespectful of their time, to be honest.

**Researcher:** Yeah.

**Participant 4:** Disability is so different. Like, a deaf person is not the same as a blind person.

**Researcher:** Yeah.

**Participant 4:** So like, I think my things were definitely sitting later on. Whereas, I think the thing is more like a phase before the phase. And what I've noticed is, like, I genuinely think that people can develop like an intuition for what is accessible and inclusive. But that means that they have to stop and think, be like, oh, what I think the default is, isn't... The default that I've seen isn't actually the best thing.

**Researcher:** Yeah.

**Participant 4:** Especially because the world's pretty ableist. And kind of a shit show. So like, getting people to like question things. And then you don't have to have all the answers. You just gotta go find them. And then have the tools to go find them. Yeah. Assorted tools.

**Researcher:** Mm-hmm.

**Participant 4:** Based on situations. Yeah.

**Researcher:** So my idea is that I create like a toolkit of these materials that we have right now. Like, or similar. I will be adding a crochet hook.

**Participant 4:** A crochet hook.

**Researcher:** And add the design justice cards. And add like broader framework things. And like general guidelines on accessibility. But then also have activities in there that you need to collaborate with the person you're designing for. And that doesn't mean that you make something exactly for them. But it's more through activities like this, you learn so much. Not just about that specific disability. But also about disability in general.

**Participant 1:** Yeah

**Participant 4:** mm-hm

**Researcher:** Like that you just need to think like different. You need to be like, oh, okay. I need to start asking questions instead of just solutions. And I think that I want to use to create like a different mindset for designers. To be like, oh, I'm not all-knowing. I am part of a process with a lot of people.

**Participant 1:** I think that makes total sense. One comment on the cards. I think I had the same comment with your toolkit. We did look at it at some point. But it's not like involved in the process.

**Researcher:** No, I know.

**Participant 3:** Is it supposed to be involved in the process at this point?

**Researcher:** No, it's more like that I want to have like a starting point kind of that you have certain things you can turn to, to get like a basic understanding before you come into the process. But because the time is very limited in this session, I didn't want to spend like, hey, take 15 minutes to read all of this. I felt like I wanted to do things first.

**Participant 1:** Yeah that's okay

**Researcher:** But the idea is also that like in a toolkit, the designers take some time to read through these things. And also I want to provide them with like there's lots of open source databases with accessibility 3D models and solutions that are already existing. And those kinds of things like that, they kind of get like

**Participant 1:** starting point

**Researcher:** A sort of a speed course and hey, OK, this is different than what you're maybe used to. And then go into something like this. But yeah, you're right. There wasn't really much time for that right now.

**Participant 1:** Yeah that's okay, it's just a general comment.

**Researcher:** Yeah, no, that's good, actually.

**Participant 1:** But also, like, I think it's really nice. Like it's detailed and everything. But in practice, I feel like designers already work on really tight schedules and stuff.

**Researcher:** mm-hm

**Participant 1:** So somehow if it's in the process or like if it's like I think at some point at one of the companies I worked for, I tried to give them a crash course on human computer interaction. And I think we ended up making a poster also to put in the office. Those kind of things also help. Like a reminder, but not all the time. But the database details, I think that's also really nice.

**Researcher:** Yeah. Yeah. So would you consider what I did in the presentation then showing like photos of like things that already exist?

**Participant 1:** Yeah

**Researcher:** I think that was something like that. And then including something along the design justice lines. Yeah, I think if you just give them like a reminder point or like some ideas and then also sources that they can go into.

**Researcher:** Oh, yeah. That's a good idea.

**Participant 1:** I also really like this visualization. [referring to the images of appliances and people with disabilities used on the poster/social media post and presentation] I think already it kind of reminds you of the difference.

**Researcher:** Thank you.

**Participant 4:** Nice.

**Researcher:** Yeah, I was like, OK, I want people to immediately when they see my poster or social media post to be like, OK, it's about disabled people and like appliances and like we bring that together and we make something cool. And I was like, well, got to make some kind of imagery around that.

**Participant 1:** Yeah

**Participant 3:** What does the middle one mean? The green body and the green.

**Researcher:** Well, that's more like invisible disabilities. Like you don't always know, like you can't always see that they have it. All the others are pretty visible.

**Participant 1:** And is it also like like either intellectual or body disabilities that are invisible?

**Researcher:** Yeah. I would put those under that.

**Participant 1:** Yeah.

**Participant 4:** I also like the disabilities or the assistive technologies around them or the bright part. Like literally it's like this shiny yellow wheelchair.

**Researcher:** Thank you. Yes, I want that. I was like, yes, I want it to be like because I think that's also part of *crip hacking*, like making things cool. Not the like sad beige bracing and like the silver wheelchair that comes out of a hospital like you want things to be cool

**Participant 4:** Lean into it

**Researcher:** because you like use them every day. And like I at least want them to be like fun and, you know, cool.

**Participant 4:** Yeah

**Researcher:** I chose white for my wheelchair because I was like, that's interesting. You don't see that often. But yeah.

**Participant 3:** It was great for your wedding.

**Researcher:** Yeah, I will look at the questions. But you've basically already answered most because you're just great with like coming up with things to say. Oh, yeah, maybe for the non-disabled people. So you already kind of mentioned it, that it kind of changed your ideas and perspective on like how like we were explaining about buttons and things like that. Can you explain something about like how it changed your outlook on designing for people with disabilities?

**Participant 1:** I don't know if it changed it a lot because I did work with people with disabilities before, but mainly I think you just get more and more. I just feel like today I could ask a bit more specific questions. I think the more you do these things, the more you get like you start to know like what questions you can ask as a designer also. I mean, you were saying it earlier that you want people to not have assumptions, but questions. So I think the more you do this, the more used to it you get in that sense. I don't know anything else.

**Participant 6:** I would agree for the most part that it's not a surprise or that it's a big mindset shift that I, it was to be expected that people were going to tell me things that I don't know the trigger thing for, but yeah, obviously I'm not going to know that, but I would expect upfront that I would hear certain things like that. Yeah, maybe more of a, yeah, I want to say maybe for example that the realization that for these very common things or maybe very, how do you say, things that I take for granted, it becomes more difficult for people with, yeah, depending on your life situation let's say. So maybe a bit of awareness on, yeah, it really is like that where you might need help with certain things. Other than that, also no crazy mindset change. Yeah.

**Researcher:** Great.

**Participant 4:** Yeah, nothing's changed. Also, because I have arthritis and I take medication, so this is not a problem for me anymore, but I've had this problem. So I'm not surprised that this is a problem for some people. And also I hear it from you. I hear a lot of your daily struggles with how the world is designed. And I think, yeah, because we chose this one instead of a different disability, there's not really anything surprising to me. But I think maybe if we had a larger group or a more diverse group or people with different disabilities, there are some, yeah, I think there would have come some information out of it that I'm not familiar with yet. But for this, yeah.

**Researcher:** Mm hmm.

**Participant 1:** Yeah, I think that's a good point. I don't think I worked with people with physical disabilities before, so that was new for me.

**Researcher:** Yeah. I wanted to get a greater variety of disabilities, but unfortunately, yeah, if they don't sign up, they don't sign up. That's it. And also I think, yeah, these are physical disabilities are often a lot more apparent and a lot more about physical products, which are a lot easier to discuss and clearly be able to talk about. And then like, oh, yeah, like participant 2, he forgets that the kettle is done. Like, yeah, you would be like, OK, put a timer. Solved.

**Participant 1:** Yeah.

**Researcher:** So, you know, like and creating a new product or adapting a product, I think, is more of an issue and more difficult to solve when you have also different physical disabilities. Like we have pretty similar physical disabilities [with participant 4].

**Participant 4:** Yeah

**Researcher:** So that might if someone else might have paralysis in one arm and this won't work, you know. But I think I want to use this as kind of like that you start to have a different understanding and a different approach to design for people with disabilities so that not necessarily everyone is covered by this solution, but then it kind of opens it up and that eventually, hopefully, throughout the process, it will become more for more people, more inclusive, hopefully.

**Participant 3:** So when you talk about physical disabilities and cognitive disabilities, is there anything in your toolkit that you have prepared for designers to open up this conversation? Because if I look at this session right now, we quickly went with this one and we didn't really pay any attention to struggles that you may have with autism or ADHD. But because you can have physical solutions to cognitive problems, is there anything in your toolkit or how do you look at that?

**Researcher:** So first of all, there is no toolkit yet. I don't know yet, but yeah.

**Participant 3:** Yeah but you're working towards something.

**Researcher:** Yeah, I do have like I have included solutions that I show as like inspiration that are for other disabilities, but I did include some things to make like a texture or like braille on things or, you know, things like that I have thought about and like I do want to put some general information about, for example, colour-blindness or but also I don't have experience

enough and I was hoping to gain that more here, which, yeah, didn't end up happening. Also, I think we didn't have enough diversity in the group to make that happen, so I might just have to decide that that's not something I'm going to do because I don't know enough about it. That's an option. I'm not sure yet.

**Participant 3:** Do you feel like there's more of a taboo on designing for autistic disabilities rather than physical disabilities?

**Researcher:** Oh, yeah, that definitely. Yeah.

**Participant 4:** Yeah.

**Researcher:** That's also an issue. Definitely. Yeah.

**Participant 4:** And it's also just harder to discuss. Like for most people with physical disabilities, you're like, that's a physical disability. They're like, that is correct. Lots of cognitive disabilities and then it's like, okay, cognitive inclusive or exclusive of intellectual. Okay, how are we? And it gets really messy and mucky. Yeah. It's easier to see that you and I hold something different versus how you think about something. I frequently forget that people aren't dyslexic. I will go to my coworkers and be like, okay, we got to figure out a way to do this. And they're like, Laura, here's the answer. And I'm like, how do you do that? And they're like, I'm just not dyslexic. And I'm like, correct. You are not. Okay, thank you.

**Researcher:** And even I forget I'm dyslexic because it's not even registering. Because in my daily life, I run into things. But I'm so used to being dyslexic. It's just how my brain functions. And I don't even see that as a disability almost anymore.

**Participant 3:** You run into things because you're dyslexic?

**Researcher:** Yeah. Like a figure of speech.

**Participant 3:** You physically run into things? Oh, I thought maybe my understanding of dyslexia is just wrong.

**Researcher:** Well, actually, there is a lot of overlap between...

**Participant 3:** I thought it had to do with like reading things wrong, like b and d.

**Participant 4:** Yeah, actually, there is a lot of overlap with like...

**Participant 3:** Physical awareness.

**Researcher:** yeah

**Participant 4:** Yeah, proprioception, which is often a thing for neurodiversity.

**Participant 3:** Okay

**Researcher:** So it can be, it can be. But I also have proprioception issues for my physical disability. So I'm not sure exactly where it comes from. But I mean more like I run into issues in my daily life. With my physical disability much more than my dyslexia. That's just how I do things. And sometimes someone tells me something about the way I do things, and I'm like, oh, really? Like, I didn't know? My brain doesn't comprehend that all of that is connected and that somehow, you know.

Anyway, it's very complicated. So I don't even notice that unless someone points that out. So it's a lot harder to discuss how that is an issue and how that could be solved. I don't really know.

**Participant 1:** I think it's also like a two-way reflection almost. Because, yeah, I mean, so many things are already used as a part of reality that you don't think of mentioning maybe as a thing. But maybe it can lead to other solutions also.

**Researcher:** Yeah, but I think also a lot of neurodivergent people don't even see their neurodivergence as a disability anymore. So it also becomes a lot more tricky. And like, do they want a solution? For what part do they want a solution? For what part do they not want a solution? And like, how this all works. I don't know. So, yeah, it might just turn out that my toolkit will only focus on physical disability. It was not my intention, but maybe that's the result. I don't know.

**Participant 3:** Because it's also difficult to just do small projects. Yeah. It will be difficult to pay enough attention to all of the disabilities that really need those disabilities.

**Researcher:** Yeah. And I do think I want to make the toolkit itself accessible. So make it colourblind friendly. Put texture and audio descriptions and all of that to make it accessible. But maybe not focused on those disabilities. Yeah, I could see that happening. Definitely. Because, yeah, it's very hard to do it all.

**Participant 6:** I mean, there's also, I feel like, some value at least in... I mean, ideally, I get that if you have a disability, you want to be as independent from other people still, regardless.

**Researcher:** Well, that's also a debate, but yeah.

**Participant 4:** Yeah, no one's independent.

**Researcher:** Nobody is independent.

**Participant 6:** That's the whole thing, yeah. Let's say you drink tea every morning. I can imagine that you don't want to have to ask anyone to help you with that. Yeah. But in the context of your toolkit, I can also imagine that there's a... Since we're trying to connect designers and people with a disability, that it's nice to have some kind of way to foster the collaboration, right? If it's not completely accessible maybe be dependent on each other. For people to kind of, okay, you do this, you do that, you kind of, I know you start talking, you, yeah, I don't know, it depends on what you want, but if you want a toolkit just for disabled designers, that's different from a toolkit, maybe that's...

**Researcher:** Yeah, I think I want to make it for designers and disabled people, but that could also be disabled designers designing for disabled people.

**Participant 6:** Yeah, yeah, yeah, it could be everything.

**Researcher:** And I do want it to be inclusive, because I just feel like wherever you have the opportunity, you should make it inclusive,

**Participant 6 and participant 4:** mm-hm

**Researcher:** And that, you know, obviously it won't be perfect, because nothing is perfectly accessible, but to at least put in the effort to make it as accessible as possible, to my knowledge, I think is very valuable,

**Participant 6:** mm-hm



**Researcher:** And then maybe it's not focused on helping that specific disability, but at least if you're a designer with that disability, you can still use it

**Participant 6:** yeah, yeah, mm-hm.

**Researcher:** to work with other people.

**Participant 3:** I think it's interesting to design a toolkit in such a way that you need each other by the design of the toolkit. That's what you mean right? [directed to participant 6]

**Participant 4 and 6:** Yeah, yeah, yeah.

**Participant 3:** You cannot conclude, uhm, you cannot use this without each other, and I'm not saying you have to make all the bright colors, saying that if you are colorblind, you really can't use it if you're a disabled designer.

**Researcher:** Yeah, no, but it is an interesting idea. Yeah.

**Participant 6:** For me, let's say I don't have a strong disability, so I need to do something to get the information out of the people I'm working with, and then vice versa, maybe to, yeah. I don't know, I get your, I completely get what you're saying, though, like if you have the opportunity to make it as accessible as possible, let's do it.

**Participant 3:** mm-hm

**Participant 4:** Also, because a lot of people think that making things baseline accessible is very difficult, and they just need to think about it.

**Participant 6:** Yeah, yeah, and it's an opportunity to showcase it and everything,

**Participant 3 and researcher:** yeah, yeah

**Participant 6:** no, I can get that.

**Participant 3:** But I think those two separate, and make it inclusive, but also design it in such a way that you need each other.

**Researcher:** Yeah, it is an interesting concept, and I do appreciate the idea in general, not to make it not inclusive, but more by design, make it so that you need each other to use it.

**Participant 4 and 6:** yeah

**Researcher:** I think that would be interesting.

**Participant 6:** Yeah, just a way to-

**Participant 4:** Facilitating interdependence without the disadvantaging the disabled person.

**Participant 6:** Yeah, because I think what you mentioned before about how it's very hard for you to consciously bring up, let me list all the things that are inconvenient to me in a day.

**Participant 4:** Yeah.

**Participant 6:** No one can do that, I think, so-

**Participant 4:** We'd be here for hours. We'd still forget things.

**Participant 6:** Yeah, exactly, you'd miss half the important things.

**Participant 4:** yeah [laughing]

**Participant 6:** So some way of emphasizing and reinforcing this conversation between, and kind of helping us see the problems that you're dealing with.

**Researcher:** mm-hm

**Participant 6:** Yeah, maybe through this way of letting other people-

**Researcher:** Yeah, yeah, because there is a lot of discourse happening around like, oh, you want to, disabled people have to be independent. And then there's this like, something that's like, well, actually, nobody's truly independent. Like you go to the shop, somebody put that food on the shelf.

**Participant 6:** mm-hm

**Researcher:** You didn't do that yourself. You're dependent on that person. When the trucks don't drive, you don't have food in the supermarket. You know, we're all interdependent.

**Participant 6:** No, but you compare it to the person that, I don't know if your thing is that your legs don't work well, but compared to the person who has working legs, let's say, that you're as independent. That's kind of how I meant it, I think.

**Researcher:** Yeah, yeah, no, I get it. I'm just saying like, there is this like thing of like balancing dependency and independency that is like, yeah, an interesting topic to be like, yes, I want to be independent in some ways, but also not being able to be independent is not a negative.

**Participant 6:** mm-hm, mm-hm

**Participant 4:** yeah

**Researcher:** And I think your idea of creating sort of an interdependence, like, as you said, not disadvantaging anyone [towards participant 4], but kind of like, you need each other to do this, is kind of the underlying idea of why I want to make this, like that. You do need each other.

**Participant 1:** yeah

**Researcher:** So yeah, I like it.

**Participant 1:** We have similar examples in the embodied interaction course from Jelle. Like we had to design things that were also like social.

**Researcher:** Oh, yeah, yeah, I know.

**Participant 1:** Yeah.

**Researcher:** yeah, we made like a wooden object that had like little conductors. So like when you would feel them, then the other persons would like start kind of like slightly vibrating so that you would feel like you were touching. Yeah, something



like that. Like it doesn't work when you're just by yourself. Nothing happens. Yeah, kind of like that. That's that's a cool idea. Yeah. OK, I'm going to check if I covered everything and then I think we're pretty much done.

So maybe more in general, the practicalities of like, I want to develop a toolkit. What do you think should be in there? What of the materials you think [laughing together with participant 3], except for the crochet hook, because that was very obvious. What do you think are like important materials that you think would be very helpful or just features of the toolkit that you think should be in there?

**Participant 1:** One thing I was thinking when we mentioned like also disabled designers designing things.

**Researcher:** mm-hm

**Participant 1:** I recently saw a video, I don't know if you've seen it, of like Lego bringing out those like Braille Legos. I don't know if it's correct.

**Researcher:** no

**Participant 1:** I can send it to you if I find it.

**Researcher:** Oh, yeah, sure.

**Participant 1:** Legos can also be useful, actually.

**Participant 3:** Yeah, I saw that video also, but they were like almost like paintings that you make with them.

**Researcher:** Oh, the dots, yeah.

**Participant 1:** yeah

**Participant 3:** But you can also use them for Braille and I've seen people also use it for printing.

**Researcher:** Oh, cool.

**Participant 3:** And also, yeah, I think that's a good point that you can instead of the diamond stickers.

**Researcher:** Yeah, include that kind of Lego.

**Participant 1:** yeah

**Researcher:** Yeah, cool.

**Participant 6:** I was thinking like a question prompt or something.

**Researcher:** Oh, yeah, that's a nice idea.

**Participant 6:** For us, at least, it came quite natural, but I can imagine in some context, it helps to have something.

**Participant 3:** It also depends on what kind of designers you have. I work at a very technical company and I am creative, but my direct colleagues from the design team are all physicists.

**Participant 6:** Oh yeah, that is not...

**Participant 3:** Most of them are physicists. They think in a very different way than creative people do. And then especially for them, I think prompts are very helpful.

**All:** mm-hm, yeah

**Participant 1:** Yeah, prompts or even activities like a small brainstorming activity.

**Participant 3:** yeah, I guess if you were to do a session like this or if you want to have a session like this, a little bit more structure would be helpful, especially at the beginning. I think we were all just kind of like, and now what?

**All:** Yeah, no, yeah, yeah.

**Researcher:** This was also an exploratory session for me to kind of know how to do this because I've never done this before. So yes, indeed, I also recognize some structure would be nice and like some like I provided some prompts like how what is the problem with this current device? Like how would you solve it? Like those kinds of things. And then like first start with sketching and then maybe prototyping and rework the prototyping, those kinds of things.

**Participant 1:** mm-hm

**Researcher:** And together with like prompting questions, I think that would probably help, right?

**Participant 3:** Yeah, I think especially to start from what goal are you going to design for? Because we made this choice very quickly and you could have made this beforehand. I think there was also an opportunity to explore the other possibilities. I think would have also, yeah, ended up with very interesting solutions.

**Researcher:** Mm-hmm. Yeah.

**Participant 3:** Especially like if you think about it from a different point, if you say, okay, there's a taboo on it and how do you bring those to the table if you want to go to the there? Yeah.

**Researcher:** Okay.

**Participant 3:** But I think for physical [disabilities], yeah, the thread and the tape and just different materials.

**Participant 1:** I think like a cardboard versus rope gives you different ideas. So I think as long as you have that kind of balance.

**Participant 3:** Yeah. I would also include clay.

**Researcher:** Yeah, I have that [laughing]. I have the air dry clay.

**Participant 3:** Oh, okay. I always bring that. Nobody has ever used it yet, but I think it's good to use.

**Participant 1:** I think it's like people don't want to open a new package.

**Participant 3:** Maybe. Maybe that's it.

**Participant 1:** Because I think if you would have like a playdough type of thing.

**Researcher:** Oh, yeah, maybe that would be nicer because that's like reusable.

**Participant 1:** Yeah.

**Researcher:** And then they wouldn't feel so committed to it.

**Participant 3:** It also depends on who you work with.

**Participant 1:** Yeah.

**Participant 3:** I think most of us are very creative and it's easy to just grab stuff and start making it. But when I did co-design sessions with non-designers, they literally just grab paper and start writing.

**Participant 4 & researcher:** Yeah. Right.

**Participant 6:** You'd have a whole essay by the end of the session.

**Participant 2:** It's like, oh, we've seen this problem before. We're going to do it this way.

**Participant 6:** Yeah, they might have a solution in mind already.

**Participant 4:** I also think that durability to a certain extent. I was not looking at how to incorporate cardboard at all because I'm not going to give the right feedback, especially because they are physical objects that are visually very useful. But I was at least really focused on touching physical, tactile feedback, especially since we were talking predominantly in the space of physical disabilities. So the rope felt like the appropriate thing. And I oftentimes feel like with these things [cardboard] never feel right. Especially if you have people with, like, tactile interests or they gravitate towards something. If we made a handle out of cardboard, I think I would have been less engaged with that.

**Participant 3:** I think if you had a different problem, then if we were to make, okay, if it's too low, I cannot carry it, it has to be higher, then you'd make it out of cardboard.

**Participant 4:** Yeah.

**Participant 3:** And then you wouldn't make it out of rope. It doesn't make sense. I mean, it is nice to have different materials for different solutions.

**Participant 4:** Yeah a mix of materials with different tactilities.

**Researcher:** Okay. Well, I'm kind of out of questions. So unless there's anything else you would like to share about this or just say anything.

**Participant 3:** What are you going to do with this information? What's next for you? [to the researcher]

**Researcher:** Yeah, so I'm going to transcribe all that we've said here and kind of take things on board that you mentioned, like improvements. I'm going to theorize some kind of toolkit. I'm gonna take this [the hacked object] home, take pictures of it, show how it's going to be used. You [participant 4] demonstrated very nicely. And kind of show that we really improved upon the design of something like this. We did that in a very quick, very short session to kind of show what is possible. And to be like, hey, look, if we provide some creative materials, we have a short brief, we have some prompts, we can do quite a lot already.

**Participant 3:** Yeah we did all of this in two hours.

**Researcher:** Yeah because participant 2 was at first wondering what we could do in 2 to 3 hours, so I made it a bit longer, but actually we did something here, very quickly, quite basic, but something substantial nevertheless. And I think especially designers are used to very quick and easy ideating and prototyping. But showing something physically, pretty quickly. You have a mechatronics, software background [to participant 2] which you didn't have experience with something like this specifically. And it's just a different mindset.

**Participant 6:** That's what I thought initially when you said hackathon and hackers. Yeah. I was wondering, where the computers were.

**Researcher:** Yeah, so I tried to kind of improve the brief a little bit to be like hardware hackathon and these appliances and kind of like, try to make it a little bit more clear. But yeah, it's still hard because, yeah, you don't want to write a whole essay explaining what we're going to do here. But yeah, it is interesting to be like, okay, there's different people with different ideas. How can we bring them together to do something like this? That's kind of like what I want to do now. And kind of look at like, how can we make a toolkit that can foster this kind of collaboration, basically.

**Participant 3:** Will you use this? [pointing to the hacked object]

**Researcher:** Maybe.

**Participant 3:** I will be curious to see if you would use this for a longer period of time.

**Researcher:** I'm going to try it at least, see how it holds up.

**Participant 3:** I wonder how valuable is the output of the session?

**Researcher:** Oh, yeah, pretty valuable to me, actually.

**Participant 3:** No, but if you were to use it, does it actually solve your problem?

**Researcher:** Oh, so yeah, yeah.

**Participant 1:** And also, does it go off at some point? Yeah.

**Participant 3:** Yeah, but maybe at some point you feel that the handle is too large, or it's just like, how valuable is the actual solution that you came up with in two hours? I think that would be interesting.

**Researcher:** Yeah, and yeah, I want to make like a toolkit that can do like this kind of first exploratory step. So the result should never be like a working prototype that you are going to manufacture tomorrow. Well, that never happens, but like maybe in a month. Like that should not be the goal, because that's unreasonable in this time. And I think it's also disabled people are often asked to give input at the very last step in the process to be like, hey, do you like this? And I'm like, no, but you can't change it anymore. Like they asked me like the ICT building and they were like, yeah, it's already built, basically. So, okay, thanks. That's very helpful.

**Participant 4:** You just want like a stamp of approval.

**Participant 3:** Yeah, exactly. We asked. It was approved.

**Participant 4:** We asked a "card-carrying member". We had someone sign off on behalf of all disabled folks.

**Researcher:** Yeah, exactly. So that's why I was like, so that's why I kind of wanted to be like, hey, this is like a first step where you involve your target group. You talk through things, you get kind of like ideas and you know what they need, what they want and kind of go from there instead of like, oh, yeah, we did this whole process and now we show you. Great, thanks.

**Participant 3:** I'm surprised we have a working prototype.

**Researcher:** Yeah, me too.

**Participant 3:** I wasn't expecting to have a...

**Researcher:** No, me neither.

**Participant 4:** Well, thanks to you [to participant 3]

**Participant 6:** Yeah, I didn't do anything. So that's on you.

**Participant 3:** No, it was definitely a joint effort.

**Participant 6:** This one is mine [points to a small part of the rope attachment]

**Researcher:** No, but coming up with all the ideas.

**Participant 3:** What was his name, sorry, the guy that left already?

**Researcher:** Participant 5

**Participant 3:** Yeah. OK, well, if he didn't come up with the one about a rope, when he brought it up, I didn't think that it was going to work. But it does.

**Researcher:** Yeah. I just made it.

**Participant 3:** I'm not the designer, I'm the maker in this instance.

**Participant 1:** Yeah you're the maker in this one.

[Participant 6 leaves]

**Participant 3:** [to participant 2] So how was it for you as someone with ADHD and autism, to design for a physical disability?

**Participant 2:** Interesting, I'm more like a software slash different kind of tools, think physical disabilities might be easier to design for than the mental disabilities. Like, I try to solve my mental disabilities in several ways to make tools to support myself. But I often forget that the tools exist. You're like, all right, I'll tell these shortcuts.

[someone walks in who is working on another project in the hallway and has heard something about what we were doing]

**Person from the hallway:** Can I interrupt? So this is what you designed? Can I see it?

**Researcher:** Yes of course.

**Participant 4:** [demonstrates how to use it] So this is quite hard to like balance it and it's heavy and it's hot usually. And then you have something to hold it with. And balance it.

**Researcher:** But we just did a very quick session, so it's a very early prototype.

**Participant 4:** Two hours ago this didn't exist.

**Person from the hallway:** Even for me it is convenient, even if like I don't have the problem. It's still very heavy.

**Researcher:** Yeah, indeed, yeah.

**Person from the hallway:** I think it will help a lot of people even if you don't have a disability.

**Participant 4:** It's at an awkward angle, it's hot and you can't hold here [on the other side of the kettle] because it's hot and it's just like yeah.

**Person from the hallway:** awesome, okay see you guys.

[person from the hallway leaves]

**Researcher:** Okay thank you all for coming, participating and giving me great ideas.

[Recording ended, afterwards some more casual conversations happened]

#### **Observations & quotes casual chats:**

Most of the participants stayed in the room after the official part was over and chatted to each other. They enjoyed being able to talk openly about disability and topics associated with it.

Some quotes from these conversations that stood out to me have been noted below.

"Maybe you shouldn't want your toolkit to be usable for all disabilities, maybe that's too much to ask for your master thesis, maybe you should just focus on physical disabilities, also because it is so diverse and in this session we mostly focussed on physical disabilities." "I've really enjoyed talking to you, I really felt a connection, a shared understanding of disability and how it effects me and how it feels" "Yeah I know what you mean, I always try to describe that feeling, but I'm not sure how" "Have you ever heard of access intimacy? That's the closest I've come to a word for the feeling" "Yes I've heard of that, also the care disabled people do for eachother, you are not just a care taker or a care receiver, you can be both" "maybe the toolkit should be about bringing designers into the disabled world instead of the other way around, have them get to know that access intimacy" "Yeah, have them share in the value of the disabled community" "Yes because we also need that, that diversity, out of the box thinking that disabled people can offer" "Disabled people are very great at adapting and we really need that right now" "Exactly, the way we have been doing things has gotten us here, which isn't great, so maybe we need fresh perspectives, new ways of doing things to get us to different, maybe better, places" "I'm proud to be disabled, that doesn't mean it's not hard or super fun all the time, but disabled people are a testament to adaptivity, and the skills I have using a wheelchair or other mobility aids, that is not a skill many people have, I'm proud of that" "Disability is neutral"

## Appendix L – Informed consent form and information sheet activity 2

# Information sheet Activity 2: Pre- and post-use interviews & diary study

I'm currently working on my Master's final assignment/thesis and I've created a prototype of a website for disabled people to increase their creative confidence by learning to 3D print. And I'm wondering what you think, the testing of this will be done in 2 short interviews (20-30 min) and you getting access to the website for 2 weeks and answering a few questions at 3 stages to ask about your opinions, experience and see if the website is effective. As a thank you, you can have something of your choice 3D printed and get to keep this. All of this will take place in the days between the 31<sup>st</sup> of October and the 19<sup>th</sup> of November. Let me know if you would be interested and/or if you know anyone else that would be interested.

### **Purpose of the study**

The purpose of the study is to learn more about how this prototype website influences your creative confidence and what you think of the prototype, how useful you think it is, what parts you like, what you don't like and how you think it could be better and what you think about the accessibility. There will be an interview at the start and at the end and a diary study (where you answer a few questions at each of the 3 stages and write these down) between those two.

### **Procedure for withdrawal**

If at any point you would like to withdraw your participation from the study you can either let me know during the session, or send me an email at [a.noordeloos@student.utwente.nl](mailto:a.noordeloos@student.utwente.nl) or you can contact my supervisor at [c.zaga@utwente.nl](mailto:c.zaga@utwente.nl) after I graduate.

### **Data collection & storage**

Certain personal information (like your name, email address, age-group, pronouns, disability) will be collected before the session, this information is needed to give demographic background to my study and be used for communication with you. Your personal information will be temporarily saved on the OneDrive cloud until all responses are collected and then it will be saved on the secure University of Twente SurfDrive, or anonymized and the original data deleted.

The interviews will be audio recorded and transcribed, this will be anonymised and then saved on the university OneDrive server. The transcription will be in the thesis and I might use quotes during my colloquium presentation, this will always be done anonymously.

You can at any point request access to the information that I have of you and you can request rectifications if you feel you were misrepresented. You also have the right to have your personal information erased.

Your data will not be shared with anyone outside of the research team. Any data that will be used in the thesis or colloquium will be anonymized.

## **Informed Consent for Activity 2: Pre- and post-use interviews & diary study**

*'I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described in the aforementioned information brochure "Information sheet Activity 2: Pre- and post-use interviews & diary study"*

*I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.*

*My questions have been answered to my satisfaction. I agree of my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time.*

*If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission. If I request further information about the research, now or in the future, I may contact Anouk Noordeloos ([a.noordeloos@student.utwente.nl](mailto:a.noordeloos@student.utwente.nl)) or after her graduation her supervisor: [c.zaga@utwente.nl](mailto:c.zaga@utwente.nl) )*

*If you have any complaints about this research, please direct them to the Secretary of the Natural Sciences and Engineering Sciences Ethics Committee at the University of Twente, P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 5607; email: [a.m.klijnstra@utwente.nl](mailto:a.m.klijnstra@utwente.nl)).*

*Signed in duplicate:*

.....  
*Name subject*

.....  
*Signature*

*I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.'*

.....  
*Name researcher*

.....  
*Signature*

## Appendix M – Questions activity 2

### Recruiting message

Hi [name], I'm currently working on my Master's final assignment/thesis and I've created a prototype of a website for disabled people to increase their creative confidence by learning to 3D print. And I'm wondering what you think, the testing of this will be done in 2 short interviews (20-30 min) and you getting access to the website for 2 weeks and answering a few questions each day to ask about your opinions, experience and see if the website is effective. As a thank you, you can have something of your choice 3D printed and get to keep this. All of this will take place in the days between the 31<sup>st</sup> of October and the 17<sup>th</sup> of November, the first interview will take place between today and the 5<sup>th</sup> of November, in the form you can let me know about your preference for a date. Let me know if you would be interested and/or if you know anyone else that would be interested. You can sign up through this link: <https://forms.office.com/e/dQZU0NhQV8>

Kind regards,

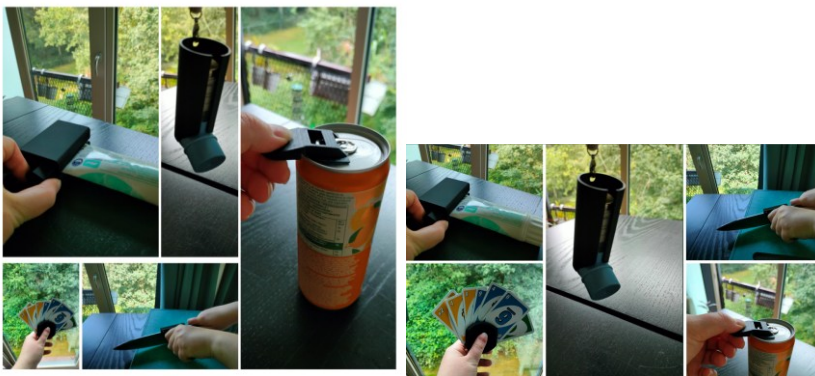
Anouk

Alternative message for social media:

Have you always wondered if 3D printed assistive technology could work better for you? This is your chance to try this out in my research project, which includes a platform for learning about 3D printing and the printing service of a 3D model of your choice, including the examples below and many more. The study is explained further in this link: <https://forms.office.com/e/dQZU0NhQV8>

In Dutch:

Heb je altijd al afgevraagd of 3D geprinte hulpmiddelen goed voor jou zouden kunnen werken? Dit is je kans om het uit te proberen in mijn onderzoeksproject, inclusief het uittesten van een platform om over 3D printen te leren en een service waar je iets van jou keuze kan laten 3D printen, onderstaande voorbeelden en vele meer! (Het platform en project zijn wel in het Engels). Het project wordt verder uitgelegd in deze link: <https://forms.office.com/e/dQZU0NhQV8>



And translated to Dutch:

Hoi [naam], ik ben momenteel bezig met mijn Master afstudeeropdracht/thesis en ik heb een prototype gecreëerd van een website waarmee ik mensen met een beperking wil helpen om meer zelfvertrouwen te krijgen in hun creativiteit door te leren over 3D printen. En nu ben ik benieuwd wat je denkt, de evaluatie zal bestaan uit 2 korte interviews (20-30 min) en uit toegang tot het prototype van de website voor 2 weken waarbij je op minimaal 3 punten wat vragen beantwoordt in een dagboek/journal wat je bijhoudt om te kijken of de website goed werkt en wat je er van vindt. Als

bedankje, kun je tijdens dit evaluatie proces een 3D model naar keuze gratis laten printen en dit object mag je houden. Dit alles zal plaatsvinden tussen 31 oktober en 17 november, het eerste interview zal plaatsvinden tussen vandaag en 5 november, in het formulier kun je je voorkeur voor een datum aangeven. De website is in het Engels en de interviews zullen ook plaatsvinden in het Engels, dus houd hier rekening mee. Laat het me weten als je geïnteresseerd bent of als je iemand anders weet die mogelijk geïnteresseerd is. Je kunt je aanmelden via deze link:

<https://forms.office.com/e/dQZU0NhQV8>

Groetjes,

Anouk

Email after sign-up

Hi [name], thank you for signing up! I see you have a preference to start at [date]/no preference. I suggest meeting up [date and time] [online/at in person location]. Let me know if that works for you. I've included the informed consent form, you will be asked to sign this at the first interview, you can read through it before then if you want.

Please let me know if you have any questions.

See you then!

Kind regards,

Anouk

**And translated to Dutch:**

Hi [naam], bedankt voor je aanmelding! Ik zie dat je een voorkeur hebt voor [datum]. Ik stel voor dat we [datum en tijd] afspreken, [online/ofline]. Laat me weten of dat voor jou uitkomt. Ik heb het informed consent form toegevoegd, je zal worden gevraagd om deze te tekenen tijdens het eerste interview dus je kan er nu alvast doorheen lezen als je wilt.

Laat het me weten als je vragen hebt.

Tot dan!

Groetjes,

Anouk

**Email after interview**

Dear [name],

We just had the interview and I want to thank you again for participating. As promised, in this email I send you the link to the website prototype: [link] and the [file is attached/link here] for the diary/journal.

Let me know if you have any questions.

Kind regards,

Anouk



# Sign-up form

## Sign up to test Disabled Design Quest - a disability maker platform all about 3D printing <sup>3</sup>

Hi, my name is Anouk and I'm working on my master's final assignment and I've created a website that teaches disabled people about 3D printing and hopefully helps you become more confident in being able to make adaptations to things you use or create new assistive technology. To make sure that this website will work for this purpose I need your help! In the testing of this website I want to have a short interview (about 20 minutes) with you to see where you're at, then give you access to the website for a week while you write about your experience in a few sentences each day (will take about 10 minutes a day) and then a final interview (about 20-30 minutes) where I can ask you what you thought about it. You need to have access to a tablet or laptop/desktop computer because the prototype is not yet suitable for use on mobile phone. Through this process you'll learn a bit about 3D printing and you can have a model of your choice printed and you get to keep it. This whole process has to take place between the 18th of October and the 3rd of November. Does this sound like something you would like to participate in? Sign-up below!

\* Required

1. What are your first and last name? \*

2. What is your email address? \*

3. Do you identify as disabled and/or neurodivergent? \*

- Yes  
 No (then you can unfortunately not participate)  
 Maybe

4. Can you explain what type of disability/neurodivergence you identify with? (Physical/mental/sensory/learning/neurodivergence etc. - you don't have to specify your diagnosis) \*

5. Do you identify as a maker/designer/inventor? \*

- Yes (then you can unfortunately not participate)  
 No  
 Maybe

6. What are your preferred pronouns? \*

- She/her  
 He/him  
 They/them  
 Other

7. What age group are you in? \*

- Under 16  
 16-25  
 26-35  
 36-45  
 46-55  
 56-65  
 65+

8. What accessibility needs do you have?

- Wheelchair accessible entrance and space  
 Wheelchair accessible parking  
 Accessible toilet  
 Quiet space  
 Need to bring a support person  
 Need to bring a service animal  
 Need for sign language interpreter/live captioning  
 Other

9. Do you have a preference for this session taking place in-person or online? \*

- In-person  
 Online  
 No preference

10. Do you have a preference for a location?

- Care  
 Ravelijn  
 Spiegel  
 Technohal  
 Vijhof  
 No preference  
 Other

11. What date & time would you prefer this takes place? \*

- Friday October 18th morning  
 Friday October 18th evening  
 Saturday October 19th morning  
 Saturday October 19th afternoon  
 Saturday October 19th evening  
 Sunday October 20th morning  
 Sunday October 20th afternoon  
 Sunday October 20th evening  
 Monday October 21st morning  
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 Wednesday October 23rd evening  
 Thursday October 24th morning  
 Thursday October 24th afternoon  
 Thursday October 24th evening  
 Friday October 25th morning  
 Friday October 25th afternoon  
 Friday October 25th evening  
 Saturday October 26th morning  
 Saturday October 26th afternoon  
 Saturday October 26th evening  
 Other

12. Have you ever been dissatisfied by the design of, or wanting to make changes to assistive technology own and/or use? If yes, can you give an example of this? \*

13. Do you have any questions?

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This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.



# Appendix N - "printing service" request form

<p><b>Printing service request form</b></p> <p>Hi! You have been testing Disabled Design Quest and now you have reached the point of using a printing service, well this is the place to be, here you can input all the information and I'll make sure it gets printed, then we'll meet up to make sure it gets to you, all at no cost to you. The file you can send to <a href="mailto:anoordeloop@student.uhweste.nl">anoordeloop@student.uhweste.nl</a></p> <p>* Required</p> <p>1. What is your name? *</p> <input type="text"/> <p>2. What is your email address? *</p> <input type="text"/> <p>3. Send your stl file and anything else you want to share to <a href="mailto:anoordeloop@student.uhweste.nl">anoordeloop@student.uhweste.nl</a></p> <input type="text"/> <p>4. What material and colour filament would you like us to use? (if you want a multi colour print upload an image of the slicer with which colour goes where, and you can only combine the same materials together) *</p> <ul style="list-style-type: none"><li><input type="checkbox"/> PLA - white</li><li><input type="checkbox"/> PLA - black</li><li><input type="checkbox"/> PLA - green</li><li><input type="checkbox"/> PLA - red</li><li><input type="checkbox"/> PLA - blue</li><li><input type="checkbox"/> PLA - mandarin orange</li><li><input type="checkbox"/> ABS - white</li><li><input type="checkbox"/> ABS - olive green</li><li><input type="checkbox"/> ABS - tangerine yellow</li><li><input type="checkbox"/> PETG - translucent</li><li><input type="checkbox"/> TPU - light blue (flexible filament)</li></ul>	<p>5. What quality would you like to have this printed at?</p> <ul style="list-style-type: none"><li><input type="radio"/> 0.08mm Extra Fine @BBL X1C</li><li><input type="radio"/> 0.08mm High Quality @BBL X1C</li><li><input type="radio"/> 0.12mm Fine @BBL X1C</li><li><input type="radio"/> 0.16mm High Quality @BBL X1C</li><li><input type="radio"/> 0.16mm High Quality @BBL X1C</li><li><input type="radio"/> 0.20mm Standard @BBL X1C</li><li><input type="radio"/> 0.20mm Strength @BBL X1C</li><li><input type="radio"/> 0.24mm Draft @BBL X1C</li><li><input type="radio"/> 0.28mm Extra Draft @BBL X1C</li></ul> <hr/> <p><small>This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.</small></p> <p><small>Microsoft Forms</small></p>
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# Appendix O – Interview & diaries activity 2

## Diaries

Diary in miro:



Pdf diary: to be filled in via adobe acrobat or printed out and filled in manually

## Journal

Hi participant, welcome to the online diary/journal! On the next pages you can answer the questions in several ways, you can put sticky notes, just write or draw or make something with shapes or stickers, whatever you want!

If you don't have enough space, feel free to change the lay out to fit your needs or continue in the free space.

There are 3 stages where you have to fill in this journal:

**Stage 1:** First use of the Disabled Design Quest website

**Stage 2:** Requesting your print of a 3D model

**Stage 3:** Receiving and trying out the 3D printed object

In between you can write in the free space pages up top, don't forget to write what date you filled in the pages!

Name: .....

## Stage 1 – First use of the Disabled Design Quest website

1. How was your first time using the website Disabled Design Quest?

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a. Can you explain what you did?

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2. How do you think it went today?

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a. How do you feel about it?

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3. Do you feel like you learned anything about 3D printing already?

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a. If so: can you explain what and how?

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b. What do you think about this?

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4. Did you encounter any problems or anything difficult?

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a. If so: can you explain something about these?

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b. And how did you overcome them?

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c. In what way did this effect your confidence in your creative capabilities?

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5. Do you feel like your confidence in 3D printing has changed?

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a. If so: how did it change?

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b. Do you feel like using DDQ contributed to this?

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c. If so: how did DDQ contribute?

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6. Do you feel like your confidence in your creative capabilities has changed?

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a. If so: how did it change?

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b. Do you feel like using DDQ contributed to this?

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c. If so: how did DDQ contribute?

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b. Is information easy to find and access? If not: please explain

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7. What do you think about the information provided about 3D printing?

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c. Is the way it is presented helpful? If not: please explain

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a. Is it written in a way that is understandable for you? If not: please explain

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d. Is the information complete? What is missing?

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## Stage 2 – Requesting your print of a 3D model

1. How did it go requesting a 3D print?

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a. What did you choose to print?

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b. Why did you choose that?

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2. How do you think it went today?

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a. How do you feel about it?

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3. Do you feel like you learned anything about 3D printing?

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a. If so: can you explain what and how?

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b. What do you think about this?

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4. Did you encounter any problems or anything difficult?

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a. If so: can you explain something about these?

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b. And how did you overcome them?

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c. In what way did this effect your confidence in your creative capabilities?

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5. Do you feel like your confidence in 3D printing has changed?

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a. If so: how did it change?

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b. Do you feel like using DDQ contributed to this?

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c. If so: how did DDQ contribute?

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6. Do you feel like your confidence in your creative capabilities has changed?

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a. If so: how did it change?

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b. Do you feel like using DDQ contributed to this?

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c. If so: how did DDQ contribute?

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a. Is it written in a way that is understandable for you? If not: please explain

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b. Is information easy to find and access? If not: please explain

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7. What do you think about the information provided about 3D printing?

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c. Is the way it is presented helpful? If not: please explain

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## Stage 3 – Receiving and trying out the 3D printed object

1. What do you think of your first 3D print?

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a. Are you satisfied with your print?

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b. Have you used it already?

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c. How did that go?

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d. Would you make any changes to it if you were to do this again? If yes: what would you change and why?

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2. Do you feel like you learned anything about 3D printing?

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a. If so: can you explain what and how?

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b. What do you think about this?

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3. Did you encounter any problems or anything difficult?

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a. If so: can you explain something about these?

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b. And how did you overcome them?

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c. In what way did this effect your confidence in your creative capabilities?

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4. Do you feel like your confidence in 3D printing has changed?

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a. If so: how did it change?

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b. Do you feel like using DDQ contributed to this?

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c. If so: how did DDQ contribute?

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5. Do you feel like your confidence in your creative capabilities has changed?

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a. If so: how did it change?

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b. Do you feel like using DDQ contributed to this?

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c. If so: how did DDQ contribute?

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a. Is it written in a way that is understandable for you? If not: please explain

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b. Is information easy to find and access? If not: please explain

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6. What do you think about the information provided about 3D printing?

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c. Is the way it is presented helpful? If not: please explain

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## Interview questions

### Pre-use interview questions

1. So I want to talk a bit about confidence, what do you think when I say “confidence”?
  - a. *Follow up:* How would you define confidence? Why is that? What is it like for you to feel confidence? Can you tell me about a time when you felt confident? Why was that? What do you think you need to feel confident?
2. What do you think when I say ‘Creativity’?
  - a. *Follow up:* How would you define creativity? Why is that? What activities do you see as creative? Why?
3. Have you ever done anything creative or made something?
  - a. *Follow up:* Can you give an example? Why did you do that? How often do you do this [type of activity]? Do you also do other creative activities? Have you thought about trying a new creative activity? Why or why not? Do you think of yourself as a creative person?
4. How confident do you feel about your creative capabilities on a scale from 1-10 where 1 is not at all and 10 is very confident?
  - a. *Follow up:* Why is that?
5. Have you ever been frustrated with the design of a product you use and wanted to change it?
  - a. *Follow up:* What product or products are you thinking of? Why were you frustrated? Did you attempt to modify it? How did you approach this? Can you explain more? How would you change it if anything was possible?
6. Do you think you could redesign or make adaptations to products [include the specific products they may have mentioned at question 2]?
  - a. *Follow up:* Why/why not?
7. Have you ever 3D printed before?
  - a. *Follow up:* If so: how did that go? What kinds of things did you create? Why these things? If not: why not?
8. Do you think 3D printing could be helpful in adapting products [link to specific product they mentioned] that you use?
  - a. *Follow up:* Why/how? Or Why not? What would you like to do with it? How would you use it?
9. How would/does it feel to be able to create your own products/adapt products?
  - a. *Follow up:* Why is that?
10. Is there anything that we didn’t talk about that you would like to share?

### Post-use interview questions

1. What was your overall experience over the last weeks like with Disabled Design Quest (DDQ)?
  - a. *Follow up:* Why is that?
2. Can you show the object you have created? Or maybe pictures of it? How do you feel about it?
3. How confident do you feel about your creative capabilities on a scale from 1-10 where 1 is not at all and 10 is very confident?
  - a. *Follow up:* Do you feel like you have more confidence in your creative capabilities than before using DDQ (include their own definition of creativity &



- confidence)? If yes: Do you feel like using Disabled Design Quest contributed to this change?
4. If you are frustrated with the design of a product in the future, do you feel like you could redesign or adapt this product?
    - a. *Follow up:* If so: how would you approach this? Do you think you would use 3D printing to make these changes? Why/why not?
  5. Was the website accessible to you?
    - a. *Follow up:* Do you think this impacted your experience?
  6. If you could, would you like to continue using DDQ?
    - a. *Follow up:* Why/why not? Do you think that using DDQ further would increase your confidence in your creative capabilities?
  7. What parts of DDQ did you like/feel like were helpful?
    - a. *Follow up:* Which parts were not good/not helpful? Did you encounter any problems? How did you overcome them?
  8. Do you have any recommendations on what changes could be made to improve it?
  9. Would you recommend DDQ to other disabled people?
  10. Did you enjoy the last 2 weeks?
    - a. *Follow up:* What did you enjoy?/Why not?
  11. Are you planning to 3D print/hack/make anything else in the future?
    - a. *Follow up:* If so: what would that be?
  12. Is there anything that we didn't talk about that you would like to share?

## Appendix P – transcripts activity 2

### Transcript interview 1 participant 1

Greeting, opening, introduction myself and project, getting permission to record and the signing of the informed consent forms happened before the recording was started.

Researcher: Okay, then let's get started. So. You already know a little bit about this project, but just for clarity: The main idea is that I developed a platform where people with disabilities or people who are neurodivergent can come to learn about 3D printing, and the idea is that this increases their overall confidence in creativity and feeling like they can make things they are able to make things. And that's kind of the goal of this platform.

And so now I want to ask you a few questions to see where you're at and then you'll get access to the platform for two weeks. Or until you hit a certain milestone and then we'll have the second interview. And during those two weeks, you have access to a diary or a journal, whatever you like to call it. And you can write a little bit about your experience there.

Participant 1: OK.

Researcher: Then we'll get started with the first interview.

Participant 1: Yep.

Researcher: So I want to talk a bit about confidence. So what comes up for you when I say confidence?

Participant 1: Yeah. Uhm, I don't understand the question.

Researcher: Okay.

Participant 1: What do you mean with confidence?

Researcher: Well, that's the question I'm asking you, what would you describe as confidence?

Participant 1: Ah okay, to feel sure in my environment, to do the things that I want to do.

Researcher: OK. Mm hmm.

Participant 1: With what I can do, and have no limitations in that.

Researcher: OK, that sounds good. So what is it like for you to feel this confidence?

Participant 1: In my daily environment?

Researcher: Yeah, for example.

Participant 1: Well, driving a car is good, is fine but, I have automatic now and that's an improvement for me. Because I have a bad knee. But also my chair isn't that good? I have a good chair for my office. That's fine, I can adjust all kinds of things, but in the car it's ... it's limited and it's ... well for a longer periods of driving. It's giving me back pain. And. At home and at the office, I have a desk that's ... adapted? ... Adaptable for the height, so I can, uh, stand and sit and I can. Uh, choose whatever I like. Uh, in that. So that's an improvement but.

Researcher: Mm hmm.

Participant 1: And. Sitting in... When we have a meeting, there are no good chairs in the meeting rooms. So when I sit there for a longer period, ... I experience, yeah. Pain in my back and I get a bit agitated sometimes because yeah, it is not nice to sit there.

Researcher: Mm hmm. So would you say that in order for you to feel confident in what you're doing, you need your environment to fit with what you need?

Participant 1: Yeah.

Researcher: Yeah, that sounds good. So. Then we go to creativity and I would like to know, what do you think when I say the word creativity?

Participant 1: Creativity thinking out-of-the-box. Not the standard solutions, but to see. Think in what is possible and not in limitations. And therefore you... And ... Yeah, you need a kind of skills or. But you also need an open mind for it.

Researcher: Yeah. OK. And do you have like a definition of how you would say what, what is creativity?

Participant 1: No, not necessarily. No.

Researcher: Okay, what kind of activities do you see as creative?

Participant 1: Well. The thinking process is one of them. And sometimes, you think in limitations. And sometimes you see things. What's what's possible in the in the future and you go backwards to see from OK, what's what do I need to make it happen? What ... what are the limitations in the in the process but the ... the first step is to think from, well, what what do you want? What do you need? What? What? What's? Necessary instead of what is possible.

Researcher: OK. Yeah, that sounds great. Have you ever done anything creative or have you made anything?

Participant 1: Well, I I do a little bit in drawing. Painting. Sculpting wood and stone. Building a camper van. So. Yeah.

Researcher: OK. And is there a reason why you do these kinds of creative activities?

Participant 1: And yeah, it gives something for me. It's a it's it's a. It's a bit of a personal space. It's something that's that's really for me. Not for the group, not for my relation, but it's especially for me, and it gives me. Space in my head. I I relax. I forget everything around me, so I get. A kind of bubble. And yeah, that's very, very nice.

Researcher: OK. And have you ever thought about trying a new creative activity? And how do you approach something like that?

Participant 1: Yeah, but. I have too many creativities. So I have to limit it for. Everything is. Nice. It's interesting is, but it all takes time, so you have to make choices in what time you have and where you want to spend it on. But I'm very curious in the new techniques.

Researcher: Mm hmm.

Participant 1: Sometimes a new language, something like that. Yeah.

Researcher: OK. And would you say you see yourself as a creative person?

Participant 1: Yeah, at work. I always give my colleagues. Another perspective. And there's. Sometimes I say from, well, let's take a step back. To look again on the problem and. See what? What else of possibilities we can. Make here.

Researcher: OK, that sounds great. So if you were to give a number between 1 and 10 of your confidence in your creative capabilities, so one is like, I'm not confident in them at all. And 10 is I'm really very confident I can do all of these things.

Participant 1: 9, I think when you.

Researcher: OK.

Participant 1: I think when you want something? You have to "verdiepen" [said in Dutch, they mean to delve deeper]

Researcher: Yeah.

Participant 1: You have to make the the next step to to make it your own.

Researcher: Mm hmm.

Participant 1: And I've become a little yeah expert because I watch YouTube films or Internet to see from where? Yeah where how do other people, experience it, solve problems and then. I just do it and try it and try it again so you can overcome.

Researcher: Yeah.

Participant 1: The things you you always, can do much more than you think. In first when. You start with something when you actually do it, you see much more possibilities instead of only the thinking process.

Researcher: Yep. And can you explain why that's not a 10?

Participant 1: Well. Yeah, there are always things that I can't do. I'm not good at ... In the in ... uh languages?

Researcher: Language yes.

Participant 1: Yeah. My wife is much better in in that. Thing so I have I have my limitations.

Researcher: OK.

Participant 1: And that's yeah, I use Chat GPT for some some words of answers and then I'll see if I. OK. Yeah, that that's that's good as well. Yeah, that gives my me ideas of.

Researcher: Mm hmm.

Participant 1: Putting some questions or for sometimes some answers.

Researcher: OK. So, have you ever been frustrated with the design of a product and you thought, I want to change that?

Participant 1: Yeah. Well, we're we're looking for. A A camper van. And all the the the the standard solutions. Doesn't fit our options what we want and how we want to use it. So that's what that's why I decided to build 1 myself. In the past.

Researcher: Mm hmm.

Participant 1: But I see a lot of things like yeah, I get a standard. Computer mouse from my work but. Yeah, there are all kinds of buttons on it, but there's no explanation where where it's for, even on the Internet, I couldn't find it, so it it works, but I think it's has more possibilities, but I don't understand it. And in the description with it, nowhere stands for for, so I think, yeah, it's a missed opportunity.

Researcher: OK. So if you could may if you could redesign or make adaptations to, for example, a campervan or your mouse. How would you approach this? And do you think you could make adaptations to it?

Participant 1: Well, standard things. I don't know if ... if I can adapt that. But first I have to make a list of the criteria from. Yeah. What? What do I need? What do I want? Where? Why doesn't something? Why doesn't it work for me?

Researcher: Mm hmm mm hmm.

Participant 1: I have my mouse. I am right-handed, but I have my mouse.

Researcher: Mm hmm.

Participant 1: On my left hand.

Researcher: Yes

Participant 1: And for my connection in the in the brain to stimulate but.

Researcher: Mm hmm.

Participant 1: The mouse isn't. And good for the left hand design. Yeah, so.

Researcher: OK. Yeah.

Participant 1: Ask my work for a left hand mouse. But they have only the standard mice, so yeah. Strange.

Researcher: So you would rather go look for a completely different solution than make adaptations to what you have?

Participant 1: Sometimes that there are possibility but for the mouse ... in the in this case maybe.

Researcher: Mm hmm.

Participant 1: I can change the the. The housing, so it's it better fit for my left hand instead of my right hand. The mouse itself works fine, it's it's does everything what it has to do. I mean it doesn't fit in my hand properly. So if I can. Yeah make.

Researcher: Yeah.

Participant 1: A little. "aanpassing" [in Dutch, but found the English word] adaption, yeah.

Researcher: Yeah.

Participant 1: To it when it's better fit than fine.

Researcher: OK. So have you ever 3D printed before?

Participant 1: No

Researcher: And. Is there a reason why you haven't?

Participant 1: Well, you need to ... have a 3D printer and yeah it's expensive. You have to have a space in the house for it. You need, knowledge, to computer and design programme.  
Well, there are lots of steps and. Yeah. It isn't. Not possible. But the. The the the "aanleiding"  
[reason/cause] To ... it's still new for me.

Researcher: OK. Yeah.

Participant 1: There's not...

Researcher: Maybe the barrier to entry is still a bit too high for you?

Participant 1: No, "ik heb nog geen aanleiding om het te gaan gebruiken" [said in Dutch, translated: I haven't come across a situation/reason for using it]

Researcher: You haven't found a use for, why you ... or what you would use it for

Participant 1: Yeah that's it.

Researcher: OK.

Participant 1: Yeah, I I see too little possibilities for me to... Yeah.

Researcher: OK. Yeah. No. Understood.

Participant 1: And then then you balance it from, yes, why not of why I do, yeah.

Researcher: Yeah, mm hmm. So do you think 3D printing could be helpful to, for example, adapt a mouse?

Participant 1: Oh yes, I do. Yeah. It's a very nice invention. Yeah.

Researcher: OK. And how do you think you would use it if you did have access to a 3D printer to, for example, to make changes to this mouse?

Participant 1: Again?

Researcher: So if you did have access to a 3D printer, how would you use it to, for example, make adaptations to your mouse?

Participant 1: Yeah. Well, I need to. The design programme. Where I can? Yeah. See what's possibilities? Sort of kind of database. For possibilities from people that already. Have found some solutions for it.

Researcher: Yeah.

Participant 1: And see if something's fits for me. Or yeah, maybe I can make some adapt ... and some.... Designs. Suitable for me for my. Yeah, process not. My issue.

Researcher: Yep, for how you use it, yeah.

Participant 1: How I use it, yeah.

Researcher: OK. So. How would it feel if you could make? A redesign or make adaptations to, for example, your mouse or any other product.

Participant 1: Wonderful. Wonderful. Yeah, it's it's, it's amazing that it's a whole world of new possibilities. So that's yeah, that would be very nice.

Researcher: OK. So we've kind of come to the end of the questions. So is there anything else that you would like to share or anything we haven't discussed that you would like to talk about?

Participant 1: Uhm, well, the the only thing is I have no knowledge of the design programme that's needed for. 3D printer so I am curious.

Researcher: Mm hmm. OK. Well, on that note, maybe we can take a look at the prototype and then I will send it to you in the chat and then you can open it. And if you could share your screen while you're doing that, then I can have a look with you and see what you're looking at. Do you know how to do that?

Participant 1: I had a link, I pressed on it but now it's gone.

Researcher: Okay.

Participant 1: nothing's opening.

Researcher: Maybe you can right click the link and say like open in or copy so you can just copy it to your browser?

Participant 1: Oh, I forgot again, yeah, with work we always used zoom and now this week we switched to teams so I'm still getting used to it. Ah there it is, OK.

Researcher: OK.

Participant 1: yeah

Researcher: so yeah, it looks great, if you close the teams then you can see the whole menu, because it's a bit hidden, yeah.

Participant 1: OK.

Researcher: And if you Scroll down a bit, there is a quick tour to see kind of what some of the features. And then you can, yeah, go find your own way from there, if you don't have any questions about it.

Participant 1: Do I just click on it?

Researcher: Yeah. And here it explains a little bit about the different parts of the platform. And as you can see the sign in is. For for the purpose of this testing really easy, it is just, you just click sign in. And you can close it again and then ... Oh yeah. Or you can log in immediately and then you are in the login part and there you have all the features. So via the menu you can go to different places or you can click on one of these projects. So I would just say, yeah, go explore.

Participant 1: OK.

Researcher: But it looks like you can open it so, you can stop sharing and then I'll explain what is going to happen next, and then we're done.

Participant 1: How do I...

Researcher: If you go back to teams, I think it will say stop sharing. Yes, OK.

Participant 1: Yeah, yep OK.

Researcher: So then next, you're going to work on this platform and there at three points, you're going to write something in a diary. So that is the first time you use it. That is when you request for



me to print a 3D model. And when you receive this model in the post. And these steps are also explained in the Diaries, so you don't have to remember them. They will also be there in the diary itself.

Participant 1: They'll pop up?

Researcher: No, there is a separate diary, not within the website. There is references to it in the prototype website but the diary is separate because everyone will go through it in their own way and timing. You can choose if you want to fill in the diary online, or in a pdf. It is a pdf you can fill in, or you can fill it in online in Miro, an online whiteboard space.

Participant 1: OK.

Researcher: So which one would have your preference?

Participant 1: Oh it doesn't matter, I know Miro, so that's fine.

Researcher: OK, then I will send you that link after this interview and you can go look there, and then I will also send you the link to the prototype website again just so you have it somewhere. And then as soon as you have received the 3D model in the post and you have written something about that in the diary, you can let me know and then we can schedule the last interview.

Participant 1: OK.

Researcher: So that doesn't have to be exactly after the two weeks if you're done sooner that is also fine, just let me know. But you have a maximum of 2 weeks to do these things.

Participant 1: OK, yeah.

Researcher: OK, do you have any questions?

Participant 1: There was a mention of a course.

Researcher: Yes

Participant 1: how much time would I need to do this course?

Researcher: so there is three levels, so for this testing it is basically only required that you go through level 1 and you can read all of that in about half an hour, and then you'll need some time to find a model and prepare it for the printing service.

Participant 1: Of course, mm hmm, OK well that's no problem

Researcher: and the other levels, you can just look through them if you're interested, but you don't have to complete those. Those do actually go into using a design program and finding your own 3D printer and all of that. But it's not necessary for this testing, so basically level 1 is what we are looking at right now.

Participant 1: Mm hmm, so one is enough, two and three are interesting

Researcher: Yeah, OK.

Participant 1: Thank you, no more questions.

Researcher: OK, well, thank you very much for participating and I will send you an email with all the rest of the info and links and then we will meet again as soon as you're done.

Participant 1: OK. Well thank you very much for the opportunity.

Researcher: OK, bye.

Participant 1: Bye.

### Transcript interview 1 participant 2

Greeting, opening, introduction myself and project, getting permission to record and the signing of the informed consent forms happened before the recording was started.

Researcher: So welcome. I want to introduce the project still very shortly, even though I know that you have read what it's about and know a little bit what it's about. The project is about. Helping disabled or neurodivergent people to better feel confident in their creativity so they feel like they can create things, adapt things. And therefore are more feel agency in this whole process. So now I want to have the first interview with you. And then we'll kind of see where you're at and then you get access to the website I've developed for two weeks and then you fill in a diary journal, something like that, about this experience, and then once you're done with. Then we'll have the second interview and then we're done.

Participant 2: OK.

Researcher: So. I will be looking to the right because that's where my questions are, not because I don't want to look at you. So the first question is, I want to talk a bit about confidence. So what do you think when I say confidence?

Participant 2: Confidence is that. I think I'm able to do something or tell something about? For example, my work or talking to people.

Researcher: OK, so your definition of confidence is. Feeling like you are capable of doing something.

Participant 2: Yes.

Researcher: OK. Can you explain why you see it that way?

Participant 2: 'Cause when I think. I am not able to do something then I feel insecure and that doesn't help doing the thing I want to do so. Yeah, I think that's that's it. So when I want to talk in public, I will feel anxious. And so I will probably not be the first to do so. Except when the subject is something I know a lot about, and then I think I will be enthusiastic enough to let hear my voice. Something like that.

Researcher: Can you describe a time where you felt confident?

Participant 2: I feel confident giving workshops in the ceramics department. The first time I felt insecure, but I realised that I know more than my students, so that helped me and doing it a lot of times and I keep learning. But now I know I don't have to think about it before workshop I feel confident enough to do. My thing and that when something occurs that I don't know, I feel enough confidence that I can solve the problem. So that's that's how I do it. So yeah. More at ease having. More experience than feeling better? So.

Researcher: OK. So you would say...

Participant 2: And I think that my image helps. My age helps my my yeah my my experience. Of being an adult and having life experience and ... when I was a little girl, I felt very insecure about a lot of things, and I've learned now. Yeah, feeling more confident that I'm able to cope.

Researcher: Hmm, so I hear you say that experience and knowledge are very important for you to feel confident.

Participant 2: For me, yes.

Researcher: Is. Is there anything else that you feel like you need to feel that confidence?

Participant 2: Maybe support? So that when I I don't know how for example a new. Software thing. I don't like being working with computers anymore because I've done that. I feel like all my life and. I want things to work so. Especially with software, sometimes it needs an update and then things change and then I feel insecure because I don't know how to solve it, and then I'm dependent on other people and. Now I know I want to be more independent. So that makes me kind of grumpy when things don't work like. Things used to work, so I think that's the the case.

Researcher: Yeah. OK.

Participant 2: Now.

Researcher: So now what do you think when I say creativity?

Participant 2: Creativity. Yeah. It's a very wide word. Yeah, I don't know the exact word for it in English, but.

Researcher: That's fine.

Participant 2: For me, creativity is. Thinking and solutions, not always be able to make it yourself but, I think in your mind, have the ... Yeah, it's. It's a kind of thinking, I guess for me it is because. You can learn stuff you don't have to know everything, but when you already think things aren't possible, then you won't get any further. So I think that's the most important about creativity. But I know now my in my experience I get people wanting to do a workshop. But the first thing they say I'm not creative and then I say everybody is creative because everybody can do something. And you shouldn't expect to do the same as I as me having experience for more than 20 years in my field. I don't expect that you are at the same level, so you have to start somewhere and then, yeah, so that that is also having to do with confidence and in confidence and then yeah. So I think that's. Yeah, when you're open. To new things or new possibilities, that's a part of being creative, I guess. Hope you have a ... Does that answer your question?

Researcher: Well, I have a follow up. So what would you say your definition of creativity is?

Participant 2: Again.

Researcher: Your definition of creativity.

Participant 2: My definition of creativity. Everybody is creative, but you have to. Want to do something? Take the next step or? Be willing to learn. I guess that's my definition of being creative. You have to take a step.

Researcher: So. What I hear from your answers is that creativity to you is a way of thinking, and not necessarily a way of doing. But doing it helps the thinking.

Participant 2: Well, I think the thinking is more important so.

Researcher: OK.

Participant 2: You you think you can't do it? But maybe you can with help, but if you and and wanting, I think that's the first step you you want something. You think you can't do it by yourself, so, but you you have you you you need that. The will of asking help and or being able to learn something and then solve it yourself, but it so it's more like. Yeah. And I think the thinking is the most important.

Researcher: OK. And So what kind of activities would you see as creative?

Participant 2: Think, think well, it begins with thinking, thinking about. And that can be everything. Think I think it start with thinking. And then. For me it's I have it start with a problem. And. Working to solution so. For me, that's. Not necessarily a problem, but you want something and then, yeah. And then a choice. Do I want to solve it myself or is there already a solution for it? So yeah, it starts with thinking and then I guess I want to do some research. And then. Again thinking and then maybe trying and asking how I think that's my. Way of being creative and thinking about creativity.

Researcher: Mm hmm. Yes. And have you ever done anything creative or made something?

Participant 2: I guess. I always. I'm a thinker. So in my mind, I'm very creative, but. And I can solve things, but then. I usually ask people to make things for me. Having the solution, but then at the same time I feel frustrated when the other one, in this case my husband. Is not always. Or listening what I want. Or doesn't have the time right now and I want it now. So I have to wait so being. Dependent or that that's I find that difficult.

Researcher: Mm hmm.

Participant 2: But yeah.

What was your question again?

Researcher: Have you ever done anything creative or made anything?

Participant 2: OK, well I I I like to work with ceramics. So in that way, yeah, I I'm being creative. Trying to solve issues for customers so. And and and I like to be creative together with my customers. So procreation, that's for me the summum of being creative, because then it's. But me making something but I like the customer to think it over what the the the creation will be like or? Well. Yeah. So, yeah, I I solve things. I create things with ceramics, but also. When there are problems in our House and my husband isn't around. Then I can be creative. Having for example, we used to have little light bulbs in the. Ceiling and. They fell down and I thought, well, let's take an post elastic rubber band and I put it around it and I put the light back and it helped. So I found that very creative of me. Having that solution, and maybe it wasn't perfect, but it worked. So that's an example. So I think in my mind I'm very creative, but I'm not able to do everything I I think I I I imagine.

Researcher: So have you ever thought about trying a new creative activity?

Participant 2: Yeah, all the time. I just bought some crochet books. I used to do that when I was a small girl with my grandma, so I have nice memories doing crochet, but now lacking time. But when I see it on my YouTube films it feels like so yeah. What is the Zen like for the and I I remember the movement so. But yeah, it's it's still, yeah. I need to take time for myself. Doing something for myself. And so now I have all the I have the books and I have the hooks. Now I need the I have some cotton, but I still need to decide now. I'm going to start and.

Researcher: Mm hmm.

Participant 2: So yeah, I I I want a lot, but it lacks mostly time. So yeah, yeah, that's my latest project.

Researcher: Do you think of yourself as a creative person.

Participant 2: Well, yeah. Yes and no. Yeah, yes. Yeah, in my mind I have a lot of solutions for a lot of things, but. Do it. Take the step to do it. That's. But that's where I'm struggling most of the time, but now I'm this morning I was working. I had some. Pinterest Ideas for Christmas? And then I. After quite some time thinking about it, maybe it is a new workshop, so now I kick myself and I said OK, just try it. Do it yourself and then you can always decide to do it. Or not. So it it takes a bump in the road to actually try it, but just like the crochet thing, it's a big bump, but yeah.

Researcher: Mm hmm. OK, so how confident do you feel about your creative capabilities on a scale from 1 to 10 where one is not at all confident and 10 is very confident?

Participant 2: I find that very difficult. I think 7,5?

Researcher: OK.

Participant 2: Yeah.

Researcher: That's good. Can you explain why you chose that number?

Participant 2: I think it's the word confident. I'm a thinker, so I. I I I'm hanging all that word. Confidence. Am I confident how? Well I'm not that confident because I chose 7,5. I didn't say 10.

Researcher: Mm hmm.

Participant 2: I think that's that's the yeah. Maybe still some kind of insecurity.

Researcher: OK. So, have you ever been frustrated with the design of a product and you wanted to change it?

Participant 2: Oh, I get very easy frustrated about that designs, but to have an example. I find it irritating when things are designed not logically. For example, website designs or well, while some buttons are buttons are in my opinion on the wrong. And you you you need to adjust, you need to. Well, you if you want to work with a programme, you need to adjust yourself and that you can't expect that the programme adjusts to you. But so there there are. There are a lot of things. That I think, and maybe that's because. My the way my mind works. That I find irritating. But there are so many things. I just don't know. So something. It can be a bottle opener that I hurt myself when I tried to open a bottle. I think that's bad. Fine, it's. Yeah, there are a lot of things. I wish I had done some design. Education myself. Because I think I, yeah. Yeah, yeah.

Researcher: So have you attempted to adapt or modify any of these products yourself?

Participant 2: Well, sometimes. An example for in my work you have some common moulds for making bowls or something? And then there are some normal measurements and I want another one. So then I make my own mould. For the measurements I want. Yeah.

Researcher: Yeah. So do you think you could redesign or make adaptations to certain products that you are frustrated with?

Participant 2: I guess sometimes I can, but. I think we are so. Programmed just to accept that there are a lot of things bad design that you think well.

Researcher: Mm hmm.

Participant 2: Am I taking a lot of time to change things that it depends on how often you use something. If you want to change it or not. If it's, it's it's a couple of times a year. Then you say, OK,

it's bad design, but when it's something you use a lot then I would. Yeah. Change it if I can. If I could. I think now if you doing this. My mind's gets an eye bulb because ... a light bulb because I thought. OK. Yeah, it's very interesting that you can do. With a 3D printer, make changes. Yeah, and that's interesting.

Researcher: Mm hmm. Have you ever 3D printed before?

Participant 2: No. And then and. In your next question, and maybe is, why not? That's because I hate sitting behind a computer. And that has to do with my eyes, my sight. So I don't like to sit too long and also my physics. I don't like to sit a long time behind a computer.

Researcher: Mm hmm.

Participant 2: But on the other hand, yeah, it would be interesting to see, and I think the most important thing is we don't have a 3D printer. So I wouldn't know where to print. So I think that, yeah.

Researcher: Mm hmm. OK. Do you think 3D printing could be helpful in adapting products that you mentioned? You have been frustrated with?

Participant 2: Adapting products. Yeah, maybe some tools I use. In my ceramics workshop. But also. But I I was thinking about a lot of things and all having to do with my eyesight and. Be prepared that that will be worse. I thought how? What what would I like to change? And or adapt.

Researcher: Mm hmm.

Participant 2: Not in the way use it, but maybe more like. We have a lot of keys for the camper van and I don't know where what key or which lock it is. So the first thing I thought, well, I'm going to use some colours, some nail Polish well. My husband didn't wasn't fan, but then I thought, well, when I can't see it anymore, I don't have anything with. The the colours wouldn't help me then, so I thought well if I could 3D print some symbols and then I put it on the key and the lock then I could feel the which key I could use and not only with keys and locks, but now we just toothbrushes. Yeah. And I saw we have the same and in this case. My husband use mine and I kept his and the colours were green and blue, so also for him it was difficult to see the difference and I thought well I when I have something on my toothbrush I could feel then I know it's mine. So then there are a lot of possibilities so I'm very.

Researcher: Mm hmm.

Participant 2: Enthusiastic about this because yeah, I can understand that 3D printing can be a solution for this.

Researcher: Mm hmm. And how would that feel if you were able to create your own products or make adaptations to these products?

Participant 2: Well, I feel very enthusiastic about that because it, helps me feeling independent and I I realised that's very important for me because you know that a lot of things there are you will be. Yeah, depending on other people. And yeah, I find it very. Important being able to create the world around me instead of. Being dependent on solutions other people have thought of, because I'm a logic person and I'm an intelligent person, so I like to yeah, be able to.

Researcher: Mm hmm.

Participant 2: Adapt all those things for me so. Yeah. Only this interview was making me enthusiastic about it because I never thought about it, that it was a solution there. There are possibilities.

Researcher: OK.

Participant 2: But I have to take a step for that and that's that's the the balance. Yeah. That that's always the balance you have to just that's the most important things.

Researcher: OK. So we've come to the end of the questions. Is there anything that we didn't discuss that you would like to discuss, anything I missed?

Participant 2: Well, I thought well. On the on the one side, you have the 3D printer, but I understand that you need to have A software you need software or or. You have to be able to to make something in the communication with your 3D printer, and I don't know if I'm capable of doing that. That's and so.

Researcher: Mm hmm.

Participant 2: What? Yeah. How would I be able to make? A. A model or or an idea to print.

Researcher: Mm hmm yeah. So at the the course that you're gonna look at on the website that I created fully outlines this whole process with step by step guides on where you can find these things. But level 1 is what we're focusing on with this testing session, which doesn't include creating your own model in a 3D modelling software.

Participant 2: OK.

Researcher: So you don't have to do that.

Participant 2: OK.

Researcher: That is part of Level 3. So that's that's not what we're gonna focus on. It is mainly about finding a model online that other people have already created and then having it printed so that you can see more like the possibilities and see how that process goes before you would go to level two or three and start making your own models.

Participant 2: Yeah. Yeah. OK. In my, in my mind, I already at Level 3.

Researcher: Yeah, but let's start at level one. But if you want to take a peek at at Level 3, feel welcome to, but you're not expected to do that right here.

Participant 2: Yeah. Yeah. OK. Yeah.

Researcher: But on that note, I'm gonna send you the link in the chat so you can open it already.

Participant 2: OK.

Researcher: And then you can have a look. And can you click in teams to share your screen so I can look with you?

Participant 2: Right. It's my first time, so.

Researcher: Next to the Big red button in the right top corner.

Participant 2: Uhm

Researcher: Yes.

Participant 2: OK.

Researcher: Yes.



Participant 2: Yeah. Oh, now you can watch with me, OK. Yeah, yeah.

Researcher: Yes. OK. Do you have ... it maybe zoomed in? On your browser.

Participant 2: I don't ...

Researcher: Because I I can't see the full screen.

Participant 2: No, I did something wrong. OK. Sorry.

Researcher: At the top, next to the url, it may have a percentage there if it's zoomed in.

Participant 2: No.

Researcher: Can you see everything, is it only in the screen sharing?

Participant 2: I have tabs open at the top.

Researcher: No but can you see the menu at the top of the page? There it says home, courses ...

Participant 2: No I just see home, courses ... Oh, yeah. Yeah. OK. When I scroll sideways I see it.

Researcher: Yeah, okay that's why I thought you might be zoomed in.

Participant 2: Oh, no, not that I'm aware

Researcher: OK. Well if you scroll down, there you can take the tour, there is explained shortly what each of the menu items entails, and you can log in, that's just the press of the "log in" button.

Participant 2: So do I click here?

Researcher: Yeah, you can.

Participant 2: Yeah.

Researcher: You can read everything at the tour, or just go through the website and look around, what ever you want.

Participant 2: Yeah.

Researcher: And the courses that's where you learn about 3D printing

Participant 2: Yeah. Ooh crip-hacking.

Researcher: Okay, but you don't have to do this right now, you can look at all of this later. Now I'm going to explain kind of what is going to happen, so for the next 2 weeks you have access to this website, you go through everything and at 3 points you fill in the diary, after the first use, after you have requested the print of your 3D model and when you have received your model in the mail. This diary has questions and free space that you can use at each stage. This diary you can fill in either online via Miro, in a pdf, or you can print this pdf.

Participant 2: I'm not sure what miro is, maybe I used it for work, but it's a long time ago I'm not sure.

Researcher: Okay so you would rather fill it in in a pdf?

Participant 2: Yeah I think so.

Researcher: Okay than I'll send you the pdf and this link I will also include another time, just so you have it if you need it later. Do you have any questions?

Participant 2: Okay sounds good, no I don't think so.

Researcher: Okay, then have fun! Bye

Participant 2: Bye

### Transcript interview 1 participant 3

Greeting, opening, introduction myself and project, getting permission to record and the signing of the informed consent forms happened before the recording was started.

Researcher: OK, great. So I wanna talk a bit about confidence. So what do you think when I say confidence?

Participant 3: I think it's like 2 separate things like confidence in yourself, like in being who you are and like just going out and showing the world yourself and also confidence in.

Researcher: Mm hmm mm hmm.

Participant 3: Being like, knowing you're able to do things, I guess.

Researcher: Mm hmm. OK. Yeah, that sounds good. So what is it like for you to feel confidence?

Participant 3: I am a pretty confident person like I am a very active in theatre and so I am around people a lot and. Yeah. So I do like to be confident, but sometimes you have these moments where it's hard to be confident.

Researcher: Mm hmm.

Participant 3: Like we have sometimes you just have to be a little bit more vulnerable and I feel a lot less confident if I have to be vulnerable.

Researcher: OK. Yeah. So what do you think you need to be able to feel confident?

Participant 3: So you need to be able to do the things you want to right? And I have a very hard time, a very hard time asking for help. So I think what I need to be confident is that. People kind of see me and and see what you need instead of me having to ask for help all the time or, like, have to communicate it all the time. And I it makes me more confident. I think if people just see what I need and are like, I'm going to do this right now.

Researcher: Yeah, that sounds great. So what do you think when I say creativity?

Participant 3: So also multiple parts I think so.

Researcher: That's OK.

Participant 3: Creativity in like the sense of creating things and coming up with new ideas. I guess that's kind of fits for everything now that I am trying to think about it. So yeah, coming up with new stuff that that hasn't maybe hasn't been before. Yeah, I think like that.

Researcher: OK, OK. So what activities would you see as creative?

Participant 3: I think making art is very creative, so any type of art so like actually making things with your hands or. Drawing and even drawing digitally, stuff like that, but also. Dance or singing or so theatre.

Researcher: Mm hmm.

Participant 3: And I so I study math, mathematics and mathematics is also very it doesn't sound very creative, but you have to be very creative to come up with solutions. So I think that's also.

Researcher: Yeah.

Participant 3: Something you can be very creative in.

Researcher: Mm hmm. Yeah, OK. I like that. So have you ever done anything creative or made anything?

Participant 3: So I do theatre, which I think is very creative, although I do do scripts, theatre show a lot less creative than making your own and I am in. I am the lead singer in advance and we write our own songs which I think is pretty creative and I used to draw a lot, but I don't have the inspiration for it anymore that much.

Researcher: OK. So how often do you do these types of activities?

Participant 3: So theatre is once a week and. My band is all ... rehearsal is once a week, but I do. I make music every day, I would say.

Researcher: OK. And have you ever thought about trying a new creative activity?

Participant 3: I try I try a lot of things. But I tend to not stick to a lot of things as well.

Researcher: OK.

Participant 3: I would like to try stuff. But but yeah, it's it probably won't stick.

Researcher: OK. Do you think of yourself as a creative person?

Participant 3: I would say so, yeah.

Researcher: OK. And how confident do you feel about your creative capabilities on a scale from 1 to 10 where one is not at all and 10 is very confident?

Participant 3: Mm hmm. So it's hard, right? I feel like I am creative, but also like putting something out there is very nerve wracking. So in that sense, I would say I'm not that confident. And also very critical about the stuff that I make myself. So I would like to end a little bit towards the middle. So I would say like 6-7, something like that.

Researcher: OK. Yeah. And have you ever been frustrated by the design of a product that you use and would like to change it?

Participant 3: Trying to think ... so I play also play guitar and. That is just very, very much fine motor skills, but I'm also trying to think how you would change that.

Researcher: Mm hmm. Well, it's it's more probably about wanting to change it. You don't have to have the solution all ready to go.

Participant 3: That is because it's. Yeah.

Researcher: But anything that you were like, hey, this could be better.

Participant 3: Specifically for, like creativity, things?

Researcher: No, it could be anything.

Participant 3: So not creativity wise at all. But I have a very hard time. With cooking and stuff. So using a knife to like put make things very like cut things very small, like big things is fine, but like getting it very small because I can't put as much pressure on my hands to like I can't pull down as much with one hand. So I have to use both hands to push down. So that was something something that would be a lot if that would change like how you would hold a knife or I think.

Researcher: Mm hmm. Yeah.

Participant 3: You would be able to to cut stuff that would make it a lot easier.

Researcher: Mm hmm. OK. So I assume you haven't tried to. Make any changes to the knife situation.

Participant 3: No.

Researcher: From the way you're describing it. So one thing I hear from you is that you would change it in a way that you could have more grip or hold it with two hands or anything like that. So now you just avoid the task. Or do you still do it?

Participant 3: I do it but I just don't do any recipes that need the food to be cut very small.

Researcher: OK. Yeah.

Participant 3: And like for like smaller things like garlic, it would use a garlic presser to to make it small enough.

Researcher: Oh yeah. OK. Yeah, that makes sense. So do you think you could redesign a knife for example, or make adaptations to a knife?

Participant 3: Uh ....?

Researcher: Like, do you think you have the the the the capability to do that?

Participant 3: I think it is like to design it probably. Like to think of solutions like making even making the handle like bigger or like adding something. To the side of it so you can use both hands.

Researcher: hmm

Participant 3: But practically, I don't know if I would make something that's actually practical.

Researcher: OK.

Participant 3: And like the actual making part of it as well.

Researcher: Yeah. OK. So. Have you ever 3D printed before?

Participant 3: My brother has a 3D printer, a resin 3D printer printer, and I've made Dnd Minis before with that.

Researcher: Oh yeah. OK.

Participant 3: But I've never actually used it myself. I sent my brother a fowl and then he did it.

Researcher: Yeah. OK. OK. And do you think 3D printing could be helpful in adapting products like a knife or something else that you might struggle with?

Participant 3: I think so.

Researcher: So how how would you use it then?

Participant 3: So you could like if you would for the knife situation if you would add something on to the knife, it might. So then you it's like a material you could use to add something on it.

Researcher: Yeah. Mm hmm.

Participant 3: So you could use it like that. I think just as the as the actual material of of making the adaptation.

Researcher: Yeah. OK. So how would it feel if you could solve this issue and make your own adaptations to these products?

Participant 3: I think that would feel pretty cool. Like I have this problem and I'm gonna fix it myself.

Researcher: Yeah. Okay, so we've actually already come to the end of the interview questions. So. The last question basically is, is there anything that we didn't discuss that you feel like is important that you did want to talk about?

Participant 3: No, I don't think so.

Researcher: OK, great. Then I'm gonna send you the link to the prototype in the chat, and then we can have a look at it together to see if all works well. So if you could.

Participant 3: Yes.

Researcher: Like share your screen. Then I can have a look with you.

Participant 3: Are you gonna see yourself? Can I still open the chat now? OK, I cannot see the chat anymore. Oh OK. Like this? Yeah, that is.

Researcher: Yes.

Participant 3: Yes.

Researcher: OK. All looks good. Do you have any immediate questions about this?

Participant 3: It is very cute.

Researcher: Thank you!

Participant 3: No, I think it's clear.

Researcher: That's great. And yeah, have a look at the prototype website and have a look around and there are basically three points where I'm going to ask you to fill out a diary journal, something like that. So the first one will be after you first use it. So that will be after today probably you'll have a look through everything and then write something. The second one is when you request a 3D print. So you go through a form and you request and then I will print it for you and then the third time is when you receive. Your 3D print, so I will. Either if you live close by, deliver it to you personally, or mail it to you.

Participant 3: OK.

Researcher: And then you can fill out the last one and after that we can schedule for a second interview. So you don't have to take those two weeks, but you have the opportunity to take the two weeks. So whenever you're finished, just let me know.

Participant 3: OK.

Researcher: OK.

Participant 3: OK. And what would you like to have in the diary or do you have like a template that I should follow?

Researcher: Let's see. Yeah, I have. I have like some questions that you can fill out. So there's three ways you can fill in the diary so you can fill it in in Miro. Online whiteboard application where you can fill in the questions or you can fill it in in apdf where you can just fill in the boxes, or you can print this PDF and fill it out in person just physically.

Participant 3: Yeah.

Researcher: Which one would have your preference?

Participant 3: I think I best to type it, I think so with the PDF.

Researcher: Great. Great. Then I'll send you a link to the PDF you do need like Adobe Acrobat to be able to fill it in.

Participant 3: Good. I too.

Researcher: I had someone the other day that didn't have that, and then it doesn't work.

Participant 3: I think I do. I never use it, but I do have.

Researcher: But I can also send you OK, if that doesn't work, just let me know. I also have a word file, but that's a little bit more annoying to fill in so the PDF is a bit easier, but if it doesn't work just let me know.

Participant 3: Oh my God. Word. Yeah. OK.

Researcher: OK. Then I'll send you that after this interview. And yeah, the then the last thing is if you have any question you can stop sharing by the way. We're good.

Participant 3: See your own website.

Researcher: Do you have any questions before we finish?

Participant 3: I don't think so.

Researcher: OK that's great. Then one little tip is to look through the projects on the website because there might be one that can fix your issue straight away. So.

Participant 3: OK.

Researcher: OK. Well, thank you very much. And yeah, have fun.

Participant 3: All right, see you soon.

Researcher: OK, bye.

#### Transcript interview 1 participant 4

Greeting, opening, introduction myself and project, getting permission to record and the signing of the informed consent forms happened before the recording was started.

Researcher: Well, then let's start the interview.

Participant 4: Yes. Let's do that.

Researcher: If you're ready for it.

Participant 4: Well, come on, let's do this. Yes. [excited]

Researcher: OK. So I want to talk a bit about confidence. So what do you think when I say the word confidence?

Participant 4: Confidence. What do I think when you say that word confident? This is I'm. I'm sort of buying time here because, uhm uhm. Well, confidence to me is more like self-confidence and it's confidence in ... my abilities and my capabilities, so to say.

Researcher: Mm hmm yeah.

Participant 4: That's the first thing I think about when you say confidence.

Researcher: OK, so do you have a a a definition for confidence for yourself?

Participant 4: Definition for confidence. Well, do you? No. [laughing]

Researcher: I do. [laughing]

Participant 4: Yeah, you. Well, that's great [laughing]. I I don't have a right definition, I think confidence is the. In our in our trust that. Things will turn out. OK. Or something. It's not very, very tangible, so it's it's quite hard to to find a proper definition about it.

Researcher: OK. Yeah. No, that's OK.

Participant 4: Hmm.

Researcher: So can you tell me about a time where you felt confident?

Participant 4: Yes, it was yesterday, I guess.

Researcher: Oh, very recent example.

Participant 4: Yeah. Yeah, very recently. Yeah, it was. It was yesterday. We were, [name colleague] and I. In a in a workshop or we we were providing a workshop and we is there and I we're providing a workshop and we we prepared a workshop for let's say 20 to 30 people or something like that. But we ended up in the main programme.

Researcher: Mm hmm mm hmm.

Participant 4: Doing a workshop for 80-100 people and we were like, OK, we can do this. So let's do this and well, we we sort of delivered in a very confident spontaneous interactive way and we really we were really satisfied with it and the audience was too. So that's a big plus as well.

Researcher: Hmm. OK, what do you think you need to feel confident?

Participant 4: Trust. That's a short answer. Do I need to elaborate on this or? [laughing]

Researcher: Very short. Yeah, a little bit of elaboration would be great [laughing].

Participant 4: OK. Well, that's that's. Well, I think it's trust in myself and trust from others so.

I really like to to be. Receive feedback on things I do, I say, or I think about it so I can talk about it and what I need is some kind of openness to to ... exchange views and ideas to gain that trust and to build confidence.

Researcher: OK. So. Now I wanna talk a little bit about creativity. So what do you think about when you hear creativity?



Participant 4: Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to.

Researcher: Mm hmm.

Participant 4: Exchange views again to to this to to debate, to, to discussions, to whatever it is so to me ... creativity is, is, is, is very much based on on language and languages.

Researcher: OK. So what activities do you see as creatives then your your writing, I would assume?

Participant 4: Yes, my writing not only my writing, my writing, my writing, writing in in general is an act of creativity. To me. Sometimes it's not so creative, but still, in the end it's an act of creativity. And on the other hand, I can see other things like like painting or or crafting or something like that as creativity or. Creativity to me as well is is like like come up with stories storytelling. Not only did the professional storytelling thing, but also your imaginary world and and trying to express your.

Researcher: Mm hmm.

Participant 4: Your inner world and it's creativity to me as well.

Researcher: OK.

So have you ever done anything creative or made anything?

Participant 4: Oh, I do write a lot of texts. Text. No, no, no. Yeah, that's that's my. And I'm writing a well. I I started writing an novel as many, many people say they do. But I really did. And so, so, so. Yeah. And that's quite a creative creative thing. I wrote blog posts on on my. My experiences as a person with a physical disability and I try to put some humour in it. So so yeah, that was kind of creative. So. And I'm not the one who was was drawing or making art or something like that because I'm I.

Researcher: Mm hmm.

Participant 4: Well, you don't want me to to make a drawing or something, because that's not my talent at all. So so [laughing].

Researcher: Yeah, that's OK [laughing].

Participant 4: I'm happy. That's OK [laughing]. That it is OK that it is. OK, then I'm not creative, yeah.

Researcher: So.

Have you ever thought about trying something new? Some new creative activity?

Participant 4: Recently I tried to. [laughing] It wasn't this success, but I tried it. I tried to create. jewellery, that's but you know what I mean? Like like, like earrings and rings. And they did it made out of.

Researcher: Yes, I know what you mean.

Participant 4: Resin [mispronounced] , do you call it in English? I don't know. It's Resin [mispronounced]. I guess it's the. It's a kind of fluid.

Researcher: Oh yeah. Resin. Yeah. Yeah, I get it now. Yeah, yeah, yeah.

Participant 4: Resin, yeah it's resin. Yeah. So that's very creative. I think it's very creative. So I tried to do a little bit different colours and different. Types of. Decorations like plants or flowers or. All these kinds of. So I was being quite creative. I did it. I did it once because it was quite. You need to be very, very. Attentive you need to be very. And very precise and it's so. It's sort of I go to bed nervous and a bit stressed about all those tiny little things, but I did it right.

Researcher: Yeah. Nice. OK. So do you think of yourself as a creative person?

Participant 4: In one sense I do, well I'm not a very creative person. I really like to play with words and to do everything with words and and sentences and stories. That's possible. But in that sense I'm very creative. But in loads of other ways, I'm not that creative. I'm very I'm very boring person to say so. No, I'm not that creative.

Researcher: OK.

Participant 4: Just.

Researcher: So if you had to rate your confidence in your creative capabilities from 1:00 to 10:00, where one is like not confident and 10 is very confident.

Participant 4: Look. But if you ask me. I'm very confident. I'm very confident when I'm writing. I'm one that I'm playing with words. I really feel that this is a thing I am capable of doing so. In general, if if we sort of limit creativity to to writing and playing with words and everything that that has to do with. Getting a message across or or debating or something like that. I would say that's a 7. But if you look at the other like like drawing and like like creating things and whatever it is, then I would. Slightly drop and well say it's a 6 because of the fact that it's a combination. Of all those possibilities.

Researcher: Yeah. OK. And have you ever been frustrated with the design of a product that you use and wanted to change it?

Participant 4: And sure. You want an example, right?

Researcher: Yes, that would be great.

Participant 4: I was. I was. I was. Yeah. Well. Not not that frustrated. I always figure out how to use a thing. How how to use such a product or such a tool in a way that it works but but still?

Researcher: Mm hmm.

Participant 4: That can be done. That that can be done in many. In many different ways that are better than they are now, so I'm I'm I'm desperately looking for the one thing.

Researcher: So maybe frustrated is not the word, so maybe it's just you're dissatisfied with how it was designed.

Participant 4: Yeah, but but there are, there is always room for improvement, right?

Researcher: Mm hmm. So you don't have a specific example?

Participant 4: Specific example well, maybe I will get back later. Maybe I can figure out.

Researcher: OK.

Participant 4: Yeah. Well, the one thing is when you you're having. Cerebral palsy like I have. Sometimes it. Yeah, I know, I know, I know. I know. Yeah, I know, I know. I know. One, it's the. It's the cooking hob. It's the cooking hob. I'm very frustrated by because before I had this one. I had another

one and all those those. Touch. How do you call them? Those touch screen buttons? How do you call them those those touch screen button they were, they were exactly.

Researcher: Yeah.

Participant 4: In the middle of the of the thing they were, they were in front in the middle of the thing and all those. How do you call it English? All those push dingy thingies, all those keys they were, they were.

Researcher: Yeah.

Participant 4: Exactly under my fingers when I grab the the. The the kitchen top the kitchen top to be to be secure and to stand secure.

Researcher: Mm hmm.

Participant 4: There are always under my fingers, so I was constantly touching those those buttons. So constantly when I was cooking I put off the stove and I put it on again and put it off and put it on and put it off and put it so that was.

Researcher: Oh yeah.

Participant 4: Kind of a frustration and it was a hell of a job to find another one that's not. That's designed in such a way that I have room to put my hands on. So. So, yeah, that's the thing.

Researcher: Yeah. OK. That's a. That's a great example. And so you attempted to modify it by finding a different product.

Participant 4: Yes, yes.

Researcher: Yeah.

Participant 4: I thought, OK, I did this for for many, many years now. Now I'm. I'm sort of. Well, I'm fed up with it. Let's, let's get another one. And still it is better because they are. These are sliders, but it's very hard to find a decent.

Researcher: Hmm.

Participant 4: Induction stove or kitchen? I don't know how to call it. It's a stove, right?

Researcher: hmm.

Participant 4: Or hob or whatever it is a decent kitchen hob

Researcher: Yeah.

Participant 4: Based on the the induction technology. That it that has actually proper proper. Proper proper....

Researcher: buttons

Participant 4: Yeah, bigger buttons that that prevent you from touching them when you are whatever you're doing. So yeah.

Researcher: Yeah. Mm hmm. Yeah, yeah, I'm I'm familiar with the problem. I hear about a person that was blind, and they also had this issue where they where like like I I can't feel anything like it doesn't.

Participant 4: Yeah, yeah.

Researcher: Induction might be safer when you're blind, but there's no physical buttons, and with gas you have like big buttons that you turn.

Participant 4: Yeah. Yeah. Well, I do miss the physical buttons. Right. So now. Yeah, now they are sliders and still touch touch screen sliders, but sliders is slightly harder to accidentally push on.

Researcher: Yeah. Yeah. If you had to redesign such a product, do you think you would be able to?

Participant 4: Designing such a product? No, I I I would give some some advice or or directions or something like that, but nope.

Researcher: Yeah, or making adaptations to it.

Participant 4: Because it's very specific. Because I do think that other people are like, oh, this is great. All the touch buttons thingies and other ones are like, no, I want a real button because that's easier for me to to handle or to feel or to whatever.

Researcher: Mm hmm. Yeah.

Participant 4: But, but I'm not a designer, so no, I won't be able to redesign a kitchen.

Researcher: OK. Then I'm wondering, have you ever 3D printed before?

Participant 4: Yes, once at UT. I I I wasn't doing it myself, but I was there and I I I saw it happening.

Researcher: OK, nice. So what was created? What was printed?

Participant 4: A very, very tiny robot thingy [laughing].

Researcher: Aha [laughing]

Participant 4: So nothing very useful. It was a very tiny thing. So yeah, that's the only. That's the only time I was there and I did it once and that was it.

Researcher: OK. So do you think 3D printing could be helpful in adapting products?

Participant 4: Then I've got a question because 3D. 3D printing is this only? Is this only done by using plastics?

Researcher: That is what I focus on, yeah.

Participant 4: OK. Well, using this kind of plastic of redesigning, for instance, a kitchen hob is a very tricky, is very tricky thing.

Researcher: Yeah, might be tricky, yeah.

Participant 4: So but for other stuff, maybe yes, it may be that that you can create some sort of add on or or or or thing you can feel properly to.

Researcher: Mm hmm.

Participant 4: To make it easier or or adjust a handle or something like that by using 3D printing.

Researcher: OK. So how would it feel to be able to create your own products or adapt products to work better for you?

Participant 4: I will be very proud, but not so confident [laughing]. No, it will be fun to to figure out how it works and to to see if I can create my very own adjustment to without [serious]. Being forced to to call in help or something.

Researcher: OK. Well, that was the end of my questions.

Participant 4: Yeah, we did it [laughing].

Researcher: Then the only thing is, is there anything that we didn't talk about that you would like to talk about?

Participant 4: No not really

Participant 4: And now what's the next fase? Because this is fase one.

Researcher: So. Yes. So we're now done with the interview. So now I'm going to send you the link to my website prototype in the chats, and I'm going to ask you to share your screen so I can have a look see if it all works out.

Participant 4: Yeah.OK.

Researcher: Mm hmm.

Participant 4: Oh, a disabled design quest. Wow. We are going on a quest.

Researcher: Mm hmm yes.

Participant 4: Now I need to share my screen.

Researcher: Yeah, that would be great.

Participant 4: OK, welcome. You need some music [laughing]. Great.

Researcher: Yes, I see something.

Participant 4: Yes, I do too, I see flowers.

Researcher: Yes.

Participant 4: I see flowers, notes of flowers. The rainbow thingy.

Researcher: As the disability pride flag.

Participant 4: Oh, is there a disability pride flag?

Researcher: Yes.

Participant 4: Oh God, another flag. Oh, I need to tell this to [collegues name]. OK, let's let's take a tour.

Researcher: But yeah, it it looks good. Yeah, you can take a tour.

Participant 4: Home, courses, community. Yeah. Do we need to sign up?

Researcher: Yeah, every time you use it, you can sign in. It's just you just click button sign in. It's very simple or log in. I think I called it.

Participant 4: It's a difference between what's the difference between sign in sign up.

Researcher: Sign up is like make an account and sign in. It's just log into that account. But for this testing you all have one account. It is all just you don't even need a password. It's very simple.

Participant 4: Ah, so you put it. You put ah, OK you put. Oh, I don't need a personal account. OK, well, that's great. And now, what do I do?

Researcher: Yeah. You can close this.

Participant 4: Okay.

Researcher: You can come back to it later if you want.

Participant 4: OK. OK. Well, I wanna click. I'm clicking.

Researcher: Is it not working? Oh dear. OK, I will look into that. But you can you can click on sign in and then you will also get out of this.

Participant 4: Yeah, great. Did you know, here you see I'm not a tech savvy.

Researcher: That's OK.

Participant 4: So do you do I need to go to courses or home?

Researcher: Yeah, you can do that. You can like on the in the top of right corner is the menu and you can always go back to those so you can go back to home. It's basically just like a normal website with a menu. You can click through things.

Participant 4: OK, it's just a normal website. OK, then I go to level one because I'm level one, right? Oh, then I have to. But how do I log in or register?

Researcher: Yes. As soon as you click on the login, you are logged in. It's that simple.

Participant 4: Oh, that's easy. OK.

Researcher: I didn't want people to have to put in anything so.

Participant 4: OK, OK, OK and now?

Researcher: You can go to level one or you can look at the skill tree where all of the seperate skills are, and here you can see level one.

Participant 4: Hi. OK. Level 1, level one is all about getting started with Ed printing.

Researcher: Yeah. And level one is where you will mainly be this testing.

Participant 4: Intro. Intro. Oh, wow. Crip hacking. What the hell is crip hacking?

Researcher: Well, you can read about it [laughing].

Participant 4: Oh, I can read about it [laughing]. Oh, that's great.

Researcher: Yes.

Participant 4: Fantastic hacking. Wow. Ah, this is cool, this will be your career. You will be a crip-hacker.

Researcher: So yeah, you can go through all of these and then at the end of level one.

Participant 4: Oh, it's a whole new world to me.

Researcher: There will be at the end of level one. There will be or the one before last will be like finding a 3D printing service and then there's a button and that will send you to a Microsoft form where you can request that I print something for you.

Participant 4: No, that Level 3 when I'm at Level 3, can I get a badge or something? I really like this.

Researcher: Yes, yes, there are badges, but for this testing it was not possible to implement that yet, so they are only in the concept for now.

Participant 4: No, I'm just kidding [laughing].

Researcher: If if you want I can send you one [laughing].

Participant 4: Oh well. What? What do I need to do next?

Researcher: You can go to the next skill so at the top there's a button on the right, next skill.

Participant 4: It's. Oh, well there, yeah.

Researcher: And then you can go through them and eventually you'll get to 3D printing service and there you can request for me to print something, huh?

Participant 4: Cement 3D printing a house. How do you ... you can 3D print the house?

Researcher: Yes, although I cannot 3D print a house for you, sorry.

Participant 4: And a metal bridge and oh.

Researcher: Yes.

Participant 4: You can ... really print almost everything. This is great, but we haven't. You're not ... you're you're going to do this. Made out of plastic, right?

Researcher: Yes. Yeah, I'm gonna do the FDM printing.

Participant 4: OK, we have the FDM and this one.

Researcher: Yeah, there's a whole explanation and a video on how that works, and that's the one we're gonna focus on. But yeah, if you go through all of these skills in level one, then eventually you'll come to 3D printing services and there there will be a button that will let you go to a form.

Participant 4: OK, great. OK.

Researcher: A form where you can request for me to print something for you.

Participant 4: OK, great. But when do you need to know? When is the second interview?

Researcher: So in you now have you now have two weeks.

Participant 4: Two weeks.

Researcher: To go through this platform and look at everything and request a 3D print, but you don't have to take the two weeks, you just have that time.

Participant 4: Mm hmm. OK. And requesting and requesting is through this platform, right?

Researcher: Yes, well it will. It will send you to a Microsoft form, but that's all in this.

Participant 4: OK. Yeah, but if I do everything, I will end up. I will end up with filling out that form.



Researcher: Yes.

Participant 4: OK, that's my end goal. OK.

Researcher: Yes. And then you there's a diary where you fill out a few questions about all of this. So the first time you fill it in is after your first use. So that will probably be today. And then the second time is when you have filled in that form. So you're done with this platform. And the third time is when you receive your 3D print in the mail or I might bring it by, I don't know yet.

Participant 4: Or I will pick it up. Well, we will decide whether we are .... but OK. But the only thing I have to do is read and watch your movies and then hit it and click click, click, click, click and then I I say well, this were my experiences in my diary and then you will schedule an yeah. OK and you will schedule another meeting.

Researcher: Yeah. And then we'll have the second interview once you're done. Yeah, that's it. Yes.

Participant 4: Hey, great, lovely.

Researcher: OK. Well then if you don't have any questions, we're done.

Participant 4: Interesting. I don't think so. It's a lot of hocus pocus to me, but yeah.

Researcher: Yeah, just have a look. And if any, if you have any, yeah.

Participant 4: It's interesting. I like to learn new things. I like to learn new things, so this is completely new to me. Let's dive into this.

Researcher: Yeah, if you have any problems, just let me know and otherwise have fun.

Participant 4: OK. And and do and do I need to? And do I need to notify you when I'm ready, or are you just?

Researcher: Yeah. Once you have received your 3D print and I finished the diary, just let me know and then we can schedule the second interview.

Participant 4: Great. Great. I will do so. Thank you and have a nice day. You too.

Researcher: OK. Yes, thank you. You too. OK, goodbye.

### Transcript interview 1 participant 5

Greeting, opening, introduction myself and project, getting permission to record and the signing of the informed consent forms happened before the recording was started.

This interview was conducted in Dutch and translated to English when transcribed.

Researcher: Let's start with the interview, if you're ready?

Participant 5: Yes, I'm all ready to go.

Researcher: I would like to talk about confidence, what do you think of when I say "confidence"?

Participant 5: Confidence? That you, from yourself, how do you say, confidence is kind of in everything you do you have this trust in yourself for what you stand for ...

Researcher: Mm hmm

Participant 5: and not having to deal with a sort of fear about what you are saying. That you stand for yourself and what you say and what you do.

Researcher: Mm hmm, so how would you define confidence?

Participant 5: I think, oh that's quite a difficult question

Researcher: Just take your time, you can think about it

Participant 5: So you just need one word, right?

Researcher: No it can be several, or a sentence, in a few words how you would define it

Participant 5: Oh okay. Trust in yourself that you can do something and a bit of self-esteem.

Researcher: Okay, that sounds good, can you tell me about a time where you felt confident?

Participant 5: In the past with my work, yeah, with my work I really had this feeling of, this is what I stand for and that's the way it is.

Researcher: Mm hmm, and what do you think you need to feel confident?

Participant 5: Knowledge

Researcher: Yeah

Participant 5: Knowledge about, knowledge about what you're talking about so that you know what you're talking about

Researcher: Mm hmm

Participant 5: So that you can explain and talk about it with other people

Researcher: Okay, clear. Then we move onto the next topic, which is creativity, so we'll do the same as for confidence, what do you think when I say "creativity"?

Participant 5: Creativity I think is sometimes coming up with a creative solution with limited means, but creativity is also that you yourself come up with things to make and being creative in coming up with solutions.

Researcher: Mm hmm

Participant 5: But creativity is, I think, also designing or imagining things to make, for example from a toilet paper roll making a children's craft project, creativity can be in many fields.

Researcher: Mm hmm, yeah, have you ever done anything creative or made anything?

Participant 5: Yeah I've just made a snuffle mat for my future dog, and then I had some fabric left over and made a rope for the dog, so that's more the making. And then I'm also creative with kids, telling them stories, creativity can also be telling stories, and thinking up these stories.

Researcher: And how often do you do creative things.

Participant 5: Every week, yeah with really simple things you can be really creative, that's what I think.

Researcher: Yeah, okay, do you see yourself as a creative person?

Participant 5: Yeah I think so.

Researcher: And if you had to give a number between 1 and 10 about your confidence over your creative capabilities, where 1 is not confident at all and 10 is very confident?

Participant: well I think I would fall somewhere around a 6? I think?

Researcher: Okay, and can you explain why you choose that number?

Participant: It can always be better, you can always improve yourself, for me it is usually with really simple things but you also have more professional things, it can always be better.

Researcher: Okay, so have you ever been frustrated with the design of a product you use and wanted to improve it or thought that it could be better?

Participant 5: Really a product or something that I've made.

Researcher: No not something that you've made, but some product you have bought and that you feel could be improved.

Participant 5: Yeah I have a fork, it's an adaptive fork with a thicker handle, and I've already been back with it to the store, because there is always water that gets in the handle, so when you're eating, water trickles out, and I've been back to the store and they couldn't come up with a solution for it, I've even sent an email to the company. Because I'm like if you just seal it or you pour some glue in there, it should be good because no water can get in there anymore.

Researcher: So you have already thought about the solution.

Participant 5: Yeah because I think it is quite a simple solution.

Researcher: So do you think you could redesign or adapt this fork handle?

Participant 5: Yeah, I think I would take the handle off, pour some 1-second glue in there and put the handle back on and then it should be closed.

Researcher: Yeah, okay. So have you ever 3D printed?

Participant 5: No, I've never done that.

Researcher: And why not?

Participant 5: because I don't have a 3D printer

Researcher: So if you would have one, or you could use someone else's would you do it then?

Participant 5: Yeah, actually my son had one, but I always thought that he could do it so much better than me, so I have stood next to it to see it work, but I haven't worked with it.

Researcher: Okay, do you think that 3D printing could be helpful, for example for printing a new handle for your fork or another product to adapt it?

Participant 5: Oh certainly, there is probably something you could do with that, yeah I think so.

Researcher: Okay, and what would it feel like to be able to design your own products or adapt products?

Participant 5: So then you're being quite creative, and you need a certain creative insight to be able to do this, but if you could, I think that would give a feeling of satisfaction.

Researcher: Yeah, okay, well then we have already come to the end of the questions, the only thing I want to ask you is if we missed anything, anything you wanted to discuss that I didn't ask you about?

Participant 5: No I don't think so

Researcher: Then I will send you the links to the website, the best is to open this on the computer, then it works the best, maybe a tablet would work, I'm not sure.

Participant 5: Okay then I will do that

Researcher: Then I will also send you a diary with that, at 3 points you have to fill this in, the first time is when you first use the website, then when you request the printing of a 3D model and the third time is when you have received this model in the post. And then each time you answer some questions in the diary. You can choose, either a word document where you can type in or a pdf that you can print and write it by hand and then scan it and send it to me.

Participant 5: Yeah sounds good

Researcher: Then you now have 2 weeks to do these steps, if you are done sooner just let me know, as soon as you're done we can schedule the second interview.

Participant 5: Okay and then you'll send it to me by mail?

Researcher: Yeah

Participant 5: Okay.

Researcher: Do you have any questions?

Participant 5: No, I think I'm good

Researcher: Okay then have fun and we'll chat again when you're finished.

Participant 5: Okay, bye!

Researcher: Bye

Opening the website together wasn't possible because the interview took place over a phone call.

## Diary entries participant 1

### Stage 1

**Date: 07-11-2024/08-11-2024**

1. How was your first time using the website Disabled Design Quest?

Very interesting. Menu is clear and has several options.

a. Can you explain what you did?

I first started by reading everything and watched the (YouTube) links

2. How do you think it went today?

It went well and it's something new so you have to take your time for it.

a. How do you feel about it?

Excited to learn something new, a whole new world opened up for me. At the same time I realize that I had no real knowledge of this.

3. Do you feel like you learned anything about 3D printing already?

A lot, the possibilities are almost endless.

a. If so: can you explain what and how?

There are possibilities in shape, material and application. You can choose existing designs, adapt them or create your own design.

b. What do you think about this?

The website provides a good structure to get acquainted with the possibilities of 3D printing.

4. Did you encounter any problems or anything difficult?

The text is English, partly technical and sometimes has long sentences. This cost me some extra effort to understand it well.

a. If so: can you explain something about these?

I couldn't right click the text with my mouse, neither Chrome nor Edge. Because of this I couldn't translate it or have it read to me.

b. And how did you overcome them?

I have a translation app on my phone and was able to follow everything well.

c. In what way did this effect your confidence in your creative capabilities?

There is a solution for everything, including this. It took me a little longer, but the subject and information given are challenging enough to persevere.

5. Do you feel like your confidence in 3D printing has changed?

After reviewing the information, yes.

a. If so: how did it change?

I now see that it is possible for everyone and you don't need to have your own 3D printer

b. Do you feel like using DDQ contributed to this?

Yes

c. If so: how did DDQ contribute?

This gives me the insight that there are 3D printing possibilities for me too.

6. Do you feel like your confidence in your creative capabilities has changed?

Yes

a. If so: how did it change?

I am creative but only in familiar areas. For example not in writing or music and also had no knowledge of 3d printing and thought it could not mean anything to me.

b. Do you feel like using DDQ contributed to this?

Yes a lot

c. If so: how did DDQ contribute?

I now know that I can have a lot of influence on making a design fit my wishes

7. What do you think about the information provided about 3D printing?

Information has a good structure.

a. Is it written in a way that is understandable for you? If not: please explain.

Information is easy to read and I understand the text, but applying it turns out to be more complicated

b. Is the information easy to find and access? If not: please explain.

Yes

c. Is the way it is presented helpful? If not: please explain.

For further explanation see free space 1

d. Is the information complete? What is missing?

For further explanation see free space 1

8. What do you think about the accessibility of the website? (half was in Dutch so was translated to English by the researcher)

See answer to question 4 + Tip 1: Lock the menu bar at the top when scrolling down so that it is always accessible.

Tip 2: In the beginning you do give an explanation of each abbreviation, but on later pages you don't explain them anymore. It costs time to read everything and look at everything, so when this is spread out over time it is sometimes difficult to remember what these abbreviations mean.

a. How did the (in)accessibility impact your experience?

Not really, maybe a little more time

9. Can you share pictures/screenshots of anything you created/worked on this stage?

Need to do some more research

10. Anything else you want to share/write/draw:

The banner is nicely chosen and has a cheerful look. The "buttons" are clearly recognizable. The menu and the Skill tree work well. However, the content on one page is better divided into paragraphs than on others. In addition, the variation/distribution of text and images can contribute to making the page a bit clearer and more pleasant to read. In the beginning you provide an explanation of the abbreviations and later on you do not explain them anymore.

**Free space 1:**

**Date: 08-11-2024**

The information itself is fine. Make it clear that the first time it takes time to master this. The first course is just too information, instead of just do it. For a first acquaintance, actually applying the information is a bit overwhelming. Being afraid of doing something wrong or not knowing how to load a file into a program can make someone drop out and that is a shame. A supplement in the form of a basic step-by-step plan can provide just that support to make the threshold or introduction easier.

## Stage 2

**Date: 08-11-2024**

1. How did it go requesting a 3D print?

Find out how is all works is a bit overwhelming

a. What did you choose to print?

A gummy bear

b. Why did you choose that?

For further explanation see free space 2

2. How do you think it went today?

In the end it was good, but it took a lot more time than I had estimated

a. How do you feel about it?

Still positive and I will follow the follow-up courses for my own design

3. Do you feel like you learned anything about 3D printing?

A lot and a wonderful opportunity

a. If so: can you explain what and how?

At first I only saw it as a toy. Now I see many more possibilities. Without this website I would never have started it on my own

b. What do you think about this?

I now see a lot of possibilities and think that 3D printing has a bright future. On a personal level through customization. But also in individual parts and thus make a good contribution to the circular economy.

4. Did you encounter any problems or anything difficult?

Yes

a. If so: can you explain something about these?

Everything is new, you have to download software (received a warning that the software had not been tested safely) and also create an account. How do you get your design into the program?

b. And how did you overcome them?

Take a deep breath and read everything calmly. It all works, but it takes quite a lot of time the first time.

b. In what way did this effect your confidence in your creative capabilities?

Like anything new, it takes practice and time to learn. I realize that this is something completely different for me and that I really need to delve deeper into my own design.



5. Do you feel like your confidence in 3D printing has changed?

Yes

a. If so: how did it change?

I see possibilities now

b. Do you feel like using Disabled Design Quest contributed to this?

Yes

c. If so: how did Disabled Design Quest contribute?

Good information taught from general to specific. You can also easily look back if you continue at a different time.

6. Do you feel like your confidence in your creative capabilities has changed?

No and yes

a. If so: how did it change?

I have gotten older (60) and see that I had overestimated myself. I realize that it now takes me more time when I start something new. Yes; the information made me enthusiastic and curious

b. Do you feel like using Disabled Design Quest contributed to this?

Yes

b. If so: how did Disabled Design Quest contribute?

This site is accessible, provides good information and I have experienced that it also allows me to handle 3D printing well.

7. What do you think about the information provided about 3D printing?

See answers stage 1 question 7

a. Is it written in a way that is understandable for you? If not: please explain

/

b. Is information easy to find and access? If not: please explain

/

c. Is the way it is presented helpful? If not: please explain

/

d. Is the information complete? What is missing?

/

8. What do you think about the accessibility of the website?

See answers stage 1 question 8

a. How did the (in)accessibility impact your experience?

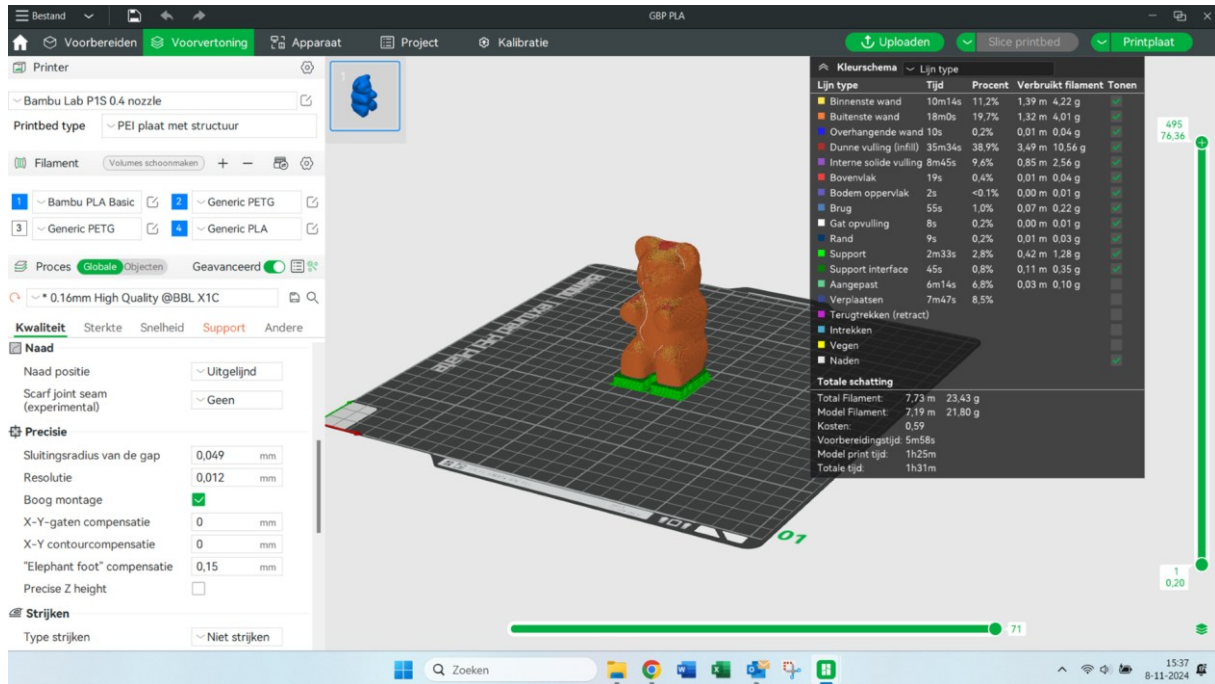
/

9. Can you share pictures/screenshots of anything you created/worked on this stage?

Cannot add image in this program

<https://makerworld.com/en/models/146205?from=search#profileid-159188>

Image sent via email:



**Free space 2:**

**Date: 08-11-2024**

Our camper has a steering lock from the Bearlock brand. Because the lock is under the dashboard and starting the engine is keyless, I forget to use it. Both when parking and before driving away. The gummy bear can help me remember to use the lock.

**Stage 3**

1. What do you think of your first 3D print?

a. Are you satisfied with your print? Please explain why or why not.

b. Have you used it already?

c. How did that go?

d. Would you make any changes to it if you were to do this again? If yes: what would you change and why?

2. Do you feel like you learned anything about 3D printing?

a. If so: can you explain what and how?

b. What do you think about this?

3. Did you encounter any problems or anything difficult?

a. If so: can you explain something about these?

b. And how did you overcome them?

d. In what way did this effect your confidence in your creative capabilities?

4. Do you feel like your confidence in 3D printing has changed?

a. If so: how did it change?

b. Do you feel like using Disabled Design Quest contributed to this?

c. If so: how did Disabled Design Quest contribute?

5. Do you feel like your confidence in your creative capabilities has changed?

a. If so: how did it change?

b. Do you feel like using Disabled Design Quest contributed to this?

c. If so: how did Disabled Design Quest contribute?

6. What do you think about the information provided about 3D printing?

a. Is it written in a way that is understandable for you? If not: please explain.

b. Is information easy to find and access? If not: please explain.

c. Is the way it is presented helpful? If not: please explain.

d. Is the information complete? What is missing?

7. What do you think about the accessibility of the website?

a. How did the (in)accessibility impact your experience?

8. Can you share pictures/screenshots of anything you created/worked on this stage?

9. Anything else you want to share/write/draw:

Diary entries participant 2

**Stage 1**

**Date: 04-11-2024**

1. How was your first time using the website Disabled Design Quest?

Interesting

a. Can you explain what you did?

I first read all the information and viewed the youtube films and already took a peek at the websites

2. How do you think it went today?

It gave me a good feeling to be heard and I think it went ok.

a. How do you feel about it?

I felt enthusiasm to learn more about 3D and its possibilities

3. Do you feel like you learned anything about 3D printing already?

Yes, I learned that there are a lot of different materials

a. If so: can you explain what and how?

After viewing some projects and seeing youtube films I saw that there is so much more possible

b. What do you think about this?

A bit overwhelming

4. Did you encounter any problems or anything difficult?

Yes, I had some problems with software on my computer and settings

a. If so: can you explain something about these?

My settings were wrong so I struggled with seeing the whole page and switching between pages.

b. And how did you overcome them?

I tried to change the settings but I couldn't so I used the mouse to view all the parts of the page. Also the pdf's weren't my thing so I printed them.

c. In what way did this effect your confidence in your creative capabilities?

I got frustrated at first. Asked help from husband but he has no time and didn't know how to help. So a bit insecure but doing it old-school by hand....

5. Do you feel like your confidence in 3D printing has changed?

Well, as I said, software has to work ... so I hope things get better

a. If so: how did it change?

My computer wasn't helpful

b. Do you feel like using DDQ contributed to this?

No.

c. If so: how did DDQ contribute?

/

6. Do you feel like your confidence in your creative capabilities has changed?

Not really.

a. If so: how did it change?

/

b. Do you feel like using DDQ contributed to this?

No.

c. If so: how did DDQ contribute?

/

7. What do you think about the information provided about 3D printing?

Interesting. A lot of information (technical).

a. Is it written in a way that is understandable for you? If not: please explain.

It is understandable

b. Is the information easy to find and access? If not: please explain.

Yes.

c. Is the way it is presented helpful? If not: please explain.

Yes, especially the links to other projects and solutions. Helps you to think in a different way.

d. Is the information complete? What is missing?

At this stage it is complete. I don't know what is missing. Maybe when I start trying to design my own I will need more information.

8. What do you think about the accessibility of the website?

For me it is ok

a. How did the (in)accessibility impact your experience?

My experience was fine. I had trouble with the settings of my computer.

9. Can you share pictures/screenshots of anything you created/worked on this stage?

I haven't created anything yet. I found a nice texture roller on thingiverse.

10. Anything else you want to share/write/draw:

Thank you for this opportunity!

## **Stage 2**

**Date: 08-11-2024**

1. How did it go requesting a 3D print?

I struggled with the software and my computer. I read all the information but missed a short to do list.

a. What did you choose to print?

I choosed a key cover.with a symbol on it

b. Why did you choose that?

I struggle with finding the right key for differ locks

2. How do you think it went today?

I'm glad that I succeeded but think I need more practice

a. How do you feel about it?

I thought it would be hard to learn but I now think it will go easier

3. Do you feel like you learned anything about 3D printing?

I feel happy that I learned that there are a lot of possibilities, quite overwhelming

a. If so: can you explain what and how?

I learned that there are already a lot of solutions that people share. That is nice to know. And overwhelming because there are so many so difficult to choose one

b. What do you think about this?

Hopeful, that people are able to change designs that don't work for them. When it is easy to adapt the designs to individuals by 3d printing is a good solution

4. Did you encounter any problems or anything difficult?

Yes. I found out that I am not use to new programmes, especially the technical programmes. I do not like sitting behind my computer. And when things are new, they cos a lot of time. But I am curious so that helps

a. If so: can you explain something about these?

I needed more support starting the new programme. What is logical for some people is new for people who are not used to work with computers and printers. There were some bumps in the road

b. And how did you overcome them?

I kept reading the info and asked for help. I could use a step to step for dummies instructions

c. In what way did this effect your confidence in your creative capabilities?

I stumbled with the technical information. Now I chose a ready made printable but I really wanted to design a differt shape and a different symbol

5. Do you feel like your confidence in 3D printing has changed?

Yes because I learned about the possibilities and now I want to learn more to be able to design my own solution

a. If so: how did it change?

After I saw all the examples of solutions people share on the different platforms it gives hope that I can really design a bespoke solution by myself

b. Do you feel like using DDQ contributed to this?

Yes because before I could not imagine the possibilities of bespoke 3D printing

c. If so: how did DDQ contribute?

I think because of sharing all the information, the examples, the youtube films and the websites, all the possibilities. It awakens a feeling of be able to be independent and beining creative. To think about solutions instead of being annoyed about bad design

6. Do you feel like your confidence in your creative capabilities has changed?

I'm starting to feel more confident that I could be able to change design or create my own solutions

a. If so: how did it change?



By the shared information and the possibility to try the 3D programme without the need of owning my own 3D printer

b. Do you feel like using DDQ contributed to this?

Yes!

c. If so: how did DDQ contribute?

By inviting to make design accessible by introducing me into the software of 3D printing. I would never have tried it without this platform

7. What do you think about the information provided about 3D printing?

...It is a lot. I now know that you need all the information. And everybody needs something different so it is good to know that there are so many possibilities. You just have to choose what fits you. I would like to have a step by step instruction, really for dummies. I think I will get better in doing it after a lot of exercise

a. Is it written in a way that is understandable for you? If not: please explain

I understand the information by itself but you need to reread the details while trying to get all the information for the printing project. Maybe use shorter sentences and a different layout of the website. Instead of the whole page more like splitting the page in two (like this form). Just easier to read

b. Is information easy to find and access? If not: please explain

At first I struggled but that is because everything is new to me. After a couple of times it's getting better

c. Is the way it is presented helpful? If not: please explain

See 7a Shorter sentences, maybe bulletpoints?

d. Is the information complete? What is missing?

The information is complete I guess, I missed a short step by step guide at the end. I kept thinking what do I need to do next? I missed the background information: found a model? Download it and from that download the programme opens itself for example

8. What do you think about the accessibility of the website?

As said, the sentences are too long, it takes my breath away while reading. Instead of one sentence, cut the sentence in two, three or even 4 lines

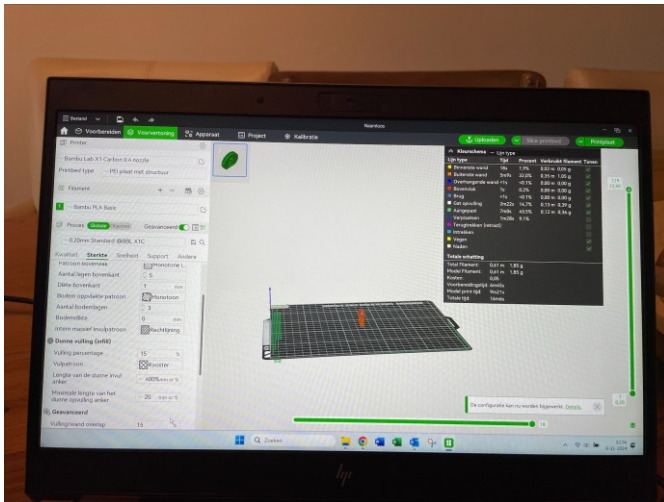
a. How did the (in)accessibility impact your experience?

I had to reread the sentences before understanding and kept my focus.

9. Can you share pictures/screenshots of anything you created/worked on this stage?

Yes I will send a screenshot

Image sent via email:



10. Anything else you want to share/write/draw:

I am still enthusiastic about 3D printing

### Stage 3

1. What do you think of your first 3D print?

I am very happy with the result

a. Are you satisfied with your print? Please explain why or why not.

The print is fine for one key

b. Have you used it already?

Yes, I tried it right away. I found out that this print was especially for round keys and not for square ones

c. How did that go?

I tried several keys. I have one key that fits

d. Would you make any changes to it if you were to do this again? If yes: what would you change and why?

Yes, I would make it larger or more square. And I would like to make changes in the figure. Now it is a Greek letter

2. Do you feel like you learned anything about 3D printing?

Definitely

a. If so: can you explain what and how?

I have learned the possibilities of 3D printing in so many ways

b. What do you think about this?

I am happy with it. So many solutions

3. Did you encounter any problems or anything difficult?

Yes, finding my way with the software, setting up my computer

a. If so: can you explain something about these?

I missed a step by step for dummies

b. And how did you overcome them?

I asked for help. I think a helpdesk is handy

d. In what way did this effect your confidence in your creative capabilities?

I know that I come further with a little help

4. Do you feel like your confidence in 3D printing has changed?

Oh yes

a. If so: how did it change?

With the printresult I saw the possibilities of 3D printing

b. Do you feel like using Disabled Design Quest contributed to this?

Yes, otherwise I would not have the courage to find out how 3D printing works

c. If so: how did Disabled Design Quest contribute?

By sharing information, the examples, the weblinks to readymade solutions, to printerpossibilities etc.

5. Do you feel like your confidence in your creative capabilities has changed?

Yes, I got inspired by the examples the website showed

a. If so: how did it change?

Scrolling through all the examples of possibilities I got my own ideas of changing or adapting designs

b. Do you feel like using Disabled Design Quest contributed to this?

Yes, because I got the opportunity to try the 3D printer guided by the website

c. If so: how did Disabled Design Quest contribute?

Guiding my through all the parts of 3D printing. First the examples, the different kinds of 3D printing, then what material possibilities and then the testing and printing

6. What do you think about the information provided about 3D printing?

I find it really interesting

a. Is it written in a way that is understandable for you? If not: please explain.

Yes but I needed some time and courage to try it

b. Is information easy to find and access? If not: please explain.

Yes it is

c. Is the way it is presented helpful? If not: please explain.

Yes it is. With all the links it is 'laagdremelig' [written in Dutch, translated to English: accessible/approachable]

d. Is the information complete? What is missing?

ás said the step by stem for dummies

7. What do you think about the accessibility of the website?

I think the sentences are too long. Took my breath away while reading. Also difficult to follow Shorter sentences and more blocks.

a. How did the (in)accessibility impact your experience?

I needed tot read more than once the sentences

8. Can you share pictures/screenshots of anything you created/worked on this stage?

Yes, I already sent my picture to Anouk

The image that was sent:



9. Anything else you want to share/write/draw:

Congratulations to Anouk for her wonderful work! I find it great that she is helping people with special needs to be independent and not take average designs for granted

**Free space:**

**Date: 13-11-2024**

Wonderful to get the opportunity to try 3D printing. For me a new world of posibilities and technique. Giving me the feeling of being able to print a solution I would like to have/use adapted to my needs

Diary entries participant 4

**Stage 1:**

**Date: 5-11-2024**

1. How was your first time using the website Disabled Design Quest?

It was interesting, I was surprised at all the possibilities and what can be done using 3D design

a. Can you explain what you did?

I just browsed through the website and watched some of the content and see hey this is interesting.

2. How do you think it went today?

It was a lot of information to digest, so I was a bit like hey okay, and I read some stuff because to me 3D printing is brand new, I'm fully unknown of all the ins and outs of 3D printing. So it was a lot to take in.

a. How do you feel about it?

I'm excited, if it's possible to do such things then there is a whole world to win.

3. Do you feel like you learned anything about 3D printing already?

Yes, I was like, I'm still not able to do it by myself, but I really like that it is well structured and has a step-by-step learning approach and I really like that.

a. If so: can you explain what and how?

See 3.

b. What do you think about this?

See 3.

4. Did you encounter any problems or anything difficult?

Yes.

a. If so: can you explain something about these?

You need some time and focus, which sounds strange, but you need focus to be able to progress and when you lack focus (which I did) then it is very overwhelming.

b. And how did you overcome them?

No not really, because I didn't have a sufficient amount of time to overcome these problems, but I see the potential and I think I would be able to overcome these troubles by doing it simply more often.

c. In what way did this effect your confidence in your creative capabilities?

Well I wasn't that confident to begin with, so I don't think so.

5. Do you feel like your confidence in 3D printing has changed?

I still haven't printed anything but, yeah I think that I would be confident in trying so, after reading all the materials and watching the videos, because it is very clearly and elaborately described, what you need to do and what the materials are and what you need to know in working with them.

a. If so: how did it change?

It increased.

b. Do you feel like using DDQ contributed to this?

Yes

c. If so: how did DDQ contribute?

See 5a.

6. Do you feel like your confidence in your creative capabilities has changed?

It's funny because I've worked with these kinds of materials several weeks ago with using 3D pens. And then I was like "I'm not able to do this" I will just make a big mess, and then it's okay. But now compared with my experiences then, my experience now is much more like, this is the material, this is how I can use it, this is what I need to do, so yeah it helps.

a. If so: how did it change?

See above

b. Do you feel like using DDQ contributed to this?

Yes.

c. If so: how did DDQ contribute?

It's a very clear process, so yes. Because it is that clear, it will contribute to my confidence in my creative skills.

7. What do you think about the information provided about 3D printing?

I'm very content with the amount of information, although it is a lot, it is very detailed and it's very useful.

a. Is it written in a way that is understandable for you? If not: please explain.

Yes

b. Is the information easy to find and access? If not: please explain.

It is a bit dense on the text part, a lot of times it is a lot of text, so maybe a more compact design with just some bullet points would work out slightly better, and maybe something that is a bit more clickable, when I want to know more about materials, then I can click here, instead of having it all on one webpage or on sites that are external so maybe you can incorporate some bits and pieces on the website and then creating deeplinks, not so much putting straightforward text.

c. Is the way it is presented helpful? If not: please explain.

Yes it's helpful, but it's also a lot

d. Is the information complete? What is missing?

Yes, maybe it's even overcomplete sometimes. Stick to the core and then when you want to share additional information then that's fine but maybe link it or something. For a beginner like me, some basic, rather elemental information would do, and then the rest can be linked somehow.

8. What do you think about the accessibility of the website?

My personal tolerance of (in)accessibility of a website is quite high, so it's hard for me to assess how accessible it would be for all of us, but to me it was quite accessible.

a. How did the (in)accessibility impact your experience?

It didn't really impact my experience

9. Can you share pictures/screenshots of anything you created/worked on this stage?

Nothing yet

10. Anything else you want to share/write/draw:

**Stage 2:**

**Date: 20-11-2024**

1. How did it go requesting a 3D print?

Good, I asked for some help to find the model I needed, but then we found a great product.

a. What did you choose to print?

A jar opener that takes the vacuum off.

b. Why did you choose that?

It's quite frustrating because I thought there should be quite a simple solution, for my problem so to say, because my wrist is fixed so I can't turn my wrist, and there are always tools that highlight the abilities of a fairly normal wrist, and this tool is quite simple and doesn't require twisting.

2. How do you think it went today?

good

a. How do you feel about it?

good

3. Do you feel like you learned anything about 3D printing?

Same as stage 1

a. If so: can you explain what and how?

Same as stage 1

b. What do you think about this?

Same as stage 1

4. Did you encounter any problems or anything difficult?

Same as stage 1

a. If so: can you explain something about these?

Same as stage 1

b. And how did you overcome them?

Same as stage 1

c. In what way did this effect your confidence in your creative capabilities?

Same as stage 1



5. Do you feel like your confidence in 3D printing has changed?

Same as stage 1

a. If so: how did it change?

Same as stage 1

b. Do you feel like using Disabled Design Quest contributed to this?

Same as stage 1

c. If so: how did Disabled Design Quest contribute?

Same as stage 1

6. Do you feel like your confidence in your creative capabilities has changed?

Same as stage 1

a. If so: how did it change?

Same as stage 1

b. Do you feel like using Disabled Design Quest contributed to this?

Same as stage 1

c. If so: how did Disabled Design Quest contribute?

Same as stage 1

7. What do you think about the information provided about 3D printing?

Same as stage 1

a. Is it written in a way that is understandable for you? If not: please explain

Same as stage 1

b. Is information easy to find and access? If not: please explain

Same as stage 1

c. Is the way it is presented helpful? If not: please explain

Same as stage 1

d. Is the information complete? What is missing?

Same as stage 1

8. What do you think about the accessibility of the website?

Same as stage 1

a. How did the (in)accessibility impact your experience?

Same as stage 1

9. Can you share pictures/screenshots of anything you created/worked on this stage?

I chose this: <https://www.thingiverse.com/thing:1962792>

### Stage 3:

**Date: 27-11-2024**

1. What do you think of your first 3D print?

My husband was really excited when I brought it home and I liked what it looked like, it looked like it was going to be perfect for me.

a. Are you satisfied with your print?

Well when I tried it for the first time it broke (see picture), it was not strong enough.

b. Have you used it already?

See the previous answer.

c. How did that go?

See the previous answer.

d. Would you make any changes to it if you were to do this again? If yes: what would you change and why?

Well, when it broke when I first tried using it and we decided to print it again, but now on it's side so it would be stronger because of the direction of the printing, we also increase the infill to 60%. This time it was heavier and strong enough and it worked really well for me (see picture 2).

2. Do you feel like you learned anything about 3D printing?

I learned that printing in a certain direction can change the strength in a direction.

a. If so: can you explain what and how?

I also learned that PLA the material that was used for my print is made from plant materials and not from petroleum/crude oil.

b. What do you think about this?

As a vegan this makes me very happy.

3. Did you encounter any problems or anything difficult?

Yes.

a. If so: can you explain something about these?

It initially broke when I used it.

b. And how did you overcome them?

We printed it again but with some different settings.

c. In what way did this effect your confidence in your creative capabilities?

I learned from it.

4. Do you feel like your confidence in 3D printing has changed?

Same as stage 1

a. If so: how did it change?

Same as stage 1

b. Do you feel like using DDQ contributed to this?

Same as stage 1

c. If so: how did DDQ contribute?

Same as stage 1

5. Do you feel like your confidence in your creative capabilities has changed?

Same as stage 1

a. If so: how did it change?

Same as stage 1

b. Do you feel like using DDQ contributed to this?

Same as stage 1

c. If so: how did DDQ contribute?

Same as stage 1

6. What do you think about the information provided about 3D printing?

Same as stage 1

a. Is it written in a way that is understandable for you? If not: please explain

Same as stage 1

b. Is information easy to find and access? If not: please explain

Same as stage 1

c. Is the way it is presented helpful? If not: please explain

Same as stage 1

d. Is the information complete? What is missing?

Same as stage 1

7. What do you think about the accessibility of the website?

Same as stage 1

a. How did the (in)accessibility impact your experience?

Same as stage 1

8. Can you share pictures/screenshots of anything you created/worked on this stage?

Picture 1 sent:



Picture 2 sent:



Picture 2 sent:



9. Anything else you want to share/write/draw:

You have to digest all of this information multiple times to get the hang of it, and I think the foundation is clear and the goals are clear.

Diary entries participant 5

**Stage 1:**

**Date: 12-11-2024**

1. How was your first time using the website Disabled Design Quest?

First feeling it out because my English is not so good

a. Can you explain what you did?

looked at home, courses and community

2. How do you think it went today?

Fine

a. How do you feel about it?

Fine

3. Do you feel like you learned anything about 3D printing already?

At first not that much because I already knew a little bit, but then I opened links and started to delve in further I did learn things.

a. If so: can you explain what and how?

By watching the videos

b. What do you think about this?

There is a lot possible with this technology

4. Did you encounter any problems or anything difficult?

The language

a. If so: can you explain something about these?

It would be great if you could choose what language you wanted the text to be in.

b. And how did you overcome them?

I regularly used google translate camera on my phone to use the website

c. In what way did this effect your confidence in your creative capabilities?

It made it possible to read more

5. Do you feel like your confidence in 3D printing has changed?

Well, I don't have a 3D printer, so not really

a. If so: how did it change?

/

b. Do you feel like using DDQ contributed to this?

/

c. If so: how did DDQ contribute?

By gathering information via the website. You can see many examples and you start thinking if maybe you can do something with that, or if you would change something or improve it.

6. Do you feel like your confidence in your creative capabilities has changed?

A little bit yes it improved

a. If so: how did it change?

By starting to think about all the things you can do with it.

b. Do you feel like using DDQ contributed to this?

Yes, without the website I don't think I would have ever looked into it.

c. If so: how did DDQ contribute?

By having all the links with examples

7. What do you think about the information provided about 3D printing?

It's a lot

a. Is it written in a way that is understandable for you? If not: please explain.

Could have been written even more simple for me

b. Is the information easy to find and access? If not: please explain.

Videos are clear, text and some links are in phrasing I don't understand

c. Is the way it is presented helpful? If not: please explain.

Decently

d. Is the information complete? What is missing?

I would divide it into more categories.

8. What do you think about the accessibility of the website?

Because of the colours and simple lay-out it is pretty accessible

a. How did the (in)accessibility impact your experience?

When you look into it further it isn't always as easy as it seems

9. Can you share pictures/screenshots of anything you created/worked on this stage?

/

10. Anything else you want to share/write/draw:

/

## **Stage 2:**

**Date: 13-11-2024**

1. How did it go requesting a 3D print?

After being interested in one of the projects on the website, I ordered an item.

a. What did you choose to print?

I chose the drinking can opener

b. Why did you choose that?

Well, I have some handproblems and this seemed like a handy assistive product.

2. How do you think it went today?

good

a. How do you feel about it?

3D printing can be quite useful and I can get some benefits from it in this way, for my issues. Especially when the type of product I'm looking for isn't available in a store then to be able to print them like this seems really useful, and really a great addition to reducing some of the issues I have and this can also help get some independence back. Then I don't always need to ask my husband to open it for me.

3. Do you feel like you learned anything about 3D printing?

I already had a bit of an idea about it, but now I really know more. I hadn't thought that all of this would be possible because I hadn't really delved into it yet. So there are more possibilities than I thought, like that you can print with cement and lasers, those techniques I didn't know about before.

a. If so: can you explain what and how?

See previous answer.

b. What do you think about this?

Well, I'm not going to be 3D printing myself, but I am thinking like, if I ever run into an issue in the future and think I would need some kind of assistive product, then I would start thinking about the possibilities that something can be made that could help me. And I would think of a 3D printer to print this. My husband has also gotten more interested in 3D printed throughout this process and is considering looking into it for after he retires. Then maybe he could make things for me, but I also know others who have a 3D printer, so I would consider asking them if they could make something for me, if needed.

4. Did you encounter any problems or anything difficult?

See stage 1

a. If so: can you explain something about these?

/

b. And how did you overcome them?

/

c. In what way did this effect your confidence in your creative capabilities?

/

5. Do you feel like your confidence in 3D printing has changed?

/

a. If so: how did it change?

/



b. Do you feel like using Disabled Design Quest contributed to this?

/

c. If so: how did Disabled Design Quest contribute?

/

6. Do you feel like your confidence in your creative capabilities has changed?

Yes

a. If so: how did it change?

It has improved a bit

b. Do you feel like using Disabled Design Quest contributed to this?

Yes

c. If so: how did Disabled Design Quest contribute?

By providing the information

7. What do you think about the information provided about 3D printing?

Same as stage 1

a. Is it written in a way that is understandable for you? If not: please explain

/

b. Is information easy to find and access? If not: please explain

/

c. Is the way it is presented helpful? If not: please explain

/

d. Is the information complete? What is missing?

/

8. What do you think about the accessibility of the website?

/

a. How did the (in)accessibility impact your experience?

/

9. Can you share pictures/screenshots of anything you created/worked on this stage?



### Drinking can opener

Maker: [Anouk](#)

**Description**  
For years I have struggled to open drinking cans, I end up using the end of a fork or spoon, but those are not always handy. I found this model on printables and it's amazing, it's small enough to fit in a bag or pocket or on a key chain so I can take it with me anywhere, and it is so easy to open a can using this tool. I printed it with help from the people at FabLab.

**Printing info**  
Printer: Bambu studio X1-Carbon  
Printing time: 35m:45s (and 7m:05s preparation time)  
Layer height: 0.28mm standard @BB1, X1C  
Nozzle size: 0.4 nozzle  
Total weight: 4.91 grams  
Filament: Bambu mate PLA black  
Plate type: textured PEI plate

Stl files created by: @BilSmith\_99136  
Downloaded from: <https://www.printables.com/model/272392-can-opener-and-lid-with-magnet-original-by-99136>

[Download files](#)

## Stage 3:

**Date: 18-11-2024**

1. What do you think of your first 3D print?

Small and very useful

a. Are you satisfied with your print?

Yes, also very nice with the magnet, I can easily hang it in the kitchen.

b. Have you used it already?

Yes with a soda can.

c. How did that go?

It was much easier to open the can, I didn't have to ask someone for help.

d. Would you make any changes to it if you were to do this again? If yes: what would you change and why?

At first I thought I might want a bigger handle, but after using it I realized that I liked to leave it on there and hold it with one hand, then I'm not bothered by the little clip that is on the can while drinking. So it's actually good the way it is.

2. Do you feel like you learned anything about 3D printing?

Yes, actually I do.

a. If so: can you explain what and how?

Mostly about the possibilities of 3D printing, so when I will need something my thoughts might go towards thinking if it is possible for that to be printed, while I wouldn't have thought about that before.

b. What do you think about this?

I think it's quite nice.

3. Did you encounter any problems or anything difficult?

Yes.

a. If so: can you explain something about these?

It's difficult for me to read English so it took some more time.

b. And how did you overcome them?

I used the google translate app and this worked quite well.

c. In what way did this effect your confidence in your creative capabilities?

Not much, it didn't really have anything to do with my creativity.

4. Do you feel like your confidence in 3D printing has changed?

Yes.

a. If so: how did it change?

I see the possibilities now, so in the future when I need something I will think about maybe 3D printing is an option to solve the problem.

b. Do you feel like using DDQ contributed to this?

Yes

c. If so: how did DDQ contribute?

The video's made me see the possibilities.

5. Do you feel like your confidence in your creative capabilities has changed?

Yes.

a. If so: how did it change?

I feel a little bit more confident, I still don't know how to 3D print and I won't do that, but now I know that I can also have things printed by other people for me.

b. Do you feel like using DDQ contributed to this?

Yes

c. If so: how did DDQ contribute?

It gave me the information & links

6. What do you think about the information provided about 3D printing?

Same as stage 1.

a. Is it written in a way that is understandable for you? If not: please explain

/

b. Is information easy to find and access? If not: please explain

/

c. Is the way it is presented helpful? If not: please explain

/

d. Is the information complete? What is missing?

/

7. What do you think about the accessibility of the website?

/

a. How did the (in)accessibility impact your experience?

/

8. Can you share pictures/screenshots of anything you created/worked on this stage?



9. Anything else you want to share/write/draw:

/

Transcript interview 2 participant 1

Greeting, opening, and getting permission to record happened before the recording was started.

Researcher: What was your overall experience over the last weeks with the disabled Design Quest website?

Participant 1: Wow that's a mouthful [laughing].

Researcher: Yeah.

Participant 1: Nice. It was ... how do you say that? A very nice experience, I never thought it was ... so many possibilities. I always thought it was a little bit of well, you have the the professional side and you have the the home side to say.

Researcher: Mm hmm. Yep.

Participant 1: And of course, in the professional side there is a lot possible, but I thought for the the home side it was ... well, more like toys or that kind of things? So I'm not really really really the the possibilities of to make adjustments and your own designs. And I was, yeah, I was. How do you say that?

Researcher: Pleasantly surprised?

Participant 1: Yeah, that's what I'm looking for. Yeah. So yeah, very positive.

Researcher: Yeah. OK. And the object you have created, how do you feel about it?

Participant 1: Good, it was ... I was always ... I was ... trying looking for a a solution and I thought something like ... a key ring? Yeah. But that's under the dashboard, so I won't see it. So I was looking for something above the the dashboard but. Well, the only thing you see is. A gummy bear one centimetre big or you have a fluffy bear that's well, that's not going to stay ... clean. So this was very nice that I thought one. Yeah, did this exactly what I am ... what I'm looking for and I put it on the dashboard and it's not irritating. It's nice to see, nice to look at, but it's not distracting when you're driving, so it's it's there and it's a reminder, but it's not .. an issue or not an obstacle when you're driving so you don't have to remove it, you can ... let it be where it's what stands, and then it's suits its purpose.

Researcher: OK. Sounds good. So do you feel like you have more confidence in your creative capabilities than before using the website?

Participant 1: Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities.

Researcher: Yeah. OK. So if you had to rate your confidence in your creative, out of the box thinking and making on a scale from 1 to 10 where 1 is feeling not confident at all in 10, feeling very confident?

Participant 1: Well, 10 is always everything but. I overestimated myself, which the first thing, the first interview ... that's because you ... your starting point is all the things you already know, and when you don't know ... writing a book or making music or 3D printing. It's new and you have to take time for it and you have to to a little bit of study but. I gave myself in the first interview 9, but that was for the the the parts I already know.

Researcher: Mm hmm.

Participant 1: I think it was 6 and now it's it's an 8 or 9 even so I see possibilities. I am enthusiastic.

Researcher: OK. Mm hmm.

Participant 1: About it, so I want to. Yeah, I want to learn more about it and I want to know more about it, so yeah.

Researcher: OK. Do you feel like disabled design Quest website contributed to this change?

Participant 1: Oh yeah. Yeah, a lot. A lot. Besides that it wasn't ... in my ... in my in my view. To explore things or it's not in my path and this opened a whole new world for me in 3D printing and I even brought it up at my work, so I'm telling about it because I'm enthusiastic.

Researcher: Mm hmm.

Participant 1: About it. So yeah, it was very, very nice.

Researcher: OK, great. So do you think if in the future you are ever frustrated with the design of a product you think you would be able to make changes to it?

Participant 1: Yeah, yeah. Now you see possibilities. Instead of only taking a saw or a hammer to to fix it now ... now you see from, OK, it's it's not fine ... it's not fine for me. But I can adapt it to my needs. There are possibilities and that I wasn't aware of about it.

Researcher: OK. So would you use 3D printing to make these changes?

Participant 1: Again?

Researcher: So if you were to make changes to these products, would you use 3D printing possibly?

Participant 1: Yeah, possibly. Yeah, I. Well, not to the the object that's already here, the physical object, the gummy bear. But, well, I'll see all kinds of other possibilities, so yeah.

Researcher: OK, so what's the website accessible to you?

Participant 1: Yeah. Yeah, it was a good, accessible. The only thing I struggled with is some languages. Well, I wrote wrote it down in the diary/journal.

Researcher: Mm hmm.

Participant 1: From the the right click, but that's maybe because I have a company computer that's ... how do you say? "Beveiligd" [said in Dutch]

Researcher: Secured.

Participant 1: Secured, yeah, so I can't access several websites.

Researcher: OK.

Participant 1: So yeah. It's limited. Yeah. So maybe there is ... was a was an issue, but the the, the the text the the links in it. Yeah, it's very nice.

Researcher: OK, sounds good.

Participant 1: It has. It has a good structure from simple basic to more to the point.

Researcher: Yeah. OK. And did this impact your experience?

Participant 1: Yeah, that's for me ... to dive in it. It it made me enthusiastic, because you're reading, but then you have to practise what you read. And then you see possibilities and you have to read back from everything is new, so we have to do new stage stages. But at the end, yeah, we we come to a nice to a nice product. And that was a very good line in it.

Researcher: OK. So if you could, would you like to you continue using this website?

Participant 1: Yeah, yeah sure. And I will recommend it to some people other people as well.

Researcher: The website or 3D printing?

Participant 1: Yeah. I would recommend to the the website from hey 3D printing is is an option is a possibility is ...

Researcher: Yeah. OK.

Participant 1: Maybe it it interests you and well, there and there you can find your basic skills and so on.

Researcher: OK. What parts of the website did you feel like were helpful?

Participant 1: Especially the the first part and the some links to YouTube to see from OK, it's in ceramic in metal and I know it's not all for the the home part, but there are possibilities. And for the home part, you have different materials, different colours, so. Yeah, that that was very nice. But you

see ... you you start easy. So we have to read it. Then you think from OK. OK, well, let's ... it's tempting to read on.

Researcher: OK. Yeah. Yeah. Nice. And did you also find parts that were less helpful or not helpful?

Participant 1: Mmm no, but I look to the other courses.

Researcher: Mm hmm.

Participant 1: Two was OK, but three was well, you you have to take time for it and you have to do do more in it and that's not the website, it's more from your skills and maybe and maybe my age, that's that's a possibility as well for. Well, yeah, you have to try things.

Researcher: Yep.

Participant 1: And before you know, you know, what is it? The first time everything is new and and well, sometimes difficult but you see possibilities and you have to continue and then you see you make another step.

Researcher: OK. Do you have any recommendations on any changes that should be made to this website?

Participant 1: Yeah, well, I wrote them in the diary journal.

Researcher: OK.

Participant 1: And there are some long sentences. And the variety of text and pictures can be more defined so you you can yeah, it's harder to read. Otherwise you read a whole part and then you see some pictures and when you. "afwisselen" [said in Dutch] Change ... make selections in it, then you. Well, you read and then you you go to the picture and then you recognise it. What you read and then you read again and then, yeah, it's a little bit friendlier. Or maybe using columns?

Researcher: Yeah.

Participant 1: Yeah, that's a possibility, yeah.

Researcher: OK.

Participant 1: When the the menu bar.

Researcher: Yeah, yeah, I read that. Yeah.

Participant 1: At the top, yeah. When you put that on hold and then you Scroll down.

Researcher: Yeah, unfortunately unfortunately that wasn't possible within this prototype. But yeah, for when it's an actual website that is public, then that's something that could be incorporated indeed.

Participant 1: OK. Yeah, that's yeah. OK.

Researcher: OK. So you already said you would recommend it to other people. So I take it you enjoy it the time using it?

Participant 1: Very, very much, yeah.

Researcher: OK, that's good. Were there any specific parts that you enjoyed?

Participant 1: Well, I'm yeah, "leergierig" [said in Dutch] so I want always.



Researcher: Like to learn?

Participant 1: Like to learn new things. And. Yeah, we have a a project on work about circular circular economy.

Researcher: Mm hmm.

Participant 1: And we have repair cafes.

Researcher: Yeah.

Participant 1: And I suggest that one. Well, maybe it's it's something to put there. But you have to need someone, a younger person. To operate it the system, but.

Researcher: Mm hmm.

Participant 1: That's maybe a nice connection to put a younger ... now it's always older people there in a repair cafe and and that's maybe tempting for younger people to connect with it and make some adjustments for people that are needed and then they see all the possibilities in that. So maybe it's a it's a nice connection.

Researcher: OK, nice. So are you planning to 3D print anything or redesign something or hack something in the future?

Participant 1: Uhh yeah, I was looking for. Yeah, a "lendensteun" [said in Dutch, translated in English to lumbar support] in the in the car? Yeah.

Researcher: Lower back support?

Participant 1: Yeah, yeah. To to to look at that, because the chair is is fine, but I haven't an adjustable. back support in it in the car so maybe I thought from now I take sometimes a towel or something and in your back. And when you have a long drive. And maybe I can find something like that. To put on the chair and support my back.

Researcher: Nice. So that's all the questions I had. The only thing left is, is there anything that I didn't discuss with you that you would like to talk about?

Participant 1: No, I will ... thank you very much for the opportunity.

Researcher: OK.

Participant 1: It was, yeah, very nice experience and I learnt a lot and I see more possibilities. And. I'm telling other people about it, so yeah. Very, very nice. So thank you again.

Researcher: OK. Yeah, well, I want to thank you for your participation and I'm really glad that you're enthusiastic about it. Now your part in this research is over and I will process this interview into a transcript and then analyse this and then anonymously it will be put in my report.

Participant 1: Mm hmm.

Researcher: And in possibly in my presentation.

Participant 1: OK.

Researcher: So. If you don't have any more questions, then. We're finished.

Participant 1: Oh, yeah, yeah. Well, I'm curious about the end result of your study.

Researcher: Yeah. OK.

Participant 1: So is there a possibility to to share that at the end?

Researcher: Yes, yes, I will. I will share the thesis with you.

Participant 1: OK. OK. Well, thank you very much in advance.

Researcher: OK. Yeah. Thank you very much.

Participant 1: OK, bye.

Researcher: OK. Bye.

### Transcript interview 2 participant 2

Greeting, opening, and getting permission to record happened before the recording was started.

Researcher: Let's get started.

Participant 2: OK, OK.

Researcher: What was your overall experience over the last weeks with the website Disabled Design Quest?

Participant 2: I felt intrigued and enthusiastic and also sometimes frustrated, but then very happy. I managed to find something and and yeah, receiving the result that was very nice to see. So thank you.

Researcher: OK. So. How confident do you feel about your creative capabilities?

Participant 2: Yeah, especially at the field of 3D printing, I feel more confident. I thought it was way out of my reach and now I see oh, when you, see other solutions you can... they share all the information and you can use that. And that's very interesting.

Researcher: OK. And if you have to rate your confidence of your creative capabilities on a scale from 1 to 10 where one is not confident at all and 10 is very confident.

Participant 2: I think now the 8,5.

Researcher: And can you explain why that number?

Participant 2: Now I see that, oh, sometimes I need a little bit of help and when I ask help and find help, I can do... I can do the thing. So that's giving me more confidence. So with the the helpdesk and. Trying, trying again and then I think everything new for the first time is hard and then when you. Yeah, do it more often. I trust that it will be easier. Yeah.

Researcher: OK. And do you feel like using Disabled Design Quest has played a role in this increase?

Participant 2: Oh yeah, it's it opened a door for me... it just, I thought it was out of my league and and now, while getting the the opportunity to to try it and not "break anything" at the same time. Yeah, that's the the the bump in the road is getting smaller.

Researcher: OK. So do you feel like if you were to be frustrated with the design of a product in the future, do you think that you could come up with a solution for it?

Participant 2: Yeah, I I think I will. Maybe at first be frustrated, but now I have the opportunity to change it and that feels good. So then I can find, or ... I think I will look for another solution so I know

now that it isn't that one, but it can be changed and maybe someone else already changed it and I can use that, so I wouldn't have thought about that earlier.

Researcher: Yeah. OK. So how would you approach this in the future? So looking at others is what I hear you say.

Participant 2: I I think I would use the website again and then look up the the links it provided and... then just yeah, use a filter and sort the solutions and it may be even ask help on the platform, I saw that was a possibility too, so when I can't find the thing I want I think I would ask for someone to design something for me and then print it for me, yeah.

Researcher: Yeah. OK. What's the website accessible to you?

Participant 2: I already told you in the asking forms, that I found the text, the the sentence is too long. So for me I I have to read the whole screen and I find it easier to read in blocks. So maybe in in one or two columns. That would be easier for me to read and maybe a bigger, font, yeah. And the sentences were too long that in. I mean, when I read it, I I I would think, oh here you have to put a point and then taking a breath and then read further also. That's why I said well I I got it, took my breath away because it yeah for reading in my head, it was yeah, too long but. That can be fixed, but yeah, the the the information given was very useful for me.

Researcher: And do you think this impacted your experience?

Participant 2: Maybe it took me some longer to understand what you were saying, so I had to read it a couple of times. Before I understood what you were asking or or telling me, yeah.

Researcher: OK, so if you could, would you keep using the website?

Participant 2: Yes, because I I got very enthusiastic about it and. As I say. You opened the door for me, so I would like to explore more.

Researcher: OK. So do you think that using this website further would increase your confidence in your creative capabilities even further?

Participant 2: Yes, I I guess so because now I I I I looked at it a quite a short while and. I'm eager to find out more, find out more. Yeah.

Researcher: OK. So what parts of the website did you feel like were helpful to you?

Participant 2: At first the the films the the YouTube links so, understanding what 3D printing really means. I knew some things, but yeah, there were so many possibilities, so I was amazed by it. And then, the the platform itself. So with the the links to other websites with the ready made solution. There were so many so. Yeah, that so that there are, so many things already 3D printed. Yeah, that I found that helpful. So yeah.

Researcher: Also, parts that you found less helpful or not helpful at all.

Participant 2: Hmm, I don't know, no, no is also an answer.

Researcher: Yes. So do you have any recommendations on what changes need to be made to improve it so besides the ones that you've already mentioned?

Participant 2: No, no, no.

Researcher: OK. So. Would you recommend this to other people with disabilities?

Participant 2: Yeah, for sure.

Researcher: OK. And can you explain this?

Participant 2: Well, I I've I always say it's very important for people to feel independent. And when you already are in special need, it is very nice to be able to, think about your own solutions. Other people it's good that there are some solutions, but it must give me a great feeling of being independent and I think that's important and that's that you ... you know best what works best for you. So that's perfect. That, that, that it's possible to change designs or to think, yeah, to, to design your own.

Researcher: OK. Did you enjoy the last well, I think a little more than a week.

Participant 2: Yeah, yeah, I I already told you, I hate working on a laptop and or... yeah, being on a computer while the the software doesn't work right and the the settings aren't right and that's oh, that's giving me ... a little frustrating, but now seeing the result of, yeah, just picking a nice solution and yeah, having it printed and then we're receiving it. Yeah, that gives a lot of joy. So yeah, that's that's given me, the faith of using it again and then OK, I have to do this on the computer, but yeah, the result is very nice. So Yeah.

Researcher: Mm hmm. OK. So are you planning to 3D print or hack anything or make anything after this?

Participant 2: Yes, yes, because. I I already was thinking about the solution for my keys and then the lock and keys and I would really print something like symbols on locks and have the matching symbols on my keys. Just for being ready for future. So when I when I lose my eyesight and I hope it will take a long time. But then now I know, oh, I I won't be dependent on everything so. Now is the time having yeah making these solutions and on the other hand maybe help my father having trouble with finding the right keys for a lot of things. Yeah, I I think I can help him with that and maybe just with colours or or something, but yeah. And I think it will be, yeah make life easier. So on the other hand, and, oh, the the toothbrush solution, I want that too. And there are, oh, I can think about more things that it can be very useful to 3D print, some bespoke solutions for me, yeah.

Researcher: OK. Well then I have one final question and that is, is there anything we didn't talk about that you would like to talk about?

Participant 2: Oh, I think a lot, but. No, I. No, I I'm very proud of you doing this because I I think it will help a lot of people. So I want to congratulate you with your website and I think it's a great idea to do to make ... an yeah... And also... How do you say that? And then a shared platform for people. And and I I think you have to shout it out that there is so much more possible in, yeah really the the bespoke solutions for people and yeah, I think a lot of people will be helped, yeah.

Researcher: Thank you.

Participant 2: So good job.

Researcher: OK. Well, thank you for participating in this interview. So after this, I will take this recording and then I will transcribe it so I will write it out. Then I will analyse this transcription and it will be used anonymously in my thesis, my report. So yeah. That is your contribution ending here.

Participant 2: You're very welcome.

Researcher: Thank you very much.

Participant 2: Very welcome. And I was. Yeah, I I liked it to join.

Researcher: OK, that's great. OK. Well then.

Participant 2: Good luck with your thesis.

Researcher: Yeah.

Participant 2: OK. Bye bye.

Researcher: Bye.

#### Transcript interview 2 participant 4

Researcher: What was your overall experience over the last few weeks with Disabled Design Quest?

Participant 4: Well it was a lot to take in, but it made me smile, because I thought it was interesting. I couldn't always image how I would use such things, such tools, or how I would make use of these opportunities. But all and all it was fun to learn more about it.

Researcher: OK, and how do you feel about the object you had printed?

Participant 4: Well it broke, so I cannot use it.

Researcher: Yes, that is unfortunate.

Participant 4: But we discussed having a new one printed so let's see how that one goes.

Researcher: Yes, we'll do that. So do you feel like you are more confident in your creative capabilities than before using DDQ?

Participant 4: Related to this specific subject?

Researcher: No more in general.

Participant 4: Oh, uhm a little bit, but I feel like I need more practice. For example take me to a 3D printer and let's do it and then see what goes wrong and I will learn from that.

Researcher: OK, so if you had to rate your confidence of your creative capabilities on a scale from 1 to 10, where 1 is not confident at all and 10 is very confident?

Participant 4: I guess a 7,5 because I still need more practice, but I'm already very good at sharing my enthusiasm about 3D printing. The only thing that I would love to see is that 3D printing would become more sustainable, because now it's mostly created from materials made out of oil, which I as a person do not like so much. So that is something I would like to address to see if we can come up with a material that is more sustainable.

Researcher: Yes, I did write a little bit about it in the material section I think, they are not as much available, but they are making some that are based on plant materials so at least they are ...

Participant 4: Biodegradable

Researcher: Yeah, so that's a little bit better.

Participant 4: Yeah, but it would be so nice to see them come up with something that is truly sustainable

Researcher: Mm hmm

Participant 4: That is made out of, whatever, recycled ... The materials are mostly recyclable, right?

Researcher: Yeah, because they are single type of plastic they are recyclable, but usually not in our current waste management system, because that is based on packaging plastic.

Participant 4: Yeah.

Researcher: Yeah I also feel conflicted about it, because there is also waste, which some people try to recycle.

Participant 4: Yeah that's also the case with the 3D pens, but I think it is important to talk about that.

Researcher: Yeah certainly, so do you think that if you were to be frustrated with the design of a product in the future that you would be able to redesign/adapt it?

Participant 4: Yeah, if I had loads of time and energy to do so, yeah. I think it's fun to see if you can ... using a design tool to be creative and to figure out and to explore what works or not.

Researcher: OK, and do you think you would use 3D printing to do that?

Participant 4: If we were able to use materials that are more sustainable, yes, I would.

Researcher: OK, was the website accessible to you?

Participant 4: Yes it was.

Researcher: OK, great, if you could would you continue to use disabled design quest?

Participant 4: Yes.

Researcher: OK, and why?

Participant 4: Because it is a very accessible way to learn about 3D printing and exploring the possibilities and getting used to ... what's needed to create a 3D design and to provide ... to provide input on more accessible equipment.

Researcher: Mm hmm. Do you think that using DDQ further would increase your confidence in your creative capabilities further.

Participant 4: Yes, like I said earlier, you have to practice and practice. But it is fun to do.

Researcher: What parts of DDQ did you like or feel like were helpful?

Participant 4: For me, it's the example projects, because then it kind of forms your ideas into practical stuff.

Researcher: Did you also find parts not so helpful or not good?

Participant 4: Well, as I said it was a little bit information dense, that could be improved by using a slightly different lay-out or something.

Researcher: Do you have any recommendations on what could be improved? Other than the ones you've already mentioned?

Participant 4: No I don't think so.

Researcher: OK, would you recommend DDQ to other disabled people?

Participant 4: Yes, it makes you sort of ... having control over something that you need or want to be changed and then you don't have to be waiting ... waiting for other people to do something, you can take the initiative and then you can be like "you seem to know an awful lot about this, can you make this idea come to life please?"

Researcher: OK, and did you enjoy the last few weeks?

Participant 4: Yes I enjoyed learning and I would like to learn even more.

Researcher: OK, so are you planning to 3D print or hack or make anything in the future?

Participant 4: I think I would be hacking, because I feel like hey I can adapt something that will then be more suitable for me or others I knew. It's more like not creating new things, but hacking existing equipment that can improved for a range of disabled people.

Researcher: Yeah, OK that's the end of my questions, is there anything we didn't talk about that you would like to talk about?

Participant 4: No not really.

Researcher: Okay, then we're done, now I will analyse this interview and use this in my report and possibly my presentation, would you like to read my report?

Participant 4: Yes that would be nice.

Researcher: OK, then we are done.

Participant 4: OK, bye!

Researcher: Bye!

## Transcript interview 2 participant 5

**Date: 19-11-2024**

Greeting, opening, and getting permission to record happened before the recording was started.

Researcher: Are you ready?

Participant 5: Yes

Researcher: OK. Then let's get started. What was your overall experience over the last weeks like with the website Disabled Design Quest?

Participant 5: Yeah mostly that it was a bit of a search sometimes, I would see the links and then later I had to remember where they were and had to search for a bit. But I think for the most part I learned a lot about the possibilities of 3D printing, especially by watching the video's.

Researcher: So I saw the photo you attached to your last diary, how do you feel about your print?

Participant 5: Yeah I'm quite happy with it, it's nicely hanging in my kitchen now, I tried it out already. And I was looking at maybe wanting a wider handle to it, like I have with my adapted cutlery, but then when using it I realized that that wouldn't be convenient because now it's nice and small and it works just fine like this and I can hold onto the can and hold the tool onto the can with my pointer finger and this keeps the lip of the can out of the way while drinking which makes it a little easier to drink.

Researcher: Ah yeah, OK. Do you feel like your confidence in your creative capabilities has changed since the start of using the website?



Participant 5: It's a bit hard to say, I feel like I haven't really had enough experience with 3D printing to really know for sure, but I do think that it has changed something in my thinking, that I don't always have to buy something, but that I can also come up with my own ideas in my head and then the possibility of having that printed, so yeah I guess it did improve a bit.

Researcher: So if you have to give a grade on a scale from 1-10 on how much trust in yourself do you feel in being creative? 1 is no trust at all, 10 is a lot of trust.

Participant 5: Oh, that's always difficult, I think I would give myself around a 6?

Researcher: OK, do you feel like the website contributed to this?

Participant 5: Oh yes, otherwise I wouldn't have known about it.

Researcher: Mm hmm, so do you feel like in the future if you were frustrated with a product that you could change it?

Participant 5: Yes I think so.

Researcher: And how would you approach this?

Participant 5: Well then I would start designing it in my head and start thinking of how I would want it to be and then I would ask someone I know if that was possible for them to 3D print it for me.

Researcher: Was the website accessible to you?

Participant 5: Yes, I think there could have been more of a division into categories, so like assistive technology, for physical disabilities, kitchen products etc.

Researcher: So like for the projects that people have done that are on the website?

Participant 5: Yeah, like more divided into categories.

Researcher: Yeah so it would be searchable.

Participant 5: Yeah so you can click like kitchen tools

Researcher: So like filters?

Participant 5: Yeah.

Researcher: Yeah, great idea. If you could, would you like to keep using the website?

Participant 5: Yeah if there were new projects added, then I would occasionally when I'm trying to come up with a solution for something then I would think to have a look on the website to see if other people have come up with things, or to get inspiration.

Researcher: OK, do you think this use would increase your trust in yourself and your creative capabilities further?

Participant 5: I'm not sure, maybe.

Researcher: OK, what parts of the website did you feel like were helpful?

Participant 5: The links, the video's and the projects that were shared and that you would see what was possible and how other people did it, to learn from them.

Researcher: Where there parts that were not so helpful?

Participant 5: No not really, although I didn't do the parts with the software

Researcher: The bambu studio?

Participant 5: Yeah, that was too complicated, so I chose one of the projects that were on the site which had all the details already, then I just had to choose a color.

Researcher: OK, would you recommend DDQ to other disabled people?

Participant 5: Yeah, if they would have some issues then I would say you should have a look on that website, and get some inspiration, or when it would come up in a conversation then that they are struggling with something and they wished there was something for it, like an assistive tool, then I would definitely recommend it and say they should have a look.

Researcher: Okay sounds good, did you enjoy the last 2 weeks?

Participant 5: Well I didn't print anything myself, but yeah I enjoyed delving into it, you can learn something from everything you do.

Researcher: So in the future are you planning to 3D print hack or make anything else?

Participant 5: Yeah if I would have ideas about it, definitely.

Researcher: Well, then I only want to ask you if there was anything that we didn't talk about that you would want to talk about?

Participant 5: Oh, not really, no.

Researcher: Okay, then we are finished, I'm now going to write out this interview in a transcript and then use it anonymously in my report and my presentation. Would you be interested in reading this report? It is in English.

Participant 5: I'll try, but I think it is a bit too difficult, but I'll be at your presentation.

Researcher: Okay sounds good, then we're done, thank you for participating!

Participant 5: Okay, thank you for the opportunity, bye!

Researcher: Bye!

## Appendix Q

### Theme 1: Community

Participant relate learning from others and getting inspiration to creativity. They also mention DDQ as giving the opportunity to get and into the 3D printing community, to see what others are doing and learn from others and in turn being able to start sharing about their own experience and what they have learned. For some participants seeing other people adapting or hacking gave them more confidence to be able to do it for themselves.

*Yeah where how do other people, experience it, solve problems and then. I just do it and try it and try it again so you can overcome. [¶ 44 in Transcript interview: 1 participant: 1](#)*

*Where I can? Yeah. See what's possibilities? Sort of kind of database. For possibilities from people that already. Have found some solutions for it. And see if something's fits for me. Or yeah, maybe I can make some adapt ... and some.... Designs. Suitable for me for my. Yeah, process not. My issue. [¶ 98 – 100 in Transcript interview: 1 participant: 1](#)*

*After I saw all the examples of solutions people share on the different platforms it gives hope that I can really design a bespoke solution by myself [¶ 89 in Diary participant: 2](#)*

*I learned that there are already a lot of solutions that people share. That is nice to know [¶ 75 in Diary participant: 2](#)*

*For me, it's the example projects, because then it kind of forms you ideas into practical stuff. [¶ 38 in Transcript interview: 2 participant: 4](#)*

*Yes, I got inspired by the examples the website showed. Scrolling through all the examples of possibilities I got my own ideas of changing or adapting designs [¶ 157 – 160 in Diary participant: 2](#)*

*The links, the video's and the projects that were shared and that you would see what was possible and how other people did it, to learn from them. [¶ 31 in Transcript interview: 2 participant: 5](#)*

*It was, yeah, very nice experience and I learnt a lot and I see more possibilities. And. I'm telling other people about it, so yeah. [¶ 86 in Transcript interview: 2 participant: 1](#)*

*Well, I think it's trust in myself and trust from others so. I really like to to be. Receive feedback on things I do, I say, or I think about it so I can talk about it and what I need is some kind of openness to to ... exchange views and ideas to gain that trust and to build confidence. [¶ 24 – 25 in Transcript interview: 1 participant: 4](#)*

*Getting a message across or or debating or something like that. [¶ 51 in Transcript interview: 1 participant: 4](#)*

*So that you can explain and talk about it with other people [¶ 20 in Transcript interview: 1 participant: 5](#)*

*Yeah, if they would have some issues then I would say you should have a look on that website, and get some inspiration, or when it would come up in a conversation then that they are struggling with something and they wished there was something for it, like an assistive tool, then I would definitely recommend it and say they should have a look. [¶ 37 in Transcript interview: 2 participant: 5](#)*

*So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to. Exchange views again to to this to to debate, to, to discussions, to whatever it is so to me ... creativity is, is, is, is very much based on on language and languages. [¶ 27 – 29 in Transcript interview: 1 participant: 4](#)*

*Yeah if there where new projects added, then I would occasionally when I'm trying to come up with a solution for something then I would think to have a look on the website to see if other people have come up with things, or to get inspiration. [¶ 27 in Transcript interview: 2 participant: 5](#)*

Participants also mention the need to be offered support from others, as well as being able to accept support as essential in them feeling confident.

*Maybe support? So that when I I don't know how for example a new. Software thing. I don't like being working with computers anymore because I've done that. I feel like all my life and. I want things to work so. Especially with software, sometimes it needs an update and then things change and then I feel insecure because I don't know how to solve it [¶ 16 in Transcript interview: 1 participant: 2](#)*

*The will of asking help and or being able to learn something* [¶ 30 in Transcript interview: 1 participant: 2](#)

*And I have a very hard time, a very hard time asking for help. So I think what I need to be confident is that. People kind of see me and and see what you need instead of me having to ask for help all the time or, like, have to communicate it all the time. And I it makes me more confident. I think if people just see what I need and are like, I'm going to do this right now.* [¶ 10 in Transcript interview: 1 participant: 3](#)

*I needed more support starting the new programme.* [¶ 81 in Diary participant: 2](#)

*I kept reading the info and asked for help.* [¶ 83 in Diary participant: 2](#)

*Now I see that, oh, sometimes I need a little bit of help and when I ask help and find help, I can do... I can do the thing. So that's giving me more confidence. So with the the helpdesk and. Trying, trying again and then I think everything new for the first time is hard and then when you. Yeah, do it more often. I trust that it will be easier. Yeah.* [¶ 11 in Transcript interview: 2 participant: 2](#)

*I asked for help. I think a helpdesk is handy. I know that I come further with a little help* [8:52 ¶ 146 – 148 in Diary participant: 2](#)

*Good, I asked for some help to find the model I needed, but then we found a great product.* [10:20 ¶ 62 in Diary participant: 4](#)

*I I think I would use the website again and then look up the the links it provided and... then just yeah, use a filter and sort the solutions and it may be even ask help on the platform, I saw that was a possibility too, so when I can't find the thing I want I think I would ask for someone to design something for me and then print it for me, yeah.* [¶ 17 in Transcript interview: 2 participant: 2](#)

## Theme 2: Problem solving

Participants described acts of problem solving as being part of creativity and when working with the DDQ program when running into issues or displayed problem-solving while thinking about products that frustrate them.

*you go backwards to see from OK, what's what do I need to make it happen? What ... what are the limitations in the in the process but the ... the first step is to think from, well, what what do you want? What do you need? What? What? What's Necessary instead of what is possible.* [¶ 26 in Transcript interview: 1 participant: 1](#)

*To look again on the problem and. See what? What else of possibilities we can. Make here.* [¶ 36 in Transcript interview: 1 participant: 1](#)

*And I can solve things, but then. I usually ask people to make things for me. Having the solution, but then at the same time I feel frustrated when the other one, in this case my husband* [¶ 34 in Transcript interview: 1 participant: 2](#)

*When there are problems in our House and my husband isn't around. Then I can be creative. Having for example, we used to have little light bulbs in the. Ceiling and. They fell down and I thought, well, let's take an post elastic rubber band and I put it around it and I put the light back and it helped. So I found that very creative of me. Having that solution, and maybe it wasn't perfect, but it worked* [¶ 38 in Transcript interview: 1 participant: 2](#)

*And I so I study math, mathematics and mathematics is also very it doesn't sound very creative, but you have to be very creative to come up with solutions. So I think that's also.* [¶ 18 in Transcript interview: 1 participant: 3](#)

*I think that would feel pretty cool. Like I have this problem and I'm gonna fix it myself.* [¶ 68 in Transcript interview: 1 participant: 3](#)

*Yeah. Yeah. Well, I do miss the physical buttons. Right. So now. Yeah, now they are sliders and still touch touch screen sliders, but sliders is slightly harder to accidentally push on.* [¶ 87 in Transcript interview: 1 participant: 4](#)

*I was. I was. I was. Yeah. Well. Not not that frustrated. I always figure out how to use a thing. How how to use such a product or such a tool in a way that it works but but still? That can be done. That that can be done in many. In many different ways that are better than they are now, so I'm I'm I'm desperately looking for the one thing.* [¶ 55 – 57 in Transcript interview: 1 participant: 4](#)

*but creativity is also that you yourself come up with things to make and being creative in coming up with solutions.* [¶ 22 in Transcript interview: 1 participant: 5](#)

*Creativity I think is sometimes coming up with a creative solution with limited means,* [¶ 22 in Transcript interview: 1 participant: 5](#)

Because I'm like if you just seal it or you pour some glue in there, it should be good because no water can get in there anymore.  
[¶ 38 in Transcript interview: 1 participant: 5](#)

I have a translation app on my phone and was able to follow everything well. [¶ 22 in Diary participant: 1](#)

I think because of sharing all the information, the examples, the youtube films and the websites, all the possibilities. It awakens a feeling of be able to be independent and being creative. To think about solutions instead of being annoyed about bad design  
[¶ 93 in Diary participant: 2](#)

I regularly used google translate camera on my phone to use the website [¶ 22 in Diary participant: 5](#)

Good, it was ... I was always ... I was ... trying looking for a a solution and I thought something like ... a key ring? Yeah. But that's under the dashboard, so I won't see it. So I was looking for something above the the dashboard but. Well, the only thing you see is. A gummy bear one centimetre big or you have a fluffy bear that's well, that's not going to stay ... clean. So this was very nice that I thought one. Yeah, did this exactly what I am ... what I'm looking for and I put it on the dashboard and it's not irritating. It's nice to see, nice to look at, but it's not distracting when you're driving, so it's it's there and it's a reminder, but it's not .. an issue or not an obstacle when you're driving so you don't have to remove it, you can ... let it be where it's what stands, and then it's suits its purpose. [¶ 10 in Transcript interview: 2 participant: 1](#)

### Theme 3: Creating & expressing inner world

Participants relate creativity to creating things and expressing their inner world, and participants describe creating objects or stories, as well as participating in arts and crafts activities.

*little bit in drawing. Painting. Sculpting wood and stone.* [¶ 28 in Transcript interview: 1 participant: 1](#)

*Building a camper van* [¶ 28 in Transcript interview: 1 participant: 1](#)

*well I I I like to work with ceramics* [¶ 38 in Transcript interview: 1 participant: 2](#)

*I just bought some crochet books. I used to do that when I was a small girl with my grandma, so I have nice memories doing crochet, but now lacking time.* [¶ 40 in Transcript interview: 1 participant: 2](#)

*I am a pretty confident person like I am a very active in theatre* [¶ 6 in Transcript interview: 1 participant: 3](#)

*Creativity in like the sense of creating things* [¶ 14 in Transcript interview: 1 participant: 3](#)

*I think making art is very creative, so any type of art so like actually making things with your hands or. Drawing and even drawing digitally, stuff like that, but also. Dance or singing or so theatre.* [¶ 16 in Transcript interview: 1 participant: 3](#)

*So I do theatre, which I think is very creative, although I do do scripts, theatre show a lot less creative than making your own and I am in. I am the lead singer in advance and we write our own songs which I think is pretty creative and I used to draw a lot, but I don't have the inspiration for it anymore that much.* [¶ 22 in Transcript interview: 1 participant: 3](#)

*so I play also play guitar* [¶ 34 in Transcript interview: 1 participant: 3](#)

*And I'm writing a well. I I started writing an novel as many, many people say they do. But I really did. And so, so, so. Yeah. And that's quite a creative creative thing. I wrote blog posts on on my. My experiences as a person with a physical disability and I try to put some humour in it* [¶ 35 in Transcript interview: 1 participant: 4](#)

*Recently I tried to. [laughing] It wasn't this success, but I tried it. I tried to create. jewellery, that's but you know what I mean? Like like, like earrings and rings. And they did it made out of. Resin [mispronounced], do you call it in English? I don't know. It's Resin [mispronounced]. I guess it's the. It's a kind of fluid. Resin, yeah it's resin. Yeah. So that's very creative. I think it's very creative. So I tried to do a little bit different colours and different. Types of. Decorations like plants or flowers or. All these kinds of. So I was being quite creative. I did it.* [¶ 41 – 45 in Transcript interview: 1 participant: 4](#)

*Yes, my writing not only my writing, my writing, my writing, writing in in general is an act of creativity. To me. Sometimes it's not so creative, but still, in the end it's an act of creativity. And on the other hand, I can see other things like like painting or or crafting or something like that as creativity or. Creativity to me as well is is like like come up with stories storytelling. Not only did the professional storytelling thing, but also your imaginary world and and trying to express your. Your inner world and it's creativity to me as well.* [¶ 31 – 33 in Transcript interview: 1 participant: 4](#)

Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to. [¶ 27 in Transcript interview: 1 participant: 4](#)

So so yeah, that was kind of creative. So. And I'm not the one who was was drawing or making art or something like that because I'm I. Well, you don't want me to to make a drawing or something, because that's not my talent at all. So so [laughing]. [¶ 35 – 37 in Transcript interview: 1 participant: 4](#)

I really feel that this is a thing I am capable of doing so. In general, if if we sort of limit creativity to to writing and playing with words and everything that that has to do with. [¶ 51 in Transcript interview: 1 participant: 4](#)

But creativity is, I think, also designing or imagining things to make, for example from a toilet paper roll making a children's craft project, creativity can be in many fields. [¶ 24 in Transcript interview: 1 participant: 5](#)

Yeah I've just made a snuffle mat for my future dog, and then I had some fabric left over and made a rope for the dog, so that's more the making. [¶ 26 in Transcript interview: 1 participant: 5](#)

And then I'm also creative with kids, telling them stories, creativity can also be telling stories, and thinking up these stories. [¶ 26 in Transcript interview: 1 participant: 5](#)

I have experienced that it also allows me to handle 3D printing well. [¶ 105 in Diary participant: 1](#)

Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities. [¶ 12 in Transcript interview: 2 participant: 1](#)

## Theme 4: imaginativeness & creative thinking

Participants describe being creative by thinking creatively or imaging new or out-of-the box ideas.

thinking out-of-the-box, think in what is possible and not in limitations. But you also need an open mind for it. [¶ 22 in Transcript interview: 1 participant: 1](#)

I always give my colleagues. Another perspective. [¶ 36 in Transcript interview: 1 participant: 1](#)

You start with something when you actually do it, you see much more possibilities instead of only the thinking process. [¶ 46 in Transcript interview: 1 participant: 1](#)

Thinking in solutions, not always be able to make it yourself but, I think in your mind, have the ... It's a kind of thinking. Yeah, when you're open. To new things or new possibilities, that's a part of being creative, I guess. [¶ 22 in Transcript interview: 1 participant: 2](#)

I think the thinking is more important so. You you think you can't do it? But maybe you can with help, but if you and and wanting, I think that's the first step you you want something. You think you can't do it by yourself, so, but you you have you you need that. [¶ 28 – 30 in Transcript interview: 1 participant: 2](#)

coming up with new ideas. So yeah, coming up with new stuff that that hasn't maybe hasn't been before. Yeah, I think like that. [¶ 14 in Transcript interview: 1 participant: 3](#)

Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to. [¶ 27 in Transcript interview: 1 participant: 4](#)

And then I'm also creative with kids, telling them stories, creativity can also be telling stories, and thinking up these stories. [¶ 26 in Transcript interview: 1 participant: 5](#)

Well then I would start designing it in my head and start thinking of how I would want it to be and then I would ask someone I know if that was possible for them to 3D print it for me. [¶ 17 in Transcript interview: 2 participant: 5](#)

It's a bit hard to say, I feel like I haven't really had enough experience with 3D printing to really know for sure, but I do think that it has changed something in my thinking, that I don't always have to buy something, but that I can also come up with my own ideas in my head and then the possibility of having that printed, so yeah I guess it did improve a bit. [¶ 9 in Transcript interview: 2 participant: 5](#)

## Theme 5: overwhelm

Participants describe being presented with the new information from DDQ and learning about 3D printing and getting to know all the options as overwhelming at times.

*For a first acquaintance, actually applying the information is a bit overwhelming.* [¶ 62 in Diary participant: 1](#)

*Find out how is all works is a bit overwhelming* [¶ 67 in Diary participant: 1](#)

*A bit overwhelming* [¶ 16 in Diary participant: 2](#)

*I feel happy that I learned that there are a lot of possibilities, quite overwhelming* [¶ 73 in Diary participant: 2](#)

*And overwhelming because there are so many so difficult to choose one* [¶ 75 in Diary participant: 2](#)

*...It is a lot. I now know that you need all the information. And everybody needs something different so it is good to know that there are so many possibilities. You just have to choose what fits you. I would like to have a step by step instruction, really for dummies. I think I will get better in doing it after a lot of excersize* [¶ 103 in Diary participant: 2](#)

*when you lack focus (which I did) then it is very overwhelming* [¶ 20 in Diary participant: 4](#)

*It is a bit dense on the text part, a lot of times it is a lot of text, so maybe a more compact design with just some bullet points would work out slightly better, and maybe something that is a bit more clickable, when I want to know more about materials, then I can click here, instead of having it all on one webpage or on sites that are external so maybe you can incorporate some bits and pieces on the website and then creating deeplinks, not so much putting straightforward text.* [¶ 46 in Diary participant: 4](#)

*Yes, maybe it's even overcomplete sometimes. Stick to the core and then when you want to share additional information then that's fine but maybe link it or something. For a beginner like me, some basic, rather elemental information would do, and then the rest can be linked somehow.* [¶ 50 in Diary participant: 4](#)

*It was a lot of information to digest, so I was a bit like hey okay, and I read some stuff because to me 3D printing is brand new, I'm fully unknown of all the ins and outs of 3D printing. So it was a lot to take in.* [¶ 8 in Diary participant: 4](#)

*Yes it's helpful, but it's also a lot* [¶ 48 in Diary participant: 4](#)

*It's a lot* [¶ 42 in Diary participant: 5](#)

*Well it was a lot to take in* [¶ 2 in Transcript interview: 2 participant: 4](#)

## Theme 6: Agency

Participants describe the need to be independent and decide what to do and when to do it, as well as for some participants agency being essential to feeling confident.

*to do the things that I want to do* [¶ 10 in Transcript interview: 1 participant: 1](#)

*choose whatever I like* [¶ 16 in Transcript interview: 1 participant: 1](#)

*Now I know I want to be more independent* [¶ 16 in Transcript interview: 1 participant: 2](#)

*in this case my husband. Is not always. Or listening what I want. Or doesn't have the time right now and I want it now. So I have to wait so being. Dependent or that that's I find that difficult.* [¶ 34 in Transcript interview: 1 participant: 2](#)

*it, helps me feeling independent and I I realised that's very important for me because you know that a lot of things there are you will be. Yeah, depending on other people. And yeah, I find it very. Important being able to create the world around me instead of. Being dependent on solutions other people have thought of, because I'm a logic person and I'm an intelligent person, so I like to yeah, be able to. Adapt all those things for me so.* [¶ 72 – 74 in Transcript interview: 1 participant: 2](#)

*I now know that I can have a lot of influence on making a design fit my wishes* [¶ 37 – 40 in Diary participant: 1](#)

*I think because of sharing all the information, the examples, the youtube films and the websites, all the possibilities. It awakens a feeling of be able to be independent and beining creative. To think about solutions instead of being annoyed about bad design* [¶ 93 in Diary participant: 2](#)



*I got frustrated at first. Asked help from husband but he has no time and didn't know how to help. So a bit insecure but doing it old-school by hand....* [¶ 24 in Diary participant: 2](#)

*Congratulations to Anouk for her wonderful work! I find it great that she is helping people with special needs to be independent and not take average designs for granted* [¶ 184 in Diary participant: 2](#)

*and really a great addition to reducing some of the issues I have and this can also help get some independence back. Then I don't always need to ask my husband to open it for me.* [¶ 71 in Diary participant: 5](#)

*It was much easier to open the can, I didn't have to ask someone for help.* [¶ 128 in Diary participant: 5](#)

*Well, I've I always say it's very important for people to feel independent. And when you already are in special need, it is very nice to be able to, think about your own solutions. Other people it's good that there are some solutions, but it must give me a great feeling of being independent and I think that's important and that's that you ... you know best what works best for you. So that's perfect. That, that, that it's possible to change designs or to think, yeah, to, to design your own.* [¶ 35 in Transcript interview: 2 participant: 2](#)

*Yes, it makes you sort of ... having control over something that you need or want to be changed and then you don't have to be waiting ... waiting for other people to do something, you can take the initiative and then you can be like "you seem to know an awful lot about this, can you make this idea come to life please?"* [¶ 44 in Transcript interview: 2 participant: 4](#)

## Theme 7: feeling assured

Participants describe that confidence for them is all about feeling assured, being able to have trust, trust in themselves and a sense of self-esteem and trust from others.

*to feel sure in my environment* [¶ 10 in Transcript interview: 1 participant: 1](#)

*The things you you always, can do much more than you think. In first when.* [¶ 46 in Transcript interview: 1 participant: 1](#)

*I think I'm able to do something or tell something about? For example, my work or talking to people.* [¶ 4 in Transcript interview: 1 participant: 2](#)

*in yourself, like in being who you are and like just going out and showing the world yourself* [¶ 2 in Transcript interview: 1 participant: 3](#)

*Trust* [¶ 22 in Transcript interview: 1 participant: 4](#)

*I think it's trust in myself and trust from others so.* [¶ 24 in Transcript interview: 1 participant: 4](#)

*confidence to me is more like self-confidence* [¶ 6 in Transcript interview: 1 participant: 4](#)

*In our in our trust that. Things will turn out. OK. Or something. It's not very, very tangible, so it's it's quite hard to to find a proper definition about it.* [¶ 12 in Transcript interview: 1 participant: 4](#)

*I really feel that this is a thing I am capable of doing so. In general, if if we sort of limit creativity to to writing and playing with words and everything that that has to do with.* [¶ 51 in Transcript interview: 1 participant: 4](#)

*Trust in yourself that you can do something and a bit of self-esteem* [¶ 12 in Transcript interview: 1 participant: 5](#)

*Confidence? That you, from yourself, how do you say, confidence is kind of in everything you do you have this trust in yourself for what you stand for ... and not having to deal with a sort of fear about what you are saying. That you stand for yourself and what you say and what you do.* [¶ 4 – 6 in Transcript interview: 1 participant: 5](#)

*In the past with my work, yeah, with my work I really had this feeling of, this is what I stand for and that's the way it is.* [¶ 14 in Transcript interview: 1 participant: 5](#)

*Yes, otherwise I would not have the courage to find out how 3D printing works. By sharing information, the examples, the weblinks to readymade solutions, to printerpossibilities etc.* [¶ 153 – 156 in Diary participant: 2](#)

*I still haven't printed anything but, yeah I think that I would be confident in trying so, after reading all the materials and watching the videos, because it is very clearly and elaborately described, what you need to do and what the materials are and what you need to know in working with them* [¶ 26 in Diary participant: 4](#)

*It's funny because I've worked with these kinds of materials several weeks ago with using 3D pens. And then I was like "I'm not able to do this" I will just make a big mess, and then it's okay. But now compared with my experiences then, my experience now is much more like, this is the material, this is how I can use it, this is what I need to do, so yeah it helps. [¶ 34 in Diary participant: 4](#)*

*I feel a little bit more confident, I still don't know how to 3D print and I won't do that, but now I know that I can also have things printed by other people for me. [¶ 156 in Diary participant: 5](#)*

*Well, 10 is always everything but. I overestimated myself, which the first thing, the first interview ... that's because you ... your starting point is all the things you already know, and when you don't know ... writing a book or making music or 3D printing. It's new and you have to take time for it and you have to a little bit of study but. I gave myself in the first interview 9, but that was for the the the parts I already know. [¶ 14 in Transcript interview: 2 participant: 1](#)*

*Good, it was ... I was always ... I was ... trying looking for a a solution and I thought something like ... a key ring? Yeah. But that's under the dashboard, so I won't see it. So I was looking for something above the the dashboard but. Well, the only thing you see is. A gummy bear one centimetre big or you have a fluffy bear that's well, that's not going to stay ... clean. So this was very nice that I thought one. Yeah, did this exactly what I am ... what I'm looking for and I put it on the dashboard and it's not irritating. It's nice to see, nice to look at, but it's not distracting when you're driving, so it's it's there and it's a reminder, but it's not .. an issue or not an obstacle when you're driving so you don't have to remove it, you can ... let it be where it's what stands, and then it's suits its purpose. [¶ 10 in Transcript interview: 2 participant: 1](#)*

*Yeah, I I think I will. Maybe at first be frustrated, but now I have the opportunity to change it and that feels good. So then I can find, or ... I think I will look for another solution so I know now that it isn't that one, but it can be changed and maybe someone else already changed it and I can use that, so I wouldn't have thought about that earlier. [¶ 15 in Transcript interview: 2 participant: 2](#)*

*Yeah, especially at the field of 3D printing, I feel more confident. [¶ 7 in Transcript interview: 2 participant: 2](#)*

*I guess a 7,5 because I still need more practice, but I'm already very good at sharing my enthusiasm about 3D printing. The only thing that I would love to see is that 3D printing would become more sustainable, because now it's mostly created from materials made out of oil, which I as a person do not like so much. So that is something I would like to address to see if we can come up with a material that is more sustainable. [¶ 12 in Transcript interview: 2 participant: 4](#)*

*Oh, uhm a little bit, but I feel like I need more practice. For example take me to a 3D printer and let's do it and then see what goes wrong and I will learn from that. [¶ 10 in Transcript interview: 2 participant: 4](#)*

*It's a bit hard to say, I feel like I haven't really had enough experience with 3D printing to really know for sure, but I do think that it has changed something in my thinking, that I don't always have to buy something, but that I can also come up with my own ideas in my head and then the possibility of having that printed, so yeah I guess it did improve a bit. [¶ 9 in Transcript interview: 2 participant: 5](#)*

## Theme 8: ability & knowledge

Knowing what you know and what you can do, needing knowledge/ability to feel confident.

*With what I can do, and have no limitations in that [¶ 12 in Transcript interview: 1 participant: 1](#)*

*Yeah, there are always things that I can't do. I'm not good at ... In the in ... uh languages? Yeah. My wife is much better in in that. Thing so I have I have my limitations. [¶ 48 – 50 in Transcript interview: 1 participant: 1](#)*

*Yeah, you need a kind of skills [¶ 22 in Transcript interview: 1 participant: 1](#)*

*I think I'm able to do something or tell something about? [¶ 4 in Transcript interview: 1 participant: 2](#)*

*'Cause when I think. I am not able to do something then I feel insecure and that doesn't help doing the thing I want to do so. Yeah, I think that's that's it. So when I want to talk in public, I will feel anxious. And so I will probably not be the first to do so. Except when the subject is something I know a lot about [¶ 8 in Transcript interview: 1 participant: 2](#)*

*but I realised that I know more than my students [¶ 10 in Transcript interview: 1 participant: 2](#)*

*you can learn stuff you don't have to know everything, but when you already think things aren't possible, then you won't get any further. [¶ 22 in Transcript interview: 1 participant: 2](#)*

*knowing you're able to do things [¶ 4 in Transcript interview: 1 participant: 3](#)*

So you need to be able to do the things you want to right? [¶ 10 in Transcript interview: 1 participant: 3](#)

it's confidence in ... my abilities and my capabilities [¶ 6 in Transcript interview: 1 participant: 4](#)

I really feel that this is a thing I am capable of doing so. In general, if if we sort of limit creativity to to writing and playing with words and everything that that has to do with. [¶ 51 in Transcript interview: 1 participant: 4](#)

that you can do something [¶ 12 in Transcript interview: 1 participant: 5](#)

Knowledge about, knowledge about what you're talking about so that you know what you're talking about [¶ 18 in Transcript interview: 1 participant: 5](#)

At the same time I realize that I had no real knowledge of this. [¶ 10 in Diary participant: 1](#)

There are possibilities in shape, material and application. You can choose existing designs, adapt them or create your own design. [¶ 14 in Diary participant: 1](#)

That there are many possibilities in shapes, different materials depending on the application, that you can influence this yourself and that the products can also be truly functional. [¶ 144 in Diary participant: 1](#)

I learned through Disabled Design Quest that a standard 3D design can be accessible to everyone. [¶ 167 – 170 in Diary participant: 1](#)

I am creative but only in familiar areas. For example not in writing or music and also had no knowledge of 3d printing and thought it could not mean anything to me. [¶ 36 in Diary participant: 1](#)

Yes, I learned that there are a lot of differen materials [¶ 12 in Diary participant: 2](#)

Well, when it broke when I first tried using it and we decided to print it again, but now on it's side so it would be stronger because of the direction of the printing, we also increase the infill to 60%. This time it was heavier and strong enough and it worked really well for me (see picture 2). [¶ 129 in Diary participant: 4](#)

I learned that printing in a certain direction can change the strength in a direction. I also learned that PLA the material that was used for my print is made from plant materials and not from petroleum/crude oil. [¶ 131 – 133 in Diary participant: 4](#)

I hadn't thought that all of this would be possible because I hadn't really delved into it yet. So there are more possibilities than I thought, like that you can print with cement and lasers, those techniques I didn't know about before. [¶ 73 in Diary participant: 5](#)

I already had a bit of an idea about it, but now I really know more. [¶ 73 in Diary participant: 5](#)

I always thought it was a little bit of well, you have the the professional side and you have the the home side to say. And of course, in the professional side there is a lot possible, but I thought for the the home side it was ... well, more like toys or that kind of things? So I'm not really really really the the possibilities of to make adjustments and your own designs. [¶ 4 – 6 in Transcript interview: 2 participant: 1](#)

Well, 10 is always everything but. I overestimated myself, which the first thing, the first interview ... that's because you ... your starting point is all the things you already know, and when you don't know ... writing a book or making music or 3D printing. It's new and you have to take time for it and you have to to a little bit of study but. I gave myself in the first interview 9, but that was for the the the parts I already know. [¶ 14 in Transcript interview: 2 participant: 1](#)

Yeah, yeah, I I already told you, I hate working on a laptop and or... yeah, being on a computer while the the software doesn't work right and the the settings aren't right and that's oh, that's giving me ... a little frustrating, but now seeing the result of, yeah, just picking a nice solution and yeah, having it printed and then we're receiving it. Yeah, that gives a lot of joy. So yeah, that's that's given me, the faith of using it again and then OK, I have to do this on the computer, but yeah, the result is very nice. So Yeah. [¶ 37 in Transcript interview: 2 participant: 2](#)

At first the the films the the YouTube links so, understanding what 3D printing really means. I knew some things, but yeah, there were so many possibilities, so I was amazed by it. And then, the the platform itself. So with the the links to other websites with the ready made solution. There were so many so. Yeah, that so that there are, so many things already 3D printed. Yeah, that I found that helpful. So yeah. [¶ 27 in Transcript interview: 2 participant: 2](#)

Yeah, I I think I will. Maybe at first be frustrated, but now I have the opportunity to change it and that feels good. So then I can find, or ... I think I will look for another solution so I know now that it isn't that one, but it can be changed and maybe someone

else already changed it and I can use that, so I wouldn't have thought about that earlier. [¶ 15 in Transcript interview: 2 participant: 2](#)

I couldn't always image how I would use such things, such tools, or how I would make use of these opportunities. But all and all it was fun to learn more about it. [¶ 2 in Transcript interview: 2 participant: 4](#)

Well then I would start designing it in my head and start thinking of how I would want it to be and then I would ask someone I know if that was possible for them to 3D print it for me. [¶ 17 in Transcript interview: 2 participant: 5](#)

## Theme 9: enthusiasm & excitement

Participant describe being excited before learning about 3D printing, but they are also even more enthusiastic/excited after beginning to learn and in the interview after having 3D printed something and being eager to learn more.

Wonderful. Wonderful. Yeah, it's it's, it's amazing that it's a whole world of new possibilities. So that's yeah, that would be very nice. [¶ 104 in Transcript interview: 1 participant: 1](#)

I will be enthusiastic enough to let hear my voice [¶ 8 in Transcript interview: 1 participant: 2](#)

Only this interview was making me enthusiastic about it because I never thought about it, that it was a solution there. There are possibilities. [¶ 74 in Transcript interview: 1 participant: 2](#)

Well, I feel very enthusiastic about that [¶ 72 in Transcript interview: 1 participant: 2](#)

So then there are a lot of possibilities so I'm very. Enthusiastic about this because yeah, I can understand that 3D printing can be a solution for this. [¶ 68 – 70 in Transcript interview: 1 participant: 2](#)

I have become very enthusiastic about the complete program. The broad information to come from zero to a 3D design and then the offer to bring this 3D design to a physical end product I have experienced as very positive. [¶ 159 – 162 in Diary participant: 1](#)

Excited to learn something new, [¶ 10 in Diary participant: 1](#)

From text to design, to order to physical end product gives a kick, which will increase your confidence and make you more enthusiastic. [¶ 158 in Diary participant: 1](#)

I have become very enthusiastic about the complete program. The broad information to come from zero to a 3D design and then the offer to bring this 3D design to a physical end product I have experienced as very positive. [¶ 162 in Diary participant: 1](#)

I felt entausiasm to learn more about 3D and its possibilities [¶ 10 in Diary participant: 2](#)

I feel happy that I learned that there are a lot of possibilities [¶ 73 in Diary participant: 2](#)

I'm excited [¶ 10 in Diary participant: 4](#)

My husband was really excited when I brought it home and I liked what it looked like, it looked like it was going to be perfect for me. [¶ 121 in Diary participant: 4](#)

I am enthusiastic. [¶ 16 in Transcript interview: 2 participant: 1](#)

It was, yeah, very nice experience and I learnt a lot and I see more possibilities. And. I'm telling other people about it, so yeah. [¶ 86 in Transcript interview: 2 participant: 1](#)

Yeah, that's for me ... to dive in it. It it made me enthusiastic, because you're reading, but then you have to practise what you read. And then you see possibilities and you have to read back from everything is new, so we have to do new stage stages. But at the end, yeah, we we come to a nice to a nice product. And that was a very good line in it. [¶ 40 in Transcript interview: 2 participant: 1](#)

I felt intrigued and enthusiastic and also sometimes frustrated, but then very happy. I managed to find something and and yeah, receiving the result that was very nice to see. So thank you. [¶ 5 in Transcript interview: 2 participant: 2](#)

Yes, I I guess so because now I I I I looked at it a quite a short while and. I'm eager to find out more, find out more. Yeah. [¶ 25 in Transcript interview: 2 participant: 2](#)

Yes, because I I got very enthusiastic about it and. As I say. You opened the door for me, so I would like to explore more. [¶ 23 in Transcript interview: 2 participant: 2](#)

I guess a 7,5 because I still need more practice, but I'm already very good at sharing my enthusiasm about 3D printing. The only thing that I would love to see is that 3D printing would become more sustainable, because now it's mostly created from materials made out of oil, which I as a person do not like so much. So that is something I would like to address to see if we can come up with a material that is more sustainable. [¶ 12 in Transcript interview: 2 participant: 4](#)

## Theme 10: satisfaction & pride

Participants describe expecting to feel satisfaction and pride if they were able to adapt products themselves and after their first 3D print they are often satisfied and some feel proud of themselves.

*I think that would feel pretty cool. Like I have this problem and I'm gonna fix it myself.* [¶ 68 in Transcript interview: 1 participant: 3](#)

*I will be very proud, but not so confident [laughing]. No, it will be fun to figure out how it works and to see if I can create my very own adjustment to without [serious]. Being forced to call in help or something.* [¶ 109 in Transcript interview: 1 participant: 4](#)

*Yeah. Yeah, very recently. Yeah, it was. It was yesterday. We were, [name colleague] and I. In a in a workshop or we were providing a workshop and we is there and I we're providing a workshop and we prepared a workshop for let's say 20 to 30 people or something like that. But we ended up in the main programme. Doing a workshop for 80-100 people and we were like, OK, we can do this. So let's do this and well, we we sort of delivered in a very confident spontaneous interactive way and we really we were really satisfied with it and the audience was too. So that's a big plus as well.* [¶ 18 – 20 in Transcript interview: 1 participant: 4](#)

*I'm happy. That's OK [laughing]. That it is OK that it is. OK, then I'm not creative, yeah.* [¶ 39 in Transcript interview: 1 participant: 4](#)

*So then you're being quite creative, and you need a certain creative insight to be able to do this, but if you could, I think that would give a feeling of satisfaction.* [¶ 52 in Transcript interview: 1 participant: 5](#)

*I am very happy with the 3D end result. It stands out just enough to remind me to use the lock but is not distracting while driving due to the nice shape.* [¶ 190 in Diary participant: 1](#)

*It's perfect for my purpose. The 3d print is according to the design. Dimensions, color and finish are very good.* [¶ 132 – 134 in Diary participant: 1](#)

*I have become very enthusiastic about the complete program. The broad information to come from zero to a 3D design and then the offer to bring this 3D design to a physical end product I have experienced as very positive.* [¶ 159 – 162 in Diary participant: 1](#)

*I'm glad that I succeeded* [¶ 69 in Diary participant: 2](#)

*I am very happy with the result* [¶ 126 in Diary participant: 2](#)

*Wonderful to get the opportunity to try 3D printing. For me a new world of possibilities and technique. Giving me the feeling of being able to print a solution I would like to have/use adapted to my needs* [¶ 188 in Diary participant: 2](#)

*I am happy with it. So many solutions* [¶ 140 in Diary participant: 2](#)

*As a vegan this makes me very happy.* [¶ 135 in Diary participant: 4](#)

*The opener is small and very useful* [¶ 122 in Diary participant: 5](#)

*Yes I'm happy with it, also very nice with the magnet, I can easily hang it in the kitchen.* [¶ 124 in Diary participant: 5](#)

*It was much easier to open the can, I didn't have to ask someone for help.* [¶ 128 in Diary participant: 5](#)

*I think it's quite nice.* [¶ 136 in Diary participant: 5](#)

Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities. [¶ 12 in Transcript interview: 2 participant: 1](#)

Nice. It was ... how do you say that? A very nice experience [¶ 4 in Transcript interview: 2 participant: 1](#)

Good, it was ... I was always ... I was ... trying looking for a a solution and I thought something like ... a key ring? Yeah. But that's under the dashboard, so I won't see it. So I was looking for something above the the dashboard but. Well, the only thing you see is. A gummy bear one centimetre big or you have a fluffy bear that's well, that's not going to stay ... clean. So this was very nice that I thought one. Yeah, did this exactly what I am ... what I'm looking for and I put it on the dashboard and it's not irritating. It's nice to see, nice to look at, but it's not distracting when you're driving, so it's it's there and it's a reminder, but it's not .. an issue or not an obstacle when you're driving so you don't have to remove it, you can ... let it be where it's what stands, and then it's suits its purpose. [¶ 10 in Transcript interview: 2 participant: 1](#)

I felt intrigued and enthusiastic and also sometimes frustrated, but then very happy. I managed to find something and and yeah, receiving the result that was very nice to see. So thank you. [¶ 5 in Transcript interview: 2 participant: 2](#)

Oh, I think a lot, but. No, I. No, I I'm very proud of you doing this because I I think it will help a lot of people. So I want to congratulate you with your website and I think it's a great idea to do to make ... an yeah... And also... How do you say that? And then a shared platform for people. And and I I think you have to shout it out that there is so much more possible in, yeah really the the bespoke solutions for people and yeah, I think a lot of people will be helped, yeah. [¶ 41 in Transcript interview: 2 participant: 2](#)

Yeah, yeah, I I already told you, I hate working on a laptop and or... yeah, being on a computer while the the software doesn't work right and the the settings aren't right and that's oh, that's giving me ... a little frustrating, but now seeing the result of, yeah, just picking a nice solution and yeah, having it printed and then we're receiving it. Yeah, that gives a lot of joy. So yeah, that's that's given me, the faith of using it again and then OK, I have to do this on the computer, but yeah, the result is very nice. So Yeah. [¶ 37 in Transcript interview: 2 participant: 2](#)

Yeah, I I think I will. Maybe at first be frustrated, but now I have the opportunity to change it and that feels good. So then I can find, or ... I think I will look for another solution so I know now that it isn't that one, but it can be changed and maybe someone else already changed it and I can use that, so I wouldn't have thought about that earlier. [¶ 15 in Transcript interview: 2 participant: 2](#)

but it made me smile, because I thought it was interesting. [¶ 2 in Transcript interview: 2 participant: 4](#)

As a vegan that makes me very happy. [¶ 14 in Transcript interview: 2 participant: 4](#)

Yeah I'm quite happy with it, it's nicely hanging in my kitchen now, I tried it out already. And I was looking at maybe wanting a wider handle to it, like I have with my adapted cutlery, but then when using it I realized that that wouldn't be convenient because now it's nice and small and it works just fine like this and I can hold onto the can and hold the tool onto the can with my pointer finger and this keeps the lip of the can out of the way while drinking which makes it a little easier to drink. [¶ 7 in Transcript interview: 2 participant: 5](#)

## Theme 11: Play

Participants describe play as being a part of creativity, by playing with words or being able to play with 3D printing while not having to be afraid of breaking something, or at first seeing 3D printing as merely a toy.

Creativity for me is ... I like to play with words and I like to play with the power of words. So to me, if you say creativity, the first thing I think about is, writing and to to be creative in in to to bring a message across or to to. [¶ 27 in Transcript interview: 1 participant: 4](#)

I I really like to play with words and to do everything with words and and sentences and stories [¶ 47 in Transcript interview: 1 participant: 4](#)

I really feel that this is a thing I am capable of doing so. In general, if if we sort of limit creativity to to writing and playing with words and everything that that has to do with. [¶ 51 in Transcript interview: 1 participant: 4](#)

At first I only saw it as a toy. Now I see many more possibilities. Without this website I would never have started it on my own [¶ 79 in Diary participant: 1](#)



Nice, at first I only saw 3d printing only as a small toy factory [¶ 146 in Diary participant: 1](#)

Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities. [¶ 12 in Transcript interview: 2 participant: 1](#)

Oh yeah, it's it opened a door for me... it just, I thought it was out of my league and and now, while getting the the opportunity to to try it and not "break anything" at the same time. Yeah, that's the the the bump in the road is getting smaller. [¶ 13 in Transcript interview: 2 participant: 2](#)

## Theme 12: adapting & hacking

Many participants describe acts of adapting and hacking when talking about products that didn't fit their needs, as well as during the learning process and in the second interview wanting to adapt or hack products in the future.

That's fine, I can adjust all kinds of things, but in the car it's ... it's limited and it's ... well for a longer periods of driving. It's giving me back pain. And. At home and at the office, I have a desk that's ... adapted? ... Adaptable for the height, so I can, uh, stand and sit and I can. Uh, choose whatever I like. Uh, in that. [¶ 16 in Transcript interview: 1 participant: 1](#)

Well, we're we're looking for. A A camper van. And all the the the the standard solutions. Doesn't fit our options what we want and how we want to use it. So that's what that's why I decided to build 1 myself. In the past. [¶ 56 in Transcript interview: 1 participant: 1](#)

Well, standard things. I don't know if ... if I can adapt that. [¶ 60 in Transcript interview: 1 participant: 1](#)

Where I can? Yeah. See what's possibilities? Sort of kind of database. For possibilities from people that already. Have found some solutions for it. And see if something's fits for me. Or yeah, maybe I can make some adapt ... and some.... Designs. Suitable for me for my. Yeah, process not. My issue. [¶ 98 – 100 in Transcript interview: 1 participant: 1](#)

Sometimes that there are possibility but for the mouse ... in the in this case maybe. I can change the the. The housing, so it's it better fit for my left hand instead of my right hand. The mouse itself works fine, it's it's does everything what it has to do. I mean it doesn't fit in my hand properly. So if I can. Yeah make. A little. "aanpassing" [in Dutch, but found the English word] adaption, yeah. To it when it's better fit than fine. [¶ 72 – 78 in Transcript interview: 1 participant: 1](#)

An example for in my work you have some common moulds for making bowls or something? And then there are some normal measurements and I want another one. So then I make my own mould [¶ 56 in Transcript interview: 1 participant: 2](#)

And yeah, I find it very. Important being able to create the world around me instead of. Being dependent on solutions other people have thought of, because I'm a logic person and I'm an intelligent person, so I like to yeah, be able to. Adapt all those things for me so. [¶ 72 – 74 in Transcript interview: 1 participant: 2](#)

Adapting products. Yeah, maybe some tools I use. In my ceramics workshop. But also. But I I I was thinking about a lot of things and all having to do with my eyesight and. Be prepared that that will be worse. I thought how? What what would I like to change? And or adapt [¶ 66 in Transcript interview: 1 participant: 2](#)

Not in the way use it, but maybe more like. We have a lot of keys for the camper van and I don't know where what key or which lock it is. So the first thing I thought, well, I'm going to use some colours, some nail Polish well. My husband didn't wasn't fan, but then I thought, well, when I can't see it anymore, I don't have anything with. The the colours wouldn't help me then, so I thought well if I could 3D print some symbols and then I put it on the key and the lock then I could feel the which key I could use and not only with keys and locks, but now we just toothbrushes. Yeah. And I saw we have the same and in this case. My husband use mine and I kept his and the colours were green and blue, so also for him it was difficult to see the difference and I thought well I when I have something on my toothbrush I could feel then I know it's mine. So then there are a lot of possibilities so I'm very. [¶ 68 in Transcript interview: 1 participant: 2](#)

I think it is like to design it probably. Like to think of solutions like making even making the handle like bigger or like adding something. To the side of it so you can use both hands. [¶ 52 in Transcript interview: 1 participant: 3](#)

So you could like if you would for the knife situation if you would add something on to the knife, it might. So then you it's like a material you could use to add something on it. So you could use it like that. I think just as the as the actual material of of making the adaptation. [¶ 64 – 66 in Transcript interview: 1 participant: 3](#)



I was. I was. I was. Yeah. Well. Not not that frustrated. I always figure out how to use a thing. How how to use such a product or such a tool in a way that it works but but still? That can be done. That that can be done in many. In many different ways that are better than they are now, so I'm I'm I'm desperately looking for the one thing. [¶ 55 – 57 in Transcript interview: 1 participant: 4](#)

Because I'm like if you just seal it or you pour some glue in there, it should be good because no water can get in there anymore. [¶ 38 in Transcript interview: 1 participant: 5](#)

Yeah, I think I would take the handle off, pour some 1-second glue in there and put the handle back on and then it should be closed. [¶ 42 in Transcript interview: 1 participant: 5](#)

On a personal level through customization. But also in individual parts and thus make a good contribution to the circular economy. [¶ 81 in Diary participant: 1](#)

I now know that I can have a lot of influence on making a design fit my wishes [¶ 40 in Diary participant: 1](#)

When it is easy to adapt the designs to individuals by 3d printing is a good solution [¶ 77 in Diary participant: 2](#)

Hopeful, that people are able to change designs that don't work for them. [¶ 77 in Diary participant: 2](#)

After I saw all the examples of solutions people share on the different platforms it gives hope that I can really design a bespoke solution by myself [¶ 89 in Diary participant: 2](#)

Yes because before I could not imagine the possibilities of bespoke 3D printing [¶ 91 in Diary participant: 2](#)

I'm starting to feel more confident that I could be able to change design or create my own solutions [¶ 94 – 95 in Diary participant: 2](#)

Scrolling through all the examples of possibilities I got my own ideas of changing or adapting designs [¶ 160 in Diary participant: 2](#)

It's quite frustrating because I thought there should be quite a simple solution, for my problem so to say, because my wrist is fixed so I can't turn my wrist, and there are always tools that highlight the abilities of a fairly normal wrist, and this tool is quite simple and doesn't require twisting. [¶ 66 in Diary participant: 4](#)

It was much easier to open the can, I didn't have to ask someone for help. [¶ 128 in Diary participant: 5](#)

I always thought it was a little bit of well, you have the the professional side and you have the the home side to say. And of course, in the professional side there is a lot possible, but I thought for the the home side it was ... well, more like toys or that kind of things? So I'm not really really really the the possibilities of to make adjustments and your own designs. [¶ 4 – 6 in Transcript interview: 2 participant: 1](#)

Yeah, yeah. Now you see possibilities. Instead of only taking a saw or a hammer to to fix it now ... now you see from, OK, it's it's not fine ... it's not fine for me. But I can adapt it to my needs. There are possibilities and that I wasn't aware of about it. [¶ 24 in Transcript interview: 2 participant: 1](#)

Oh, I think a lot, but. No, I. No, I I'm very proud of you doing this because I I think it will help a lot of people. So I want to congratulate you with your website and I think it's a great idea to do to make ... an yeah... And also... How do you say that? And then a shared platform for people. And and I I think you have to shout it out that there is so much more possible in, yeah really the the bespoke solutions for people and yeah, I think a lot of people will be helped, yeah. [¶ 41 in Transcript interview: 2 participant: 2](#)

Yes, yes, because. I I already was thinking about the solution for my keys and then the lock and keys and I would really print something like symbols on locks and have the matching symbols on my keys. Just for being ready for future. So when I when I lose my eyesight and I hope it will take a long time. But then now I know, oh, I I won't be dependent on everything so. Now is the time having yeah making these solutions and on the other hand maybe help my father having trouble with finding the right keys for a lot of things. Yeah, I I think I can help him with that and maybe just with colours or or something, but yeah. And I think it will be, yeah make life easier. So on the other hand, and, oh, the the toothbrush solution, I want that too. And there are, oh, I can think about more things that it can be very useful to 3D print, some bespoke solutions for me, yeah. [¶ 39 in Transcript interview: 2 participant: 2](#)

Well, I've I always say it's very important for people to feel independent. And when you already are are in special need, it is very nice to be able to, think about your own solutions. Other people it's good that there are some solutions, but it must it give me a great feeling of being independent and I think that's important and that's that you ... you know best what works best for you. So

that's perfect. That, that, that it's possible to change designs or to think, yeah, to, to design your own. [¶ 35 in Transcript interview: 2 participant: 2](#)

I think I would be hacking, because I feel like hey I can adapt something that will then be more suitable for me or others I knew. It's more like not creating new things, but hacking existing equipment that can improved for a range of disabled people. [¶ 48 in Transcript interview: 2 participant: 4](#)

But we printed it again with different settings and now the tool works well. However, it would be nice if you could adjust the opening of the opener to the thickness of the lid edge. That would be a great challenge to explore with a design specialist. I'd be happy to work on this together with someone more experienced! [¶ 6 in Transcript interview: 2 participant: 4](#)

Yeah, if they would have some issues then I would say you should have a look on that website, and get some inspiration, or when it would come up in a conversation then that they are struggling with something and they wished there was something for it, like an assistive tool, then I would definitely recommend it and say they should have a look. [¶ 37 in Transcript interview: 2 participant: 5](#)

It's a bit hard to say, I feel like I haven't really had enough experience with 3D printing to really know for sure, but I do think that it has changed something in my thinking, that I don't always have to buy something, but that I can also come up with my own ideas in my head and then the possibility of having that printed, so yeah I guess it did improve a bit. [¶ 9 in Transcript interview: 2 participant: 5](#)

### Theme 13: The possibilities of 3D printing

Many participants describe both being curious of the possibilities of 3D printing and being surprised at the amount of possibilities of 3D printing and realizing that it was possible for them to 3D print too, without having a 3D printer or having much technical knowledge.

Well, there are lots of steps and. Yeah. It isn't. Not possible. But the. The the the "aanleiding" [reason/cause] To ... it's still new for me. There's not... No, "ik heb nog geen aanleiding om het te gaan gebruiken" [said in Dutch, translated: I haven't come across a situation/reason for using it] Yeah, I I see too little possibilities for me to... Yeah. And then then you balance it from, yes, why not of why I do, yeah. [¶ 82 – 92 in Transcript interview: 1 participant: 1](#)

Oh yes, I do. Yeah. It's a very nice invention. Yeah. [¶ 94 in Transcript interview: 1 participant: 1](#)

See what's possibilities? Sort of kind of database. For possibilities from people that already. Have found some solutions for it. [¶ 98 in Transcript interview: 1 participant: 1](#)

Yeah, I I see too little possibilities for me to... Yeah. [¶ 90 in Transcript interview: 1 participant: 1](#)

I can understand that 3D printing can be a solution for this [¶ 70 in Transcript interview: 1 participant: 2](#)

Only this interview was making me enthusiastic about it because I never thought about it, that it was a solution there. There are possibilities. [¶ 74 in Transcript interview: 1 participant: 2](#)

So but for other stuff, maybe yes, it may be that that you can create some sort of add on or or or or thing you can feel properly to. To make it easier or or adjust a handle or something like that by using 3D printing. [¶ 105 – 107 in Transcript interview: 1 participant: 4](#)

a whole new world opened up for me [¶ 10 in Diary participant: 1](#)

A lot, the possibilities are almost endless. [¶ 12 in Diary participant: 1](#)

There are possibilities in shape, material and application. You can choose existing designs, adapt them or create your own design. [¶ 14 in Diary participant: 1](#)

The website provides a good structure to get acquainted with the possibilities of 3D printing. [¶ 16 in Diary participant: 1](#)

I now see that it is possible for everyone and you don't need to have your own 3D printer [¶ 28 in Diary participant: 1](#)

This gives me the insight that there are 3D printing possibilities for me too. [¶ 32 in Diary participant: 1](#)

At first I only saw it as a toy. Now I see many more possibilities. Without this website I would never have started it on my own [¶ 79 in Diary participant: 1](#)

I now see a lot of possibilities and think that 3D printing has a bright future. [¶ 81 in Diary participant: 1](#)

On a personal level through customization. But also in individual parts and thus make a good contribution to the circular economy. [¶ 81 in Diary participant: 1](#)

I see possibilities now [¶ 93 in Diary participant: 1](#)

That there are many possibilities in shapes, different materials depending on the application, that you can influence this yourself and that the products can also be truly functional. [¶ 144 in Diary participant: 1](#)

I learned through Disabled Design Quest that a standard 3D design can be accessible to everyone. [¶ 170 in Diary participant: 1](#)

Good. Disabled Design Quest starts at the basics and also gives you a glimpse of the possibilities for creating your own design [¶ 172 in Diary participant: 1](#)

Positive. By having the result in your hands it becomes real and you see even more possibilities. [¶ 166 in Diary participant: 1](#)

After viewing some projects and seeing youtube films I aw that there is so much more possible [¶ 14 in Diary participant: 2](#)

I feel happy that I learned that there are a lot of possibilities, quite overwhelming [¶ 73 in Diary participant: 2](#)

When it is easy to adapt the designs to individuals by 3d printing is a good solution [¶ 77 in Diary participant: 2](#)

Yes because I learned about the possibilities and now I want to learn more to be able to design my own solution [¶ 87 in Diary participant: 2](#)

Yes because before I could not imagine the possibilities of bespoke 3D printing [¶ 91 in Diary participant: 2](#)

I think because of sharing all the information, the examples, the youtube films and the websites, all the possibilities. It awakens a feeling of be able to be independent and beining creative. To think about solutions instead of being annoyed about bad design [¶ 93 in Diary participant: 2](#)

By the shared information and the possibility to try the 3D programme whithout the need of owning my own 3D printer [¶ 97 – 99 in Diary participant: 2](#)

...It is a lot. I now know that you need all the information. And everybody needs something different so it is good to know that there are so many possibilities. You just have to choose what fits you. I would like to have a step by step instruction, really for dummies. I think I will get better in doing it after a lot of excersize [¶ 103 in Diary participant: 2](#)

I have learned the possibilities of 3D printing in so many ways [¶ 138 in Diary participant: 2](#)

Oh yes. With the printresult I saw the possibilities of 3D printing [¶ 149 – 152 in Diary participant: 2](#)

Yes, otherwise I would not have the courage to find out how 3D printing works. By sharing information, the examples, the weblinks to readymade solutions, to printerpossibilities etc. [¶ 153 – 156 in Diary participant: 2](#)

Yes, because I got the opportunity to try the 3D printer guided by the website. Guiding my through all the parts of 3D printing. First the examples, the different kinds of 3D printing, then what material possibilities and then the testing and printing [¶ 161 – 164 in Diary participant: 2](#)

I am happy with it. So many solutions [¶ 140 in Diary participant: 2](#)

if it's possible to do such things then there is a whole world to win. [¶ 10 in Diary participant: 4](#)

I still haven't printed anything but, yeah I think that I would be confident in trying so, after reading all the materials and watching the videos, because it is very clearly and elaborately described, what you need to do and what the materials are and what you need to know in working with them [¶ 26 in Diary participant: 4](#)

I was surprised at all the possibilities and what can be done using 3D design [¶ 4 in Diary participant: 4](#)

There is a lot possible with this technology [¶ 16 in Diary participant: 5](#)

By gathering information via the website. You can see many examples and you start thinking if maybe you can do something with that, or if you would change something or improve it. [¶ 32 in Diary participant: 5](#)

By starting to think about all the things you can do with it. Yes, without the website I don't think I would have ever looked into it. By having all the links with examples [¶ 35 – 40 in Diary participant: 5](#)

3D printing can be quite useful and I can get some benefits from it in this way, for my issues. Especially when the type of product I'm looking for isn't available in a store then to be able to print them like this seems really useful [¶ 71 in Diary participant: 5](#)

I hadn't thought that all of this would be possible because I hadn't really delved into it yet. So there are more possibilities than I thought, like that you can print with cement and lasers, those techniques I didn't know about before. [¶ 73 in Diary participant: 5](#)

Yes, actually I do. Mostly about the possibilities of 3D printing, so when I will need something my thoughts might go towards thinking if it is possible for that to be printed, while I wouldn't have thought about that before. [¶ 132 – 134 in Diary participant: 5](#)

The video's made me see the possibilities. [¶ 152 in Diary participant: 5](#)

I see the possibilities now, so in the future when I need something I will think about maybe 3D printing is an option to solve the problem. [¶ 148 in Diary participant: 5](#)

I never thought it was ... so many possibilities [¶ 4 in Transcript interview: 2 participant: 1](#)

I always thought it was a little bit of well, you have the the professional side and you have the the home side to say. And of course, in the professional side there is a lot possible, but I thought for the the home side it was ... well, more like toys or that kind of things? So I'm not really really really the the possibilities of to make adjustments and your own designs. [¶ 4 – 6 in Transcript interview: 2 participant: 1](#)

Yeah, well, especially at the 3D printing. This is my first experience, well first ... well, we saw it on another place. You see it passing by but ... actually interacting with it, doing something and that's creative of course, you create something, something not only digital, but you have a physical product at the end. So yeah, it was very nice and when I didn't had the opportunity from you I never ... take the the the effort to explore this these possibilities. [¶ 12 in Transcript interview: 2 participant: 1](#)

It was, yeah, very nice experience and I learnt a lot and I see more possibilities. And. I'm telling other people about it, so yeah. [¶ 86 in Transcript interview: 2 participant: 1](#)

Yeah, that's for me ... to dive in it. It it made me enthusiastic, because you're reading, but then you have to practise what you read. And then you see possibilities and you have to read back from everything is new, so we have to do new stage stages. But at the end, yeah, we we come to a nice to a nice product. And that was a very good line in it. [¶ 40 in Transcript interview: 2 participant: 1](#)

Oh yeah. Yeah, a lot. A lot. Besides that it wasn't ... in my ... in my in my view. To explore things or it's not in my path and this opened a whole new world for me in 3D printing and I even brought it up at my work, so I'm telling about it because I'm enthusiastic. [¶ 20 in Transcript interview: 2 participant: 1](#)

Yeah, yeah. Now you see possibilities. Instead of only taking a saw or a hammer to to fix it now ... now you see from, OK, it's it's not fine ... it's not fine for me. But I can adapt it to my needs. There are possibilities and that I wasn't aware of about it. [¶ 24 in Transcript interview: 2 participant: 1](#)

Yeah, possibly. Yeah, I. Well, not to the the object that's already here, the physical object, the gummy bear. But, well, I'll see all kinds of other possibilities, so yeah. [¶ 28 in Transcript interview: 2 participant: 1](#)

Especially the the first part and the some links to YouTube to see from OK, it's in ceramic in metal and I know it's not all for the the home part, but there are possibilities. And for the home part, you have different materials, different colours, so. Yeah, that that was very nice. But you see ... you you start easy. So we have to read it. Then you think from OK. OK, well, let's ... it's tempting to read on. [¶ 48 in Transcript interview: 2 participant: 1](#)

Two was OK, but three was well, you you have to take time for it and you have to do do more in it and that's not the website, it's more from your skills and maybe and maybe my age, that's that's a possibility as well for. Well, yeah, you have to try things. And before you know, you know, what is it? The first time everything is new and and well, sometimes difficult but you see possibilities and you have to continue and then you see you make another step. [¶ 52 – 54 in Transcript interview: 2 participant: 1](#)

At first the the films the the YouTube links so, understanding what 3D printing really means. I knew some things, but yeah, there were so many possibilities, so I was amazed by it. And then, the the platform itself. So with the the links to other websites with

the ready made solution. There were so many so. Yeah, that so that there are, so many things already 3D printed. Yeah, that I found that helpful. So yeah. [¶ 27 in Transcript interview: 2 participant: 2](#)

But I think for the most part I learned a lot about the possibilities of 3D printing, especially by watching the video's. [¶ 5 in Transcript interview: 2 participant: 5](#)

Yeah I'm quite happy with it, it's nicely hanging in my kitchen now, I tried it out already. And I was looking at maybe wanting a wider handle to it, like I have with my adapted cutlery, but then when using it I realized that that wouldn't be convenient because now it's nice and small and it works just fine like this and I can hold onto the can and hold the tool onto the can with my pointer finger and this keeps the lip of the can out of the way while drinking which makes it a little easier to drink. [¶ 7 in Transcript interview: 2 participant: 5](#)

## Theme 14: Investment & barriers

In interview 1 participants described certain barriers to 3D printing like not having a 3D printer or not having the knowledge. During the learning process participants also discovered that they had to invest both time, patience and focus and that certain barrier had to be overcome, like computer problems, struggling with terminology and learning something new being difficult.

*I have too many creativities. So I have to limit it for. Everything is. Nice. It's interesting* [¶ 32 in Transcript interview: 1 participant: 1](#)

*but it all takes time, so you have to make choices in what time you have and where you want to spend it on.* [¶ 32 in Transcript interview: 1 participant: 1](#)

*Well, you need to ... have a 3D printer and yeah it's expensive* [¶ 82 in Transcript interview: 1 participant: 1](#)

*You have to have a space in the house for it, knowledge, to computer and design programme.* [¶ 82 in Transcript interview: 1 participant: 1](#)

*you need to ... have a 3D printer* [¶ 82 in Transcript interview: 1 participant: 1](#)

*Yeah, but. I have too many creativities. So I have to limit it for. Everything is. Nice. It's interesting is, but it all takes time, so you have to make choices in what time you have and where you want to spend it on. But I'm very curious in the new techniques.* [¶ 31 – 32 in Transcript interview: 1 participant: 1](#)

*I think when you want something? You have to “verdiepen” [said in Dutch, they mean to delve deeper]. You have to make the the next step to to make it your own.* [¶ 40 – 42 in Transcript interview: 1 participant: 1](#)

*Well, you need to ... have a 3D printer and yeah it's expensive. You have to have a space in the house for it. You need, knowledge, to computer and design programme. Well, there are lots of steps and. Yeah. It isn't. Not possible. But the. The the the “aanleiding” [reason/cause] To ... it's still new for me.* [¶ 82 in Transcript interview: 1 participant: 1](#)

*but it lacks mostly time* [¶ 42 in Transcript interview: 1 participant: 2](#)

*That's because I hate sitting behind a computer. And that has to do with my eyes, my sight. So I don't like to sit too long and also my physics. I don't like to sit a long time behind a computer.* [¶ 62 in Transcript interview: 1 participant: 2](#)

*we don't have a 3D printer.* [¶ 64 in Transcript interview: 1 participant: 2](#)

*No. And then and. In your next question, and maybe is, why not? That's because I hate sitting behind a computer. And that has to do with my eyes, my sight. So I don't like to sit too long and also my physics. I don't like to sit a long time behind a computer. But on the other hand, yeah, it would be interesting to see, and I think the most important thing is we don't have a 3D printer. So I wouldn't know where to print. So I think that, yeah.* [¶ 62 – 64 in Transcript interview: 1 participant: 2](#)

*But but yeah, it's it probably won't stick* [¶ 28 in Transcript interview: 1 participant: 3](#)

*because I don't have a 3D printer* [¶ 46 in Transcript interview: 1 participant: 5](#)

*I couldn't right click the text with my mouse, neither Chrome nor Edge. Because of this I couldn't translate it or have it read to me.* [¶ 20 in Diary participant: 1](#)

*In the end it was good, but it took a lot more time than I had estimated* [¶ 73 in Diary participant: 1](#)

*At first I only saw it as a toy. Now I see many more possibilities. Without this website I would never have started it on my own* [¶ 79 in Diary participant: 1](#)

*Everything is new, you have to download software (received a warning that the software had not been tested safely) and also create an account. How do you get your design into the program?* [¶ 85 in Diary participant: 1](#)

*Take a deep breath and read everything calmly. It all works, but it takes quite a lot of time the first time.* [¶ 87 in Diary participant: 1](#)

*I have gotten older (60) and see that I had overestimated myself. I realize that it now takes me more time when I start something new. Yes; the information made me enthusiastic and curious* [¶ 101 in Diary participant: 1](#)

*Not really, maybe it took a little more time* [¶ 55 in Diary participant: 1](#)

*Like anything new, it takes practice and time to learn. I realize that this is something completely different for me and that I really need to delve deeper into my own design.* [¶ 89 in Diary participant: 1](#)

*This cost me some extra effort to understand it well.* [¶ 18 in Diary participant: 1](#)

*I thought it would be hard to learn but I now think it will go easier* [¶ 71 in Diary participant: 2](#)

*Yes. I found out that I am not use to new programmes, especially the technical programmes. I do not like sitting behind my computer. And when things are new, they cos a lot of time.* [¶ 79 in Diary participant: 2](#)

*I needed more support starting the new programme. What is logical for some people is new for people who are not used to work with computers and printers. There were some bumps in the road* [¶ 81 in Diary participant: 2](#)

*Yes, I had some problems with software on my computer and settings. My settings were wrong so I struggled with seeing the whole page and switching between pages. I tried to change the settings but I couldn't so I used the mouse to view all the parts of the page. Also the pdf's weren't my thing so I printed them. I got frustrated at first. Asked help from husband but he has no time and didn't know how to help. So a bit insecure but doing it old-school by hand... Well, as I said, software has to work ... so I hope things get better. My computer wasn't helpful* [¶ 18 – 28 in Diary participant: 2](#)

*the possibility to try the 3D programme whithout the need of owning my own 3D printer* [¶ 97 in Diary participant: 2](#)

*I would never have tried it without this platform* [¶ 101 in Diary participant: 2](#)

*By inviting to make design accessible by introducing me into the software of 3D printing.* [¶ 101 in Diary participant: 2](#)

*At first I struggled but that is because everything is new to me. After a couple of times it's getting better* [¶ 107 in Diary participant: 2](#)

*Yes, finding my way with the software, setting up my computer* [¶ 141 – 142 in Diary participant: 2](#)

*Yes it is. With all the links it is "laagdremelig" [written in Dutch, translation: accessible/approachable]* [¶ 172 in Diary participant: 2](#)

*Yes but I needed some time and courage to try it* [¶ 168 in Diary participant: 2](#)

*I needed tot read more than once the sentences* [¶ 178 in Diary participant: 2](#)

*You need some time and focus, which sounds strange, but you need focus to be able to progress and when you lack focus (which I did) then it is very overwhelming. No not really, because I didn't have a sufficient amount of time to overcome these problems, but I see the potential and I think I would be able to overcome these troubles by doing it simply more often.* [¶ 20 – 22 in Diary participant: 4](#)

*You have to digest all of this information multiple times to get the hang of it* [¶ 180 in Diary participant: 4](#)

*When you look into it further it isn't always as easy as it seems* [¶ 54 in Diary participant: 5](#)

*Well, 10 is always everything but. I overestimated myself, which the first thing, the first interview ... that's because you ... your starting point is all the things you already know, and when you don't know ... writing a book or making music or 3D printing. It's*

*new and you have to take time for it and you have to to a little bit of study but. I gave myself in the first interview 9, but that was for the the the parts I already know. [¶ 14 in Transcript interview: 2 participant: 1](#)*

*Yeah, that's for me ... to dive in it. It it made me enthusiastic, because you're reading, but then you have to practise what you read. And then you see possibilities and you have to read back from everything is new, so we have to do new stage stages. But at the end, yeah, we we come to a nice to a nice product. And that was a very good line in it. [¶ 40 in Transcript interview: 2 participant: 1](#)*

*From the the right click, but that's maybe because I have a company computer that's ... how do you say? "Beveiligd" [said in Dutch]. Secured, yeah, so I can't access several websites. So yeah. It's limited. Yeah. So maybe there is ... was a was an issue, but the the, the the text the the links in it. Yeah, it's very nice. [¶ 32 – 36 in Transcript interview: 2 participant: 1](#)*

*Two was OK, but three was well, you you have to take time for it and you have to do do more in it and that's not the website, it's more from your skills and maybe and maybe my age, that's that's a possibility as well for. Well, yeah, you have to try things. And before you know, you know, what is it? The first time everything is new and and well, sometimes difficult but you see possibilities and you have to continue and then you see you make another step. [¶ 52 – 54 in Transcript interview: 2 participant: 1](#)*

*I felt intrigued and enthusiastic and also sometimes frustrated, but then very happy [¶ 5 in Transcript interview: 2 participant: 2](#)*

*Yeah, yeah, I I already told you, I hate working on a laptop and or... yeah, being on a computer while the the software doesn't work right and the the settings aren't right and that's oh, that's giving me ... a little frustrating, but now seeing the result of, yeah, just picking a nice solution and yeah, having it printed and then we're receiving it. Yeah, that gives a lot of joy. So yeah, that's that's given me, the faith of using it again and then OK, I have to do this on the computer, but yeah, the result is very nice. So Yeah. [¶ 37 in Transcript interview: 2 participant: 2](#)*

*Oh yeah, it's it opened a door for me... it just, I thought it was out of my league and and now, while getting the the opportunity to to try it and not "break anything" at the same time. Yeah, that's the the the bump in the road is getting smaller. [¶ 13 in Transcript interview: 2 participant: 2](#)*

*Maybe it took me some longer to understand what you were saying, so I had to read it a couple of times. Before I understood what you were asking or or telling me, yeah. [¶ 21 in Transcript interview: 2 participant: 2](#)*

*I guess a 7,5 because I still need more practice, but I'm already very good at sharing my enthusiasm about 3D printing. The only thing that I would love to see is that 3D printing would become more sustainable, because now it's mostly created from materials made out of oil, which I as a person do not like so much. So that is something I would like to address to see if we can come up with a material that is more sustainable. [¶ 12 in Transcript interview: 2 participant: 4](#)*

*Yeah, if I had loads of time and energy to do so, yeah. I think it's fun to see if you can ... using a design tool to be creative and to figure out and to explore what works or not. [¶ 26 in Transcript interview: 2 participant: 4](#)*

*Yes, like I said earlier, you have to practice and practice. But it is fun to do. [¶ 36 in Transcript interview: 2 participant: 4](#)*

*If we were able to use materials that are more sustainable, yes, I would. [¶ 28 in Transcript interview: 2 participant: 4](#)*

*Oh yes, otherwise I wouldn't have known about it. [¶ 13 in Transcript interview: 2 participant: 5](#)*

*No not really, although I didn't do the parts with the software. Yeah, that was too complicated, so I chose one of the projects that were on the site which had all the details already, then I just had to choose a color. [¶ 33 – 35 in Transcript interview: 2 participant: 5](#)*

## Theme 15: Clarity & structure

Many participants describe liking the clear structure of DDQ with a clear path forward, but some struggling with the absence of explicit instruction or the language being English or technical.

*Menu is clear and has several options. [¶ 4 in Diary participant: 1](#)*

*The website provides a good structure [¶ 16 in Diary participant: 1](#)*

*The text is English, partly technical and sometimes has long sentences. This cost me some extra effort to understand it well. [¶ 18 in Diary participant: 1](#)*



Information is easy to read and I understand the text, but applying it turns out to be more complicated ¶ 44 in Diary participant: 1

Lock the menu bar at the top when scrolling down so that it is always accessible. ¶ 52 in Diary participant: 1

In the beginning you do give an explanation of each abbreviation, but on later pages you don't explain them anymore. It costs time to read everything and look at everything, so when this is spread out over time it is sometimes difficult to remember what these abbreviations mean. ¶ 53 in Diary participant: 1

However, the content on one page is better divided into paragraphs than on others. In addition, the variation/distribution of text and images can contribute to making the page a bit clearer and more pleasant to read. ¶ 59 in Diary participant: 1

In the beginning you provide an explanation of the abbreviations and later on you do not explain them anymore. ¶ 59 in Diary participant: 1

A supplement in the form of a basic step-by-step plan can provide just that support to make the threshold or introduction easier. ¶ 62 in Diary participant: 1

The first course is just too information, instead of just do it ¶ 62 in Diary participant: 1

Good information taught from general to specific. You can also easily look back if you continue at a different time. ¶ 97 in Diary participant: 1

Good. Disabled Design Quest starts at the basics and also gives you a glimpse of the possibilities for creating your own design ¶ 172 in Diary participant: 1

Information has a good structure. ¶ 42 in Diary participant: 1

It is understandable ¶ 44 in Diary participant: 2

I read all the information but missed a short to do list. ¶ 63 in Diary participant: 2

A lot of information (technical). ¶ 42 in Diary participant: 2

I could use a step to step for dummies instructions ¶ 83 in Diary participant: 2

I stumbled with the technical information. ¶ 85 in Diary participant: 2

...It is a lot. I now know that you need all the information. And everybody needs something different so it is good to know that there are so many possibilities. You just have to choose what fits you. I would like to have a step by step instruction, really for dummies. I think I will get better in doing it after a lot of exercise ¶ 103 in Diary participant: 2

I understand the information by itself but you need to reread the details while trying to get all the information for the printing project. Maybe use shorter sentences and a different layout of the website. Instead of the whole page more like splitting the page in two (like this form). Just easier to read ¶ 105 in Diary participant: 2

The information is complete I guess, I missed a short step by step guide at the end. I kept thinking what do I need to do next? I missed the background information: found a model? Download it and from that download the programme opens itself for example ¶ 111 in Diary participant: 2

Shorter sentences, maybe bulletpoints? ¶ 109 in Diary participant: 2

As said, the sentences are too long, it takes my breath away while reading. Instead of one sentence, cut the sentence in two, three or even 4 lines, I had to reread the sentences before understanding and kept my focus. ¶ 113 – 115 in Diary participant: 2

I missed a step by step for dummies ¶ 144 in Diary participant: 2

I think the sentences are too long. Took my breath away while reading. Also difficult to follow Shorter sentences and more blocks. ¶ 176 in Diary participant: 2

but I really like that it is well structured and has a step-by-step learning approach and I really like that. ¶ 12 in Diary participant: 4

*I still haven't printed anything but, yeah I think that I would be confident in trying so, after reading all the materials and watching the videos, because it is very clearly and elaborately described, what you need to do and what the materials are and what you need to know in working with them* [¶ 26 in Diary participant: 4](#)

*It's a very clear process, so yes. Because it is that clear, it will contribute to my confidence in my creative skills.* [¶ 40 in Diary participant: 4](#)

*It is a bit dense on the text part, a lot of times it is a lot of text, so maybe a more compact design with just some bullet points would work out slightly better, and maybe something that is a bit more clickable, when I want to know more about materials, then I can click here, instead of having it all on one webpage or on sites that are external so maybe you can incorporate some bits and pieces on the website and then creating deeplinks, not so much putting straightforward text.* [¶ 46 in Diary participant: 4](#)

*Yes, maybe it's even overcomplete sometimes. Stick to the core and then when you want to share additional information then that's fine but maybe link it or something. For a beginner like me, some basic, rather elemental information would do, and then the rest can be linked somehow.* [¶ 50 in Diary participant: 4](#)

*and I think the foundation is clear and the goals are clear.* [¶ 180 in Diary participant: 4](#)

*First feeling it out because my English is not so good* [¶ 4 in Diary participant: 5](#)

*It would be great if you could choose what language you wanted the text to be in.* [¶ 20 in Diary participant: 5](#)

*Could have been written even more simple for me* [¶ 44 in Diary participant: 5](#)

*Videos are clear, text and some links are in phrasing I don't understand* [¶ 46 in Diary participant: 5](#)

*I would divide it into more categories.* [¶ 50 in Diary participant: 5](#)

*It's difficult for me to read English so it took some more time.* [¶ 137 – 140 in Diary participant: 5](#)

*It has. It has a good structure from simple basic to more to the point.* [¶ 38 in Transcript interview: 2 participant: 1](#)

*Yeah. Yeah, it was a good, accessible. The only thing I struggled with is some languages. Well, I wrote wrote it down in the diary/journal.* [¶ 30 in Transcript interview: 2 participant: 1](#)

*When the the menu bar. At the top, yeah. When you put that on hold and then you Scroll down.* [¶ 62 – 64 in Transcript interview: 2 participant: 1](#)

*And there are some long sentences. And the variety of text and pictures can be more defined so you you can yeah, it's harder to read. Otherwise you read a whole part and then you see some pictures and when you. "afwisselen" [said in Dutch] Change ... make selections in it, then you. Well, you read and then you you go to the picture and then you recognise it. What you read and then you read again and then, yeah, it's a little bit friendlier. Or maybe using columns? Yeah, that's a possibility, yeah.* [¶ 58 – 60 in Transcript interview: 2 participant: 1](#)

*Yeah, that's for me ... to dive in it. It it made me enthusiastic, because you're reading, but then you have to practise what you read. And then you see possibilities and you have to read back from everything is new, so we have to do new stage stages. But at the end, yeah, we we come to a nice to a nice product. And that was a very good line in it.* [¶ 40 in Transcript interview: 2 participant: 1](#)

*I already told you in the asking forms, that I found the text, the the sentence is too long. So for me I I have to read the whole screen and I find it easier to read in blocks. So maybe in in one or two columns. That would be easier for me to read and maybe a bigger, font, yeah. And the sentences were too long that in. I mean, when I read it, I I I would think, oh here you have to put a point and then taking a breath and then read further also. That's why I said well I I got it, took my breath away because it yeah for reading in my head, it was yeah, too long but.* [¶ 19 in Transcript interview: 2 participant: 2](#)

*Well, as I said it was a little bit information dense, that could be improved by using a slightly different lay-out or something.* [¶ 40 in Transcript interview: 2 participant: 4](#)

*Yeah mostly that it was a bit of a search sometimes, I would see the links and then later I had to remember where they were and had to search for a bit* [¶ 5 in Transcript interview: 2 participant: 5](#)

*Yes, I think there could have been more of a division into categories, so like assistive technology, for physical disabilities, kitchen products etc. Yeah, like more divided into categories. Yeah so you can click like kitchen tools* [¶ 19 – 25 in Transcript interview: 2 participant: 5](#)

## Theme 16: Interesting & educational

Participants describe the content on DDQ as interesting and educational, they feel like they learned about 3D printing and can use this knowledge in the future because it changed the way they think about it.

*Very interesting* [¶ 4 in Diary participant: 1](#)

*It took me a little longer, but the subject and information given are challenging enough to persevere.* [¶ 24 in Diary participant: 1](#)

*This gives me the insight that there are 3D printing possibilities for me too.* [¶ 32 in Diary participant: 1](#)

*provides good information* [¶ 105 in Diary participant: 1](#)

*I have experienced that it also allows me to handle 3D printing well.* [¶ 105 in Diary participant: 1](#)

*I have become very enthusiastic about the complete program. The broad information to come from zero to a 3D design and then the offer to bring this 3D design to a physical end product I have experienced as very positive.* [¶ 159 – 162 in Diary participant: 1](#)

*I learned through Disabled Design Quest that a standard 3D design can be accessible to everyone.* [¶ 167 – 170 in Diary participant: 1](#)

*Interesting* [¶ 4 in Diary participant: 2](#)

*Yes, especially the links to other projects and solutions. Helps you to think in a different way.* [¶ 48 in Diary participant: 2](#)

*Interesting* [¶ 42 in Diary participant: 2](#)

*Yes, otherwise I would not have the courage to find out how 3D printing works. By sharing information, the examples, the weblinks to readymade solutions, to printerpossibilities etc.* [¶ 153 – 156 in Diary participant: 2](#)

*Yes, because I got the opportunity to try the 3D printer guided by the website. Guiding my through all the parts of 3D printing. First the examples, the different kinds of 3D printing, then what material possibilities and then the testing and printing* [¶ 161 – 164 in Diary participant: 2](#)

*I find it really interesting* [¶ 166 in Diary participant: 2](#)

*but I really like that it is well structured and has a step-by-step learning approach and I really like that.* [¶ 12 in Diary participant: 4](#)

*It was interesting, I was surprised at all the possibilities and what can be done using 3D design* [¶ 4 in Diary participant: 4](#)

*I'm very content with the amount of information, although it is a lot, it is very detailed and it's very useful.* [¶ 42 in Diary participant: 4](#)

*Yes it's helpful, but it's also a lot* [¶ 48 in Diary participant: 4](#)

*Well, when it broke when I first tried using it and we decided to print it again, but now on it's side so it would be stronger because of the direction of the printing, we also increase the infill to 60%. This time it was heavier and strong enough and it worked really well for me.* [¶ 129 in Diary participant: 4](#)

*I just browsed through the website and watched some of the content and see hey this is interesting.* [¶ 6 in Diary participant: 4](#)

*At first not that much because I already knew a little bit, but then I opened links and started to delve in further I did learn things.* [¶ 12 in Diary participant: 5](#)

*By gathering information via the website. You can see many examples and you start thinking if maybe you can do something with that, or if you would change something or improve it.* [¶ 32 in Diary participant: 5](#)

*By starting to think about all the things you can do with it. Without the website I don't think I would have ever looked into it. By having all the links with examples* [¶ 35 – 40 in Diary participant: 5](#)

*I feel a little bit more confident, I still don't know how to 3D print and I won't do that, but now I know that I can also have things printed by other people for me. [¶ 156 in Diary participant: 5](#)*

*It gave me the information & links [¶ 160 in Diary participant: 5](#)*

*After being interested in one of the projects on the website, I ordered an item. [¶ 63 in Diary participant: 5](#)*

*And I was, yeah, I was. How do you say that? [Researcher: Pleasantly surprised?] Yeah, that's what I'm looking for. Yeah. So yeah, very positive. [¶ 6 – 8 in Transcript interview: 2 participant: 1](#)*

*It was, yeah, very nice experience and I learnt a lot and I see more possibilities. And. I'm telling other people about it, so yeah. [¶ 86 in Transcript interview: 2 participant: 1](#)*

*Especially the the first part and the some links to YouTube to see from OK, it's in ceramic in metal and I know it's not all for the the home part, but there are possibilities. And for the home part, you have different materials, different colours, so. Yeah, that that was very nice. But you see ... you you start easy. So we have to read it. Then you think from OK. OK, well, let's ... it's tempting to read on. [¶ 48 in Transcript interview: 2 participant: 1](#)*

*I thought it was way out of my reach and now I see oh, when you, see other solutions you can... they share all the information and you can use that. And that's very interesting. [¶ 7 in Transcript interview: 2 participant: 2](#)*

*That can be fixed, but yeah, the the the information given was very useful for me. [¶ 19 in Transcript interview: 2 participant: 2](#)*

*but it made me smile, because I thought it was interesting. [¶ 2 in Transcript interview: 2 participant: 4](#)*

*Because it is a very accessible way to learn about 3D printing and exploring the possibilities and getting used to ... what's needed to create a 3D design and to provide ... to provide input on more accessible equipment. [¶ 32 – 34 in Transcript interview: 2 participant: 4](#)*

*For me, it's the example projects, because then it kind of forms you ideas into practical stuff. [¶ 38 in Transcript interview: 2 participant: 4](#)*

*I couldn't always image how I would use such things, such tools, or how I would make use of these opportunities. But all and all it was fun to learn more about it. [¶ 2 in Transcript interview: 2 participant: 4](#)*

*But we printed it again with different settings and now the tool works well. However, it would be nice if you could adjust the opening of the opener to the thickness of the lid edge. That would be a great challenge to explore with a design specialist. I'd be happy to work on this together with someone more experienced! [¶ 6 in Transcript interview: 2 participant: 4](#)*

*Yes I enjoyed learning and I would like to learn even more. [¶ 46 in Transcript interview: 2 participant: 4](#)*

*But I think for the most part I learned a lot about the possibilities of 3D printing, especially by watching the video's. [¶ 5 in Transcript interview: 2 participant: 5](#)*

*Well I didn't print anything myself, but yeah I enjoyed delving into it, you can learn something from everything you do. [¶ 39 in Transcript interview: 2 participant: 5](#)*

## Theme 17: Thinking about the future

Many participants are relating what they have learned to a change in their mindset and seeing more possibilities to apply the gained knowledge to other areas of their lives and planning to adapt/hack products in the future or 3D print again.

*Maybe so. For a flat bottom I had to remove a small support, that was easy. I attached it with double sided tape. [¶ 140 in Diary participant: 1](#)*

*Thanks for this opportunity, it was very educational and I will definitely delve further into this in the future. I have the whole as a very positive experience :-)  
[¶ 191 in Diary participant: 1](#)*

*Still positive and I will follow the follow-up courses for my own design [¶ 75 in Diary participant: 1](#)*

*Now I chose a ready made printable but I really wanted to design a different shape and a different symbol [¶ 85 in Diary participant: 2](#)*

Yes because I learned about the possibilities and now I want to learn more to be able to design my own solution [¶ 87 in Diary participant: 2](#)

Yes, I would make it larger or more square. And I would like to make changes in the figure. Now it is a Greek letter [¶ 134 in Diary participant: 2](#)

Well, I'm not going to be 3D printing myself, but I am thinking like, if I ever run into an issue in the future and think I would need some kind of assistive product, then I would start thinking about the possibilities that something can be made that could help me. And I would think of a 3D printer to print this. My husband has also gotten more interested in 3D printed throughout this process and is considering looking into it for after he retires. Then maybe he could make things for me, but I also know others who have a 3D printer, so I would consider asking them if they could make something for me, if needed. [¶ 77 in Diary participant: 5](#)

At first I thought I might want a bigger handle, but after using it I realized that I liked to leave it on there and hold it with one hand, then I'm not bothered by the little clip that is on the can while drinking. So it's actually good the way it is. [¶ 130 in Diary participant: 5](#)

Uhh yeah, I was looking for. Yeah, a "lendensteun" [said in Dutch, translated in English to lumbar support] in the in the car?  
Yeah. [Researcher: Lower back support?] Yeah, yeah. To to to look at that, because the chair is is fine, but I haven't an adjustable. back support in it in the car so maybe I thought from now I take sometimes a towel or something and in your back. And when you have a long drive. And maybe I can find something like that. To put on the chair and support my back. [¶ 80 – 82 in Transcript interview: 2 participant: 1](#)

Well, I'm yeah, "leergierig" [said in Dutch] so I want always. [Researcher: Like to learn?] Like to learn new things. And. Yeah, we have a project on work about circular circular economy. And we have repair cafes. And I suggest that one. Well, maybe it's it's something to put there. But you have to need someone, a younger person. To operate it the system, but. That's maybe a nice connection to put a younger ... now it's always older people there in a repair cafe and and that's maybe tempting for younger people to connect with it and make some adjustments for people that are needed and then they see all the possibilities in that. So maybe it's a it's a nice connection. [¶ 70 – 78 in Transcript interview: 2 participant: 1](#)

About it, so I want to. Yeah, I want to learn more about it and I want to know more about it, so yeah. [¶ 18 in Transcript interview: 2 participant: 1](#)

Oh yeah. Yeah, a lot. A lot. Besides that it wasn't ... in my ... in my in my view. To explore things or it's not in my path and this opened a whole new world for me in 3D printing and I even brought it up at my work, so I'm telling about it because I'm enthusiastic. [¶ 20 in Transcript interview: 2 participant: 1](#)

Yes, yes, because. I I already was thinking about the solution for my keys and then the lock and keys and I would really print something like symbols on locks and have the matching symbols on my keys. Just for being ready for future. So when I when I lose my eyesight and I hope it will take a long time. But then now I know, oh, I I won't be dependent on everything so. Now is the time having yeah making these solutions and on the other hand maybe help my father having trouble with finding the right keys for a lot of things. Yeah, I I think I can help him with that and maybe just with colours or or something, but yeah. And I think it will be, yeah make life easier. So on the other hand, and, oh, the the toothbrush solution, I want that too. And there are, oh, I can think about more things that it can be very useful to 3D print, some bespoke solutions for me, yeah. [¶ 39 in Transcript interview: 2 participant: 2](#)

Yes, because I I got very enthusiastic about it and. As I say. You opened the door for me, so I would like to explore more. [¶ 23 in Transcript interview: 2 participant: 2](#)

I I think I would use the website again and then look up the the links it provided and... then just yeah, use a filter and sort the solutions and it may be even ask help on the platform, I saw that was a possibility too, so when I can't find the thing I want I think I would ask for someone to design something for me and then print it for me, yeah. [¶ 17 in Transcript interview: 2 participant: 2](#)

Yeah, if I had loads of time and energy to do so, yeah. I think it's fun to see if you can ... using a design tool to be creative and to figure out and to explore what works or not. [¶ 26 in Transcript interview: 2 participant: 4](#)

Because it is a very accessible way to learn about 3D printing and exploring the possibilities and getting used to ... what's needed to create a 3D design and to provide ... to provide input on more accessible equipment. [¶ 32 – 34 in Transcript interview: 2 participant: 4](#)

*I think I would be hacking, because I feel like hey I can adapt something that will then be more suitable for me or others I knew. It's more like not creating new things, but hacking existing equipment that can improved for a range of disabled people. [¶ 48 in Transcript interview: 2 participant: 4](#)*

*Yeah I'm quite happy with it, it's nicely hanging in my kitchen now, I tried it out already. And I was looking at maybe wanting a wider handle to it, like I have with my adapted cutlery, but then when using it I realized that that wouldn't be convenient because now it's nice and small and it works just fine like this and I can hold onto the can and hold the tool onto the can with my pointer finger and this keeps the lip of the can out of the way while drinking which makes it a little easier to drink. [¶ 7 in Transcript interview: 2 participant: 5](#)*

*Well then I would start designing it in my head and start thinking of how I would want it to be and then I would ask someone I know if that was possible for them to 3D print it for me. [¶ 17 in Transcript interview: 2 participant: 5](#)*

*Yeah if there where new projects added, then I would occasionally when I'm trying to come up with a solution for something then I would think to have a look on the website to see if other people have come up with things, or to get inspiration. [¶ 27 in Transcript interview: 2 participant: 5](#)*

*Yeah if I would have ideas about it, definitely. [¶ 41 in Transcript interview: 2 participant: 5](#)*

*It's a bit hard to say, I feel like I haven't really had enough experience with 3D printing to really know for sure, but I do think that it has changed something in my thinking, that I don't always have to buy something, but that I can also come up with my own ideas in my head and then the possibility of having that printed, so yeah I guess it did improve a bit. [¶ 9 in Transcript interview: 2 participant: 5](#)*

## Theme 18: Product doesn't fit with needs

Participants describe some of the problems they currently have with products, because these products don't fit with their needs, they want to change this, but don't always know how, for have an idea for how but don't know how to put it into practice.

*The mouse isn't. And good for the left hand design. Yeah, so. [¶ 68 in Transcript interview: 1 participant: 1](#)*

*With cooking and stuff. So using a knife to like put make things very like cut things very small, like big things is fine, but like getting it very small because I can't put as much pressure on my hands to like I can't pull down as much with one hand. So I have to use both hands to push down. So that was something something that would be a lot if that would change like how you would hold a knife or I think. [¶ 40 in Transcript interview: 1 participant: 3](#)*

*One, it's the. It's the cooking hob. It's the cooking hob. I'm very frustrated by because before I had this one. I had another one and all those those. Touch. How do you call them? Those touch screen buttons? How do you call them those those touch screen button they were, they were exactly. In the middle of the of the thing they were, they were in front in the middle of the thing and all those. How do you call it English? All those push dingy thingies, all those keys they were, they were. Exactly under my fingers when I grab the the. The the kitchen top the kitchen top to be to be secure and to stand secure. There are always under my fingers, so I was constantly touching those those buttons. So constantly when I was cooking I put off the stove and I put it on again and put it off and put it on and put it off and put it so that was. Kind of a frustration and it was a hell of a job to find another one that's not. That's designed in such a way that I have room to put my hands on. So. So, yeah, that's the thing. I thought, OK, I did this for for many, many years now. Now I'm. I'm sort of. Well, I'm fed up with it. Let's, let's get another one. And still it is better because they are. These are sliders, but it's very hard to find a decent. [¶ 63 – 75 in Transcript interview: 1 participant: 4](#)*

*a fork, it's an adaptive fork with a thicker handle, and I've already been back with it to the store, because there is always water that get's in the handle, so when you're eating, water trickles out, and I've been back to the store and they couldn't come up with a solution for it, I've even sent an email to the company [¶ 38 in Transcript interview: 1 participant: 5](#)*

*Our camper has a steering lock from the Bearlock brand. Because the lock is under the dashboard and starting the engine is keyless, I forget to use it. Both when parking and before driving away. The gummy bear can help me remember to use the lock. [¶ 127 in Diary participant: 1](#)*

*I struggle with finding the right key for differ locks [¶ 67 in Diary participant: 2](#)*

*It's quite frustrating because I thought there should be quite a simple solution, for my problem so to say, because my wrist is fixed so I can't turn my wrist, and there are always tools that highlight the abilities of a fairly normal wrist, and this tool is quite simple and doesn't require twisting. [¶ 66 in Diary participant: 4](#)*

*Well, I have some handproblems and this seemed like a handy assistive product. [¶ 67 in Diary participant: 5](#)*

*Uhh yeah, I was looking for. Yeah, a "lendensteun" [said in Dutch, translated in English to lumbar support] in the in the car? Yeah. [Researcher: Lower back support?] Yeah, yeah. To to to look at that, because the chair is is fine, but I haven't an adjustable back support in it in the car so maybe I thought from now I take sometimes a towel or something and in your back. And when you have a long drive. And maybe I can find something like that. To put on the chair and support my back. [¶ 80 – 82 in Transcript interview: 2 participant: 1](#)*