BACHELOR'S THESIS

CO-DESIGNING AN ONLINE PLATFORM FOR ASD

about co-designing with adolescents on the autism spectrum and what such a platform would look like

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ABSTRACT

Around 1% of the population worldwide is diagnosed on the autism spectrum. Partly because of their difficulties with social and nonverbal communication and interaction, the internet offers a great place for adolescents on the spectrum to organise themselves. They are seen to share ideas and experiences or ask each other for advice for dealing with certain difficulties in their daily life, caused by the Autism Spectrum Disorder (ASD).

In this paper, a designated online platform for adolescents on the autism spectrum was developed in close collaboration with the target group. For this, a co-design approach consisting out of 3 iterations was used. The co-design sessions were conducted with 3 participants on the autism spectrum with ages ranging from 13 to 15.

Research on the characteristics of ASD that could have an influence on the co-design process was done and possible solutions for the accompanying challenges were formed. During the iterations of the process, these characteristics were evaluated and finally the expected and experienced influence of these on the collaborations were compared. Simultaneously, a prototype of the online platform was developed and updated every iteration of the co-design.

ACKNOWLEDGEMENT

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CHAPTER 1 INTRODUCTION

With the rise and accessibility of the internet, individuals on the autism spectrum[1], are increasingly seen to turn to platforms on the internet in order to organise themselves. Wrong Planet [2], a web-based community designed specifically for individuals on the autism spectrum, has over 300k threads and groups (Subreddits) on Reddit count almost 100k subscribers [3]. On these social groups within these platforms, individuals on the spectrum are seen to share ideas and experiences or ask each other for advice for dealing with certain difficulties in their daily life, caused by the Autism Spectrum Disorder (ASD).

This raises the idea that there may be a demand for a designated platform for those individuals on the autism spectrum, where they can unify, talk to each other and seek advice. This leads to the topic of this Graduation Project, where such a platform was built together with the target group: adolescents (between the age of 10 and 19 [4]) on the autism spectrum. This was done with the use of a co-design approach, where the main focus was to introduce the stakeholders involved as an active party in the design and development process. Co-design combines generative/exploratory research (understanding the user needs) with developmental design and thus helped to ensure that the resulted product meets the needs of the target group and their usability requirements.

1.1 AUTISM SPECTRUM DISORDER

Autism Spectrum Disorder refers to a broad range of neurodevelopmental disorders that are characterized by problems with social communication and interaction, repetitive behaviours and challenges with speech and nonverbal communication. On the long term, these problems and challenges may cause difficulties for the individuals in achieving and maintaining a job and keeping relationships. Around 1% of the population worldwide is diagnosed on the autism spectrum[5]. Until 2013, ASD was divided into 4 categories: Autistic Disorder, Childhood Disintegrative Disorder, Pervasive Development Disorder-Not Otherwise Specified (PDD-NOS) and Asperger Syndrome but

[1] There are some controversies and discussions going on about how to reference this. In this paper, there is chosen to refer to "people on the (autism) spectrum", because this naming was observed to be the most neutral.

[2] https://wrongplanet.net/

[3] https://www.reddit.com/r/ASD and https://www.reddit.com/r/aspergers

[4] https://www.who.int/maternal_child_adolescent/adolescence/en/

[5] https://www.autism.org.uk/about/what-is/myths-facts-stats.aspx

in that year the American Psychiatric Association (2013) merged these four distinct diagnoses into the umbrella diagnosis of Autism Spectrum Disorder. This is the diagnosis that will be referred to during this project.

1.2 RESEARCH QUESTION

The research question for this paper was as follows:

"How could an online platform be developed with the use of a co-design approach for and with adolescents on the autism spectrum?"

To answer this research question, this project was divided into two main paths: the co-design process with the corresponding sub-question:

"Which characteristics of ASD have an influence on the co-design process?"

and the development of the online platform, with the corresponding sub-question:

"What would a designated online platform for ASD look like?"

The latter was more used as a tool to gain insights about the process of co-designing with adolescents on the spectrum. The different paths are visualized during this paper as follows: chapters concerning co-design are marked with a black square, chapters about the development of the online platform are marked with a white square and chapters that involve a combination of both are marked grey (see Figure 1).

1.1 CO-DESIGN
1.2 ONLINE PLATFORM
1.3 BOTH

Figure 1, example markings

1.3 OUTLINE

In the first part of this paper, a theoretical framework is formed. State-of-the-Art research on existing and similar platforms, such as Reddit and Wrong Planet, was conducted to identify their strengths and weaknesses and explore what this new platform has to incorporate. In this part, a literature review was done about the general characteristics of ASD, the influence of these characteristics on the co-design process and the value of online sharing for adolescents on the autism spectrum.

Next, in the second part of this paper, different approaches for (co-)design were elaborated and a method for the co-design of this project was formed. This method was used to conduct the co-design

for the development of the online platform with 3 participants ranging from the age of 13 to 15 on the autism spectrum.

In the third part of this paper, these co-design sessions, the influences of the characteristics of ASD on the co-design process and the different prototypes of the online platform were elaborated. These results were then compared and concluded in the following part, were the research question was answered.

Thereafter, these results, amongst some other interesting points, were discussed. Also, in collaboration with Alan Deuvletian and Wojtek Jarosinski, two more discussions were held: about the differences in the co-design approaches (Alan and Wojtek used a web-based approach of the co-design) and about the different outcomes of the online platform per user group. Out of the first, a concluding comparison of the advantages and disadvantages of the different approaches was made.

CHAPTER 2 STATE OF THE ART REVIEW ON ASD AND THE INTERNET

In this chapter, a literature review on the characteristics of ASD and the influence of these on the co-design was done in order to identify possible challenges that need to be taken into account while setting up the co-design process. To better understand the target demographic and the importance of the development of the platform, the value of online sharing for individuals on the autism spectrum was also reviewed. Lastly, to learn about problems with existing online platforms, State-of-the-Art research on these was conducted.

2.1 CHARACTERISTICS OF ASD

In Table 1, the different characteristics of ASD according to autism Speaks[6], an organization for ASD advocacy from the US are compared with their 'matching' DSM-5 diagnostic criteria.

Table 1, characteristics of ASD

Autism Speaks	DSM-5
Loss of previously acquired speech, babbling or social skills	
Avoidance of eye contact	A2. Deficits in nonverbal communicative behaviours used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.
Persistent preference for solitude	A3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behaviour to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to the absence of interest in peers.
Difficulty understanding other people's feelings	A1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions. A2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.

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[6] https://www.ASDspeaks.org/learn-signs

	A3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behaviour to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to the absence of interest in peers.
Delayed language development	
Persistent repetition of words or phrases (echolalia)	
Resistance to minor changes in routine or surroundings	B2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns or verbal-nonverbal behaviour.
Restricted interests	B3. Highly restricted, fixated interests that are abnormal in intensity or focus.
Repetitive behaviours (flapping, rocking, spinning, etc.)	B1. Stereotyped or repetitive motor movements, use of objects, or speech.
Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours	B4 Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment.

For readability purposes, the characteristics as defined by Autism Speaks will be used during the rest of this project. For this project, there are some characteristics that are more important to take into account while working together with adolescents than others. In Table 2, the possible influence that the characteristic could have on collaboration are elaborated and the importance of this characteristic are labelled with either low (L), medium (M) or high (H).

Table 2, characteristics of ASD and their influence on collaboration

characteristic of ASD	influence on collaboration	label
Loss of previously acquired speech, babbling or social skills	Lack of social skills may cause difficulties in the general process of working together.	M
Avoidance of eye contact	May cause the adolescent to feel uncomfortable but does not influence the collaboration in a negative sense.	L
Persistent preference for solitude	Could be an issue while working together, because of the presence of the designer, teacher, other participants, etc.	H
Difficulty understanding other people's feelings	May be a bigger issue when working in a group than individually. Also, could prove difficulties in the relationship between the designer and participant.	H
Delayed language development	Could cause difficulties in voicing their opinions.	H
Persistent repetition of words or phrases (echolalia)	Could cause difficulties in voicing their opinions.	H
Resistance to minor changes in routine or surroundings	Could cause difficulties when working together in an unfamiliar environment and with a badly planned out schedule.	H
Restricted interests	Could have an influence on the concentration and motivation of the participant during the session..	H
Repetitive behaviours (flapping, rocking, spinning, etc.)	Does not really have a negative influence on the collaboration.	L

Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours	Could distract the participant during the session or cause distress which has a negative influence on the general atmosphere of the session or even the wellbeing of the participant.	H

2.2 THE VALUE OF ONLINE SHARING

To identify what value online sharing via the internet offers for individuals on the autism spectrum, again, a literature review was done. Multiple factors that contribute to this value were found.

The first factor is that online discussion forums, such as Reddit and Wrong Planet, function as supportive communities for both individuals on the autism spectrum as their family. Nguyen, Phung and Venkatesh (2013) point out that these types of platforms are used by individuals on the autism spectrum to connect and share experiences, find answers to health questions and express themselves. Jordan (2010) notes that they can also help alleviate the symptoms by talking to others who experience the same and help reduce possible social isolation, also for the families, by creating a stronger sense of community. Thus, it could be stated that the internet offers a good opportunity for individuals on the autism spectrum and their families to find each other and unite.

Secondly, the fact that the internet makes it easier for individuals on the autism spectrum to group with similar others and join forces, could also help with creating more overall awareness. Davidson (2008) notes that individuals on the autism spectrum use the internet, besides for social support, for claiming a voice in society. Jordan (2010) adds that the use of online forums and blog posts indeed could help individuals on the autism spectrum and their families to advocate for themselves by taking away social boundaries. Therefore, it could be concluded that the internet may help with strengthening this group of people in civilization.

As a third factor, the internet could help individuals on the autism spectrum with easier communication by eliminating complex aspects of real-life communication. Davidson (2008) states that the internet has been shown to be an appropriate and unusually accommodating medium for those on the autism spectrum because of the characteristic preferences for communication at a socio-spatial distance. Benford and Standen (2009) add that aspects that contributed to the internet being a potentially more comfortable communication medium included: visual anonymity, a different and more flexible pace of communication and the permanence of text. Putnam and Chong (2008) also note that it accommodates the ASD need for sameness because of the predictable and familiar characteristics. In other words, the internet takes away the difficulties of real-life communication by

offering a sense of distance and anonymity, a more accommodating pace, higher predictability, and stability.

The fourth, and arguably one of the more important factors, is that communication via the internet decreases the levels of stress as experienced in real life interactions. Benford and Standen (2009) and Putnam and Chong (2008) agree on the fact that the use of a computer or the internet for communication helps to reduce the complexity of social interactions with others by allowing the users to set their own pace. Therefore, individuals on the autism spectrum were able to lessen the emotional, social and time pressures as experienced in offline situations while communicating through the internet, which could contribute to an overall lower sense of stress.

Lastly, the internet could help increase research efforts and create fundraising opportunities. Jordan (2010) points out that the Internet increases the availability of information which helps to raise public awareness and knowledge of a subject such as ASD. Thus, this new recognition could attract more attention from researchers, companies, and investors.

2.3 ASD AND CO-DESIGN

To find out what the challenges are that need to be taken into account while setting up the co-design process with individuals on the autism spectrum, the characteristics of ASD that could have an influence on this need to be identified first. For this, a literature review was done.

The first important characteristic that needs to be taken into account while designing the co-design process, is the difficulty of communication. Francis, Balbo and Firth (2009) list communication problems in understanding others and being understood as the first characteristic of the 10. According to them, this characteristic could cause challenges in the ability to understand the given instructions and interaction with the other participants. Schall and McDonough (2010) add that individuals on the autism spectrum have significant challenges with reciprocity in communication and the use and understanding of non-verbal communication. Bossavit and Parsons (2016) point out that specific methods must be developed when doing a co-design with the involvement of individuals with special educational needs such as ASD. Their particular communication needs and preferences make it difficult to participate in standard methods like questionnaires or personas. Millen, Edlin-White and Cobb (2010) also observe limited language and communication skills as a characteristic that requires a more considerate approach when involving individuals on the autism spectrum in the co-design process, especially when attempting to elicit the participant's opinion while evaluating the

design ideas. Therefore, it could be concluded that difficulties in communication are indeed a challenge for co-design, that needs to be taken into account while setting up this process.

The second characteristic that may have an influence on the co-design process, is difficulty in routine changes. Francis et al. (2009) mention difficulties with disruption of routine as the third characteristic on their list. According to them, this characteristic has a negative influence on the ability to engage with people they have never met before, which could lead prevent the participant from opening up and could possibly lead to anxiety. Also, dealing with unknown situations and being asked to perform unfamiliar tasks may be relatively hard for them. Schall and McDonough (2010) support that many individuals on the autism spectrum indeed resist or have difficulties with changes in routine, upon which Millen et al. (2010) add that any changes to their environment or routine prove difficult for individuals on the autism spectrum to understand or adapt to because they find it hard to be flexible in their thought processes. Thus, while setting up the co-design sessions with the participants, there needs to be paid attention to this characteristic.

The third important characteristic is the lack of imaginary skills. Francis et al. (2009) include cognition problems like poor comprehension of abstract concepts and figures of speech as the sixth item on their list. They state that this characteristic could be problematic for the co-design process because it affects the ability to play a role and imagine hypothetical situations. Millen et al. (2010) point out that poor imaginative skills as seen in individuals on the autism spectrum could cause difficulties, for example, with the use of lo-fi prototypes, because this requires a high use of imagination by the participant. Bossavit and Parsons (2016) add that the use of visual and structured methods and providing concrete examples while co-designing with individuals on the autism spectrum turn out to be more successful than the use of abstract concepts for discussion, due to their lack of imagination. This statement is supported by Benton, Johnson, Ashwin, Brosnan and Grawemeyer (2012), by noting that communication difficulties, including lacking imagination skills, are one of the characteristics in ASD that present a unique challenge for designers intending to work together with this group. Thus, while setting up the co-design process, it is also important to keep in mind the limitation of the imagination of these participants.

Lastly, there needs to be thought about the motivation of the participants. Another characteristic, as listed by Francis et al. (2009) is a high likelihood that individuals on the autism spectrum will not be motivated to take part in activities that they do not find interesting. This could be problematic in a

co-design process, where full engagement of all the participants is very essential. Millen, Cobb and Patel (2011) point out that researchers conducting a co-design session should always be aware of the fact that the method of the session may need to change at short notice due to the participants sudden shortened attention span or unwillingness to cooperate after a bad day. Therefore, it needs to be kept in mind that flexibility is very important when co-designing with individuals on the autism spectrum, because other methods may need to be formed during the session to keep the participant interested and engaged.

2.4 EXISTING PLATFORMS

To find out about the existing options and their shortcomings, 4 platforms (Reddit, Facebook, Twitter and Wrong Planet) were explored as part of the State-of-the-Art. The problems with these platforms were identified in order to learn from them and incorporate these into the new platform.

2.4.1 REDDIT

Reddit is a bulletin-board based American social news, media aggregation and discussion website developed in 2005. Reddit is at the moment of writing the 6th most popular website in the United States and ranks 21th worldwide with 542 million visitors every month, according to Alexa [7]. The website is broken up into more than a million so-called 'subreddits', which are communities or groups within the platform and counts 330 million 'redditors' [8] (users). A key feature of the website is the use of up- and downvotes, where users can cast negative or positive votes on a post. The amount of up- and downvotes determines the visibility of the post on the website, so popular posts are displayed to most people.

When searching for 'subreddits' about ASD, results show up very easily. In Figure1, the 6 top results are shown. It can be seen that these include communities for individuals on the autism spectrum (1.4k members), aspergers (50.5k members) and ASD (42.4k members) (both state that they are open for everyone within the autism spectrum), girls with asperger (15.9k members), partners of individuals on the spectrum(2.4k members) and a general group about ASD (3.9k members).

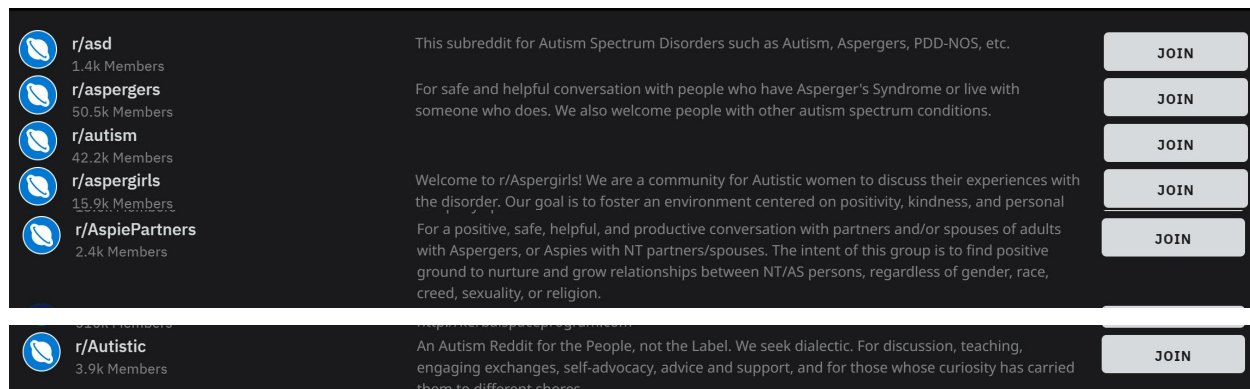
[7] https://www.alexa.com/topsites

[8] https://expandedramblings.com/index.php/reddit-stats/

r/asd 1.4k Members	This subreddit for Autism Spectrum Disorders such as Autism, Aspergers, PDD-NOS, etc.	JOIN
r/aspergers 50.5k Members	For safe and helpful conversation with people who have Asperger's Syndrome or live with someone who does. We also welcome people with other autism spectrum conditions.	JOIN
r/autism 42.2k Members		JOIN
r/aspergirls 15.9k Members	Welcome to r/Aspergirls! We are a community for Autistic women to discuss their experiences with the disorder. Our goal is to foster an environment centered on positivity, kindness, and personal	JOIN
r/AspiePartners 2.4k Members	For a positive, safe, helpful, and productive conversation with partners and/or spouses of adults with Aspergers, or Aspies with NT partners/spouses. The intent of this group is to find positive ground to nurture and grow relationships between NT/AS persons, regardless of gender, race, creed, sexuality, or religion.	JOIN
r/Autistic 3.9k Members	An Autism Reddit for the People, not the Label. We seek dialectic. For discussion, teaching, engaging exchanges, self-advocacy, advice and support, and for those whose curiosity has carried them to different shores.	JOIN

Figure 2, communities for ASD on Reddit [9]

The downside of the use of Reddit is that it does not present a clear overview. There a multiple subreddits dedicated to ASD, which makes it difficult to keep track of them all and the system of up- and downvotes lead to an unorganized post structure with different topics all over the place. Also, a lot of people in the target group (adolescents on the autism spectrum) may not be aware of these communities, since Reddit is not specifically intended for them or they just do not know about it.

2.4.2 FACEBOOK

An even more popular website than Reddit and on the 3d place in the US on Alexa's ranking, is Facebook, with 2.32 billion visitors per month [10]. Facebook may be the most well-known social media platform and offers the possibility to create groups for certain topics as well. When searching for groups about ASD, many groups showed up. In Figure 2, some of the results are shown. Notable was, that a certain part of these groups was not only directed at the individuals on the spectrum, but also to their parents or partners.

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[9] https://www.reddit.com/search?q=asd

[10] https://newsroom.fb.com/company-info/

Figure 3, some groups for ASD on Facebook

The biggest problem with these groups on Facebook is the fact that there are so many. As can be seen in Figure 2, these groups are not nearly as big as the ones on Reddit, because the members are spread all over them (e.g. there are already 2 groups shown on the example that are just dedicated to the Netherlands). For Facebook applies the problem with the target group as well, a lot of the adolescents on the spectrum may not be aware of the existence of the groups, either because they do not use Facebook at all, or they do not know about the group-features.

2.4.3 TWITTER

Another popular social media website, number 8 on the ranking in the US by Alexa, is Twitter. As opposed to both Reddit and Facebook, Twitter does not provide the option to make groups or communities. The website is based on small messages, called 'tweets', up to 280 characters, that users post on the platform. To label a tweet to a certain topic or theme, users can add so-called 'hashtags' to their tweet. In Figure3, an example can be seen of how the user incorporates the hashtags #askingautistics and #actuallyautistic in the tweet, to aim it at a certain group of people. Another hashtag that is observed to be used a lot by individuals on the spectrum is #neurodiversesquad.

Figure 4, example of a thread on Twitter with the hashtags #askingautistics and #actuallyautistic[11]

This is also where the problem with Twitter can be seen: there is no option to really form a community. The use of the hashtags does not provide a clear overview, does not give insight into the members of a group and makes certain post quite hard to find, because they are all over the place. Another problem with Twitter is that a really big part of the target group is not represented here. Either because they do not use Twitter at all or because they are not aware of the specific hashtags that are used to communicate with the community.

2.4.4 WRONG PLANET

The only website that was found that specifically targeted people on the spectrum, is Wrong Planet [12]. Wrong Planet is an online platform, created for individuals on the autism spectrum, and hosts a blog as well as a forum. In Figure 4, a partly overview of the forum can be seen. As shown, the people on the forum are quite active and the amount of threads (topics) is very high. This raises the question of why Wrong Planet is fairly unknown and why a big part of this group still turns to other websites such as Reddit, Facebook and Twitter.

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[11] https://twitter.com/hashtag/actuallyautistic?lang=en

[12] https://wrongplanet.net/

Forum

General Discussion	Total Posts	Total Threads	Last Post
General Autism Discussion Talk about anything that has at least something to do with Autism, Asperger's, ADHD, and life. Other unrelated discussion belongs in the Random Discussion forum.	1,433,077 posts	77,003 threads	Latest post by KeepOn at 58 minutes ago
Getting to know each other Let's use this forum to get to know each other better. This is also the place to say "Hi! I'm new" and start as a new member.	213,299 posts	19,386 threads	Latest post by AnonymousAnonymous at Yesterday, 5:04 pm
Autism Politics, Activism, and Media Representation Are you fed up with the misrepresentation of Autism in the media? Looking to protest? How about planning a campaign to spread awareness? Discuss the politics, activism, and advocacy of Autism and Asperger's in this forum.	70,296 posts	4,595 threads	Latest post by magz at 50 minutes ago
News and Current Events Interested in the latest news about autism or that weird thing they found at the bottom of the lake?	210,573 posts	13,884 threads	Latest post by cyberdad at 16 minutes ago
Bipolar, Tourettes, Schizophrenia, and other Psychological Conditions If you have Bipolar, Tourettes, or another condition, please make Wrong Planet your home! We welcome all neurodiverse individuals, with or without Autism! Have something other than Autism? This is your place!	31,674 posts	3,198 threads	Latest post by nick007 at Yesterday, 11:13 pm

Coping In Life	Total Posts	Total Threads	Last Post
Parents' Discussion This forum is for discussing the various issues related to parenting children with Asperger's Syndrome and Autism.	129,891 posts	9,730 threads	Latest post by magz at Today, 2:58 am
Love and Dating Whether you're a smooth-talking Adonis or a lonely heart, this forum can be used for discussing relationships and romance.	530,129 posts	19,690 threads	Latest post by **funeralxempire** at 45 minutes ago
The Haven For those times when you're feeling blue and need to get a little help from your friends. Discuss all those issues that are not covered by the other forums in the Coping in life category.	262,479 posts	17,462 threads	Latest post by **sly279** at Today, 2:46 am
Social Skills and Making Friends Having Autism means you may not have great social skills, but that doesn't mean you can't learn them! Discuss friendship and social skills here!	129,635 posts	10,927 threads	Latest post by shortfatbalduglyman at Yesterday, 9:34 pm
School and College Life How is life at school? Talk about anything from grades, to classmates to your favorite subjects. Whether you dislike or enjoy school this is for you.	52,221 posts	5,374 threads	Latest post by Antrax at Yesterday, 12:31 pm
Work and finding a Job When you grow up you'll be put in a container called a cubicle. The bleak oppressiveness will warp your spine and destroy your capacity to feel joy. Luckily you'll have a boss like me to motivate you with something called fear. Discuss work and your job in this forum!	63,446 posts	6,863 threads	Latest post by breaks0 at Yesterday, 7:10 pm
Health, Fitness, and Sports Do you have a healthy diet? Are you a tennis pro or is trying to find photographs of Anna Kournikova the extent of your interest in sports? Can you bench press? Do you know the meaning of pain? How many pushups can you do? Drop and give me 50...	48,564 posts	4,696 threads	Latest post by TUF at 58 minutes ago

Figure 5, the forum on Wrong Planet[13]

A possible answer to this question could have something to do with the interface. The website looks quite outdated and is not very user-friendly in practice. Another problem with Wrong Planet, is the fact that they also do not include the whole target group, which is quite questionable for a website that is specifically created for this target group. When looking at the ages of the users, there could be

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[13] https://wrongplanet.net/forums/

concluded that there were zero to none younger users (adolescents) present on the website, which will be the target group for this Graduation Project.

2.5 CONCLUSION OF STATE OF THE ART

2.5.1 THE CHARACTERISTICS OF ASD AND CO-DESIGN

In the first part of this chapter, the general characteristics of Autism Spectrum Disorder were elaborated and labelled of either low, medium or high importance for the collaboration. In the third part of this chapter, a literature review was done on the specific characteristics of ASD that could cause difficulties for the co-design process and 4 characteristics were found. In the table below, the outcome of the literature review (in *cursive*) is combined with the characteristics that were labelled high in the first part and the possible influence that they could have on the co-design process is discussed.

Table 3, characteristics of ASD with a high labelled influence on co-design

characteristic of ASD	influence on co-design
Persistent preference for solitude	Could be an issue while working together, because of the presence of the designer, teacher, other participants, etc.
Difficulties in understanding other people's feelings	May be a bigger issue when working in a group than individually. Also, could prove difficulties in the relationship between the designer and participant.
Delayed language development *(difficulties in communication)*	Could cause difficulties in voicing their opinions.
Persistent repetition of words or phrases (echolalia)	Could cause difficulties in voicing their opinions.
Resistance to minor changes in routine or surroundings *(difficulties in changes in routine, environment, and situations)*	Could cause difficulties when working together in an unfamiliar environment and with a badly planned out schedule.
Restricted interests *(exclusive motivation for only their specific interests)*	Could have an influence on the concentration and motivation of the participant during the session.
Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours	Could distract the participant during the session or cause distress which has a negative influence on the general atmosphere of the session or even the wellbeing of the participant.
Lack of imaginary skills	Affects the ability to play a role and imagine hypothetical situations and could cause difficulties with the use of lo-fi prototypes, because this requires a high use of imagination by the participant.

The characteristics in the table had to be considered when setting up the co-design process and ways to deal with these challenges needed to be found. For this, further research on different co-design strategies was done in the following chapter (Chapter 3).

2.5.2 THE VALUE OF ONLINE SHARING

In the second part of this chapter, 5 different factors that give online sharing via the internet value for individuals on the autism spectrum were found:

- The first factor is that online discussion forums offer a good opportunity for individuals on the autism spectrum and their families to form communities.
- The second factor is that the internet could help individuals on the autism spectrum with claiming their voice in society and creating more awareness for this group of people.
- The third factor is that the internet takes away the complexity of real-life communication and therefore offers an appropriate medium for communication for individuals on the autism spectrum.
- The fourth factor is that communication via the internet decreases the overall sense of stress as experienced in real life interactions.
- The last factor is that the internet could also help increase research efforts and fundraising opportunities by creating more recognition for ASD.

These factors offer a deeper understanding of the relationship between the internet, online sharing, and individuals on the autism spectrum. This understanding of the target group could be used while co-designing together with these people to build the designated online platform. These factors also provide some sort of guideline for core features that need to be included on the online platform, like a forum option.

2.5.3 PROBLEMS WITH EXISTING PLATFORMS

Lastly, 3 main problems with existing platforms were identified.

- The first one had to do with a lack of overview of both the available groups and communities and the posts and messages.
- The second was the shortage of ease of use and user-friendly interfaces.
- Lastly, a problem with the target group was found, where all the discussed platforms did not include the whole target group, but mainly the group of adolescents.

<div align="center">

CHAPTER 3 **METHOD**

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For the design of the online platform, there was made use of a co-design process. In Chapter 2, some challenges that come on the autism spectrum that needed to be taken into account while setting up the co-design process were identified. With these in mind, a method was formed in this chapter. To do that, different strategies and approaches for the co-design were discussed and elaborated. Out of this, the best fitting method was constructed (Figure 9 on page 26).

3.1 CLASSICAL VS CO-DESIGN

Before the method could be constructed, it was important to take a closer look at the general features of co-design. To understand the principle of co-design, a comparison between the classical user-centered design and co-design process was made.
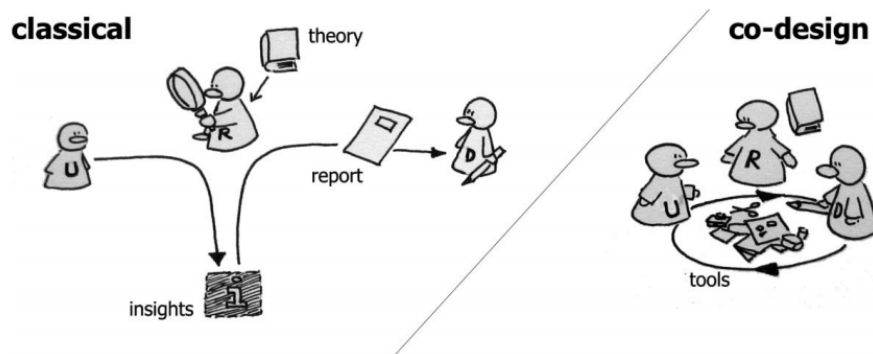

Figure 6, classical vs co-design (Sanders & Stappers, 2008)

In the figure above (Figure 6), the role of users, researchers, and designers in the classical design and co-design process are pictured. It can be seen, that there is a clear separation in the classical approach between the user, researcher, and designer. The researcher uses theoretical research to gain insights and supplements this with observations of the user. The gathered information will be published in a report, that is handed to the designer. In the classical approach, these 3 entities are working for, instead of with, each other. However, in the co-design approach, it can be seen that the researcher, user, and designer are pictured together, with a pile of 'tools' in the middle of them. In this case, the 3 entities are working together very closely to generate the best insights.
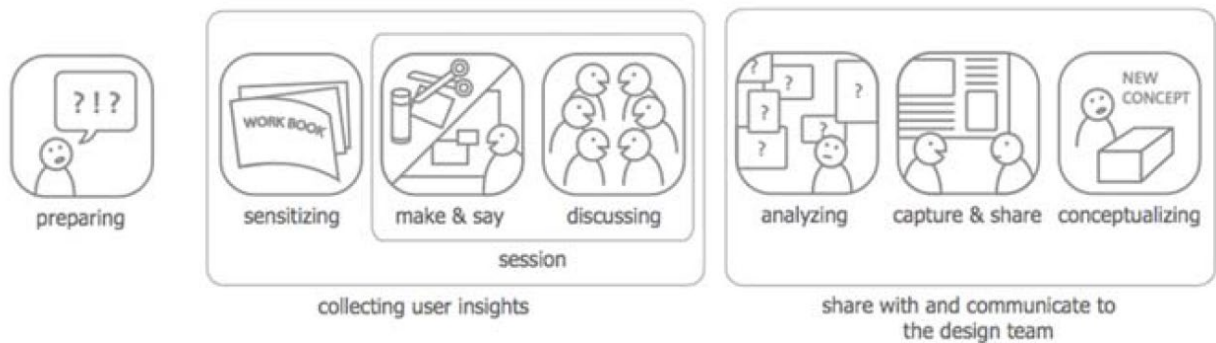
Figure 7, the 3 phases of co-design (Holmlid et al., 2015)

In Figure 7, Holmlid et al. (2015) picture the 3 different phases of co-design: preparing, collecting and communicating. In the first phase, preparing, the researcher/designer starts to prepare the co-design sessions that will take place with the users. In this phase, literature research could be conducted and a method to gain user insights will be formed.

With these preparations, the researcher/designer enters the next phase of collecting user insights, which could be separated into 3 different parts. The first one is sensitizing, which could be seen as an optional part. In this part, the researcher/designer is using so-called sensitizing toolkits (Sleeswijk Visser et al, 2005) to spark the imagination of the participants. This could also be skipped, for example when working with prototyping. The next 2 parts are where the co-design sessions with the users take place: make & say and discussing. The sessions could also be divided into 3 categories: insight generation, concept exploration and converging towards specification (Holmlid et al, 2015). Dependent on the specific category, the researcher/designer makes use of different tools to collect user insights, such as context mapping, speed-sketching, and prototyping.

The last phase is about sharing and communicating the collected user insights with the design team. The researcher first analyses the data, captures and shares the insights with the other designers in the team and finally this information will be translated into the concept: this could either be a Lo-Fi or Hi-Fi prototype or close to a final product.

When working with a more linear approach to design, these phases could be only completed once. On the other hand, when working with a more iterative approach like the Creative Technology Design Process (see paragraph 3.2 on page 23), these phases will be executed multiple times where every iteration ends with a new version of the prototype. In the case of this project, there was chosen to do

3 iterations, in order to make sure that there is enough room to explore the different stages of the development process and identify and eliminate as many errors as possible in a short time span.

3.2 CREATIVE TECHNOLOGY DESIGN PROCESS

During this project, the Creative Technology Design Process (Mader & Eggink, 2014) was used as a starting point. The Creative Technology Design Process consists of 4 phases: ideation, specification, realisation, and evaluation. In the first phase, ideation, the design problem is defined, relevant research is done, and initial ideas are generated. The second phase, specification, is entered when some kind of design concept is formed. In this phase, the usability and functionality requirements are formed. For this, storyboards or user scenarios could be used. After this phase, the realisation phase is initiated. In this phase, the usability and functionality requirements that were formed in the specification phase are realized and a prototype will be made. Lastly, in the evaluation phase, the prototype of the realisation phase will be tested through for example user or function testing and it will be decided if all the requirements are met. After

Figure 8, the Creative Technology Design Process (Mader & Eggink, 2014)

the 4th phase of evaluation, the designer decides whether or not the prototype meets all the requirements and either new requirements are formed, or the prototype will be developed into a final product.
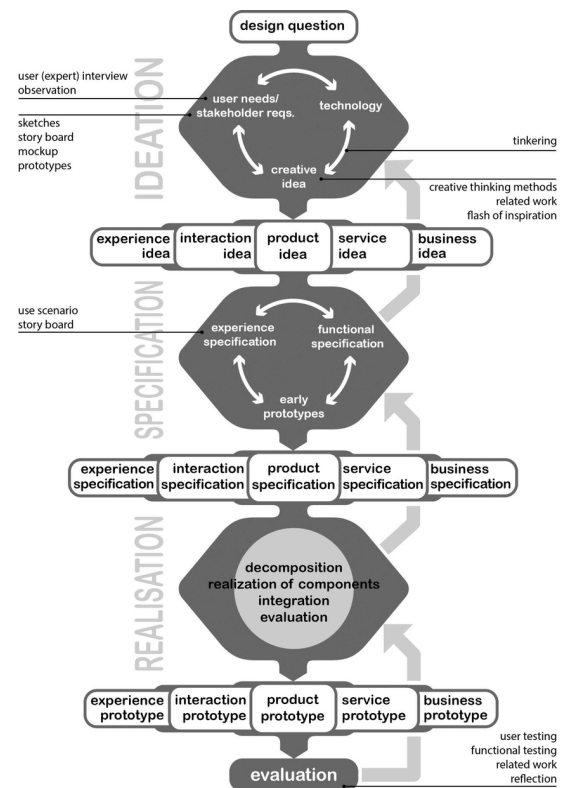
The place of the co-design phases, as elaborated on in the previous paragraph, could be compared with these 4 phases. In that case, the 3 categories of collecting user insights with co-design sessions (Holmlid et al., 2015): insight generation, concept exploration and converging towards specification are parallel with the ideation, specification and realisation phases of the Creative Technology Design Process. The last phase of this process, the evaluation phase, could be compared to the last phase of the co-design process, which is communicating the insights and conceptualizing it. In the case of this project, the co-design phases were placed inside the specification phase of the Creative Technology

Design Process, and were iterated 3 times, while the other phases of the Creative Technology Design Process were only executed once. In paragraph 3.6 (on page 26), this newly constructed method will be elaborated further.

3.3 WORKING WITH THE CHARACTERISTICS OF ASD

As concluded in chapter 2, the important characteristics of ASD that could form challenges while collaborating and co-designing with adolescents on the autism spectrum can be found in the table below. Next to it, possible solutions to avoid the negative influences of this characteristic were formed.

Table 4, solutions for the negative influences of the characteristics of ASD on the co-design

characteristic of ASD	influence on co-design	solution
Persistent preference for solitude	Could be an issue while working together, because of the presence of the designer, teacher, other participants, etc.	The sessions will be conducted individual and will take place in a room where only the participant and the designer are present.
Difficulties in understanding other people's feelings	May be a bigger issue when working in a group than individually. Also, could prove difficulties in the relationship between the designer and participant.	The sessions will be conducted individually and the designer needs to keep this characteristic in mind while communicating with the participant.
Delayed language development *(difficulties in communication)*	Could cause difficulties in voicing their opinions, understanding instructions and interacting with other participants.	The designer must give the participant very clear instructions, ask for opinions very carefully and sessions will be individual to avoid difficulties in the interaction with other participants.
Persistent repetition of words or phrases (echolalia)	Could cause difficulties in voicing their opinions.	If one of the participants experiences this characteristic heavily, a teacher or therapeutic could be included in the session.
Resistance to minor changes in routine or surroundings *(difficulties in changes in routine, environment, and situations)*	Could cause difficulties when working together in an unfamiliar environment and with a badly planned out schedule, also, makes it difficult to open up to people they have never met before which could prevent the participant from opening up.	The sessions will take place in an environment that is familiar for the participants (classroom), a visual schedule that displays the sequence of activities (IDEAS) of the session will be used and the designer needs to invest in creating a bond with the participant to make sure the participant opens up.
Restricted interests *(exclusive motivation for only their specific interests)*	Could have an influence on the concentration and motivation of the participant during the session.	To keep the participant engaged and motivated, the designer needs to find out what their interests are and use these in the session where possible.

Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours	Could distract the participant during the session or cause distress which has a negative influence on the general atmosphere of the session or even the wellbeing of the participant.	The session will take place in a quiet environment with as little as possible external stimulants/distractions.
Lack of imaginary skills	Affects the ability to play a role and imagine hypothetical situations and could cause difficulties with the use of lo-fi prototypes, because this requires a high use of imagination by the participant.	The designer will give the participant different options and examples when necessary. Also, questions about the opinions of the participants are preferably closed.

3.4 IDEAS

The IDEAS method (Benton & Johnson, 2011) is a method developed to provide support to help children on the autism spectrum participate in typical one-on-one Participatory Design (co-design) sessions. This session consists of an introduction to the design topic, a discussion of previous experience/demonstration of similar software, generation of own design idea and drawing out interface design of their best idea. It also includes a visual schedule that displayed the sequence of these activities and acted as a checklist to document the child's progress.

The IDEAS method was designed for a one-time co-design session, where the sessions for this project took place 3 times because of the use of iteration within the Creative Technology Design Process. Because the IDEAS method starts off with a more introductory phase this method was mainly used to build up the first session (although the terms "discussion" and "gathering design ideas" were used for the following sessions as well). However, because of the characteristics of ASD of difficulties in changes in routine, environment, and situations, the visual schedule was used in these sessions as well (Table 4).

3.5 PARTICIPANTS

To find participants for the co-design, contact with a school in Enschede was established. This school, Panta Rhei College, is specialized in special high school education for adolescents on havo/VWO level (11- 16 years old) with a focus primarily on Autism Spectrum Disorder. A letter to the parents of the students (Appendix A: Invitation co-design) was sent, to ask for their consent. This was compulsory because all of the students were underaged.

After sending out the letter, a week time was given for the parents to respond. After this period, the reactions were gathered and a pool of 3 participants could be made. The participants were as follows:

- ▪ A, 13 years old
- ▪ B, 14 years old
- ▪ C, 15 years old

According to their teacher, all 3 of the participants had very different types of ASD and all needed their very own approach on working together with them. This heterogeneity of the Autism Spectrum is also discussed by Frauenberger (2014), who states that the Autism Spectrum is extraordinarily diverse in its manifestations. This made this group of participants very well suited for the project. However, this made it hard for the designer to prepare the approach for the session beforehand, so an open and flexible attitude was necessary when entering the sessions. On the other hand, the large differences in the characteristics of the participants made the approach for the co-design sessions even more interesting.

3.6 FINAL METHOD

In Figure 9, a schematic overview of the concluding method is pictured (see also Appendix B). The method takes the 4 phases of the Creative Technology Design Process as a starting point and consists out of the 4 phases: ideation, specification, realisation and finally evaluation and combines these with the 3 phases of co-design as stated by Holmlid et al. (2015).

3.6.1 IDEATION

In the first phase, ideation, the State-of-the-Art research on existing platforms and the literature review on characteristics of ASD and the value of online sharing for individuals on the autism spectrum were done (Chapter 2). With this information, contact was made with a school to find participants for the co-design and a conversation with the teacher of the participants took place. With the use of these
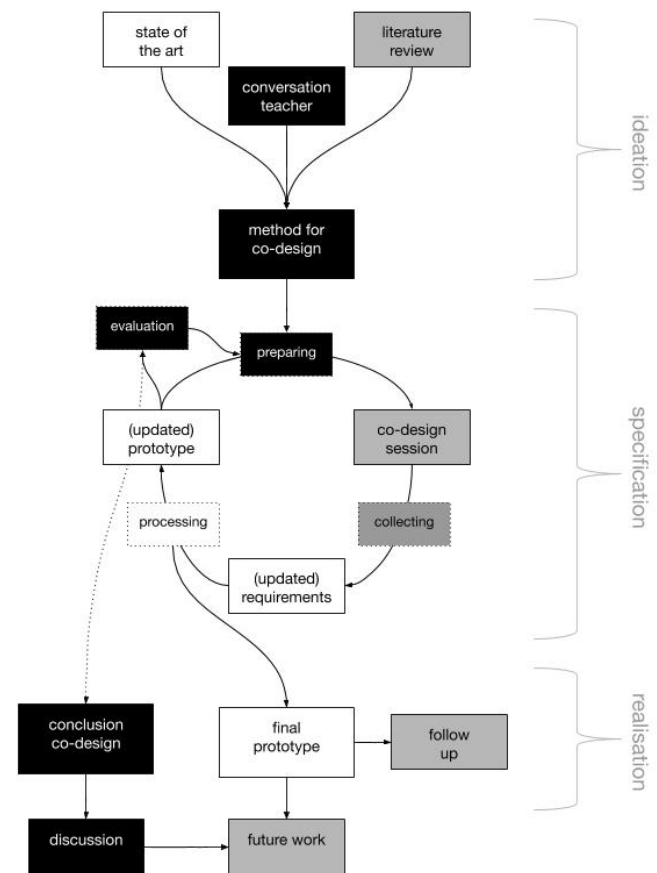

Figure 9, schematic overview of the final method for this project

3 resources, the following method for the co-design sessions with the adolescents on the autism spectrum could be formed.

3.6.2 SPECIFICATION

The specification phase was where the co-design sessions and the iteration of this project took place. Every iteration starts with the first phase (Holmlid et al., 2015): preparing. This is where the designer prepared for the co-design session that followed. In this co-design session, information and insights were gathered from the participants and were then collected (phase 2: collecting by Holmlid et al., 2015) and transformed into an (updated) set of requirements for the platform. With this set of requirements, an (updated) version of the prototype was developed (phase 3: processing by Holmlid et al., 2015) and the evaluation phase (Holmlid et al., 2015) was entered. In this phase, the co-design session was reflected upon and the approaches and strategies to minimize the negative influences of the characteristics of ASD were evaluated. Also, different situations that happened during the sessions and the reaction of the designer towards these situations were discussed. The outcomes of this evaluation and the resulted (updated version of the) prototype were used to prepare for the following session, and the loop was started again.

In total, there were 3 iterations of these phases conducted. The iterative loop was broken when the processing phase has been reached for the third time and the realisation phase was entered.

3.6.2.1 THE CO-DESIGN SESSIONS

For the co-design sessions, 3 participants took part. The participants were students at the Panta Rhei College in Enschede with the ages of 13, 14 and 15 and were all diagnosed with a disorder on the autism spectrum.

Because of the characteristics of persistent preference for solitude, difficulties in understanding other people's feelings and changes in routine, environment and situations (table 3) and the fact that the participants did not know each other, it was decided that the sessions would be conducted individually rather than in groups, with only the designer and the participant being present. Also, the designer needed to invest in creating a bond with the participant and find out about the interests early on in the process (in the 'breaking the ice' phase, Figure 11 on page 29), in order to make it easier for the participant to open up and keep the participant engaged and motivated.

To minimize the negative influence of the characteristic of unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours and, again, the characteristic of difficulties with changes in routine, environment and situations, the sessions took place in a designated, quiet room at their school, during school time. This room was already familiar for the participants and had as little distractions and other stimuli as possible.

According to the teacher, all three of the participants had a hard time keeping their focus for a long time, so the sessions were planned to take up 15 to 30 minutes per participant. He also pointed out that the participants had difficulties with formulating their opinions and answering open questions. This could also be seen in table 3 as characteristics of lack of imaginary skills and difficulties in communication. For this reason, the designer needs to formulate very clear instructions, ask for opinions carefully and ask the participants closed rather than open questions.

Lastly, to create some structure in the sessions, a visual schedule that displayed the sequence of activities for that session and the activities for the following sessions (Figure 10 and Appendix D) was made and used as a guideline during the sessions.
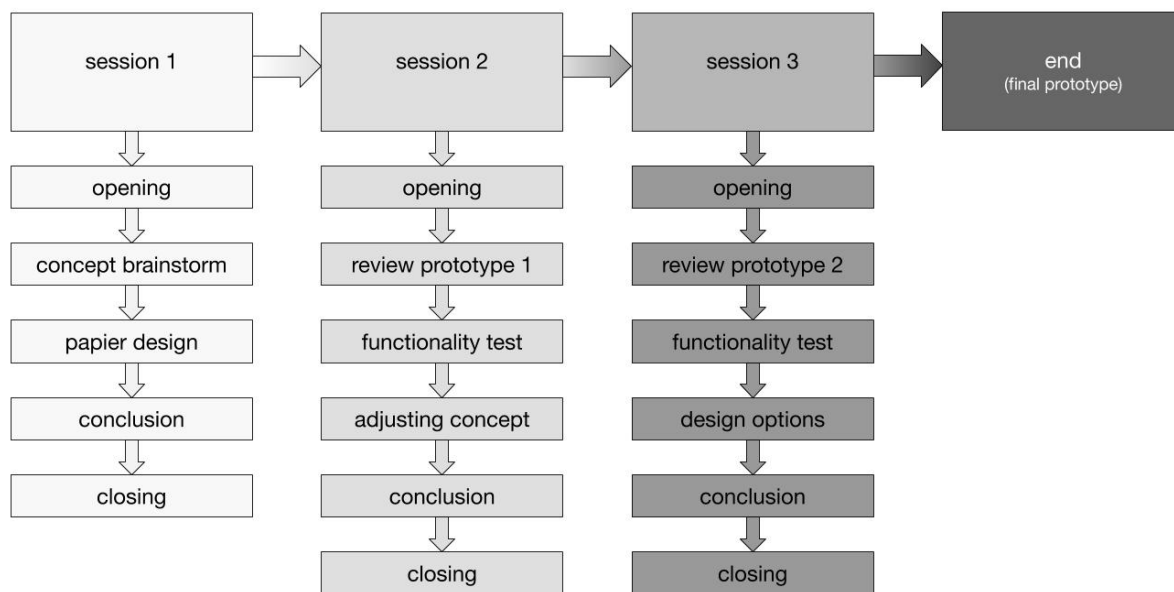

Figure 10, visual schedule (translated in English)

For the contents of the sessions, the following plan was made:

Table 5, rough planning co-design sessions

session	goal	tasks	tool
1	Insight generation	General discussion. Concept brainstorm. Paper prototyping assignment.	Toolkit/probe (Sanders & Stappers, 2014)
2	Concept exploration	Testing assignment v1(user testing). Test functionality. Functionality brainstorm.	Lo-Fi prototyping
3	Converging towards specification	Testing assignment v2 (user testing). Making design choices.	Hi-Fi prototyping
FU	Follow up	Send final prototype to the participants.	User testing

To keep the sessions as structured as possible. each session was built up out of 4 different stages: breaking the ice, discussion, gathering design ideas and wrapping up (Figure 11).
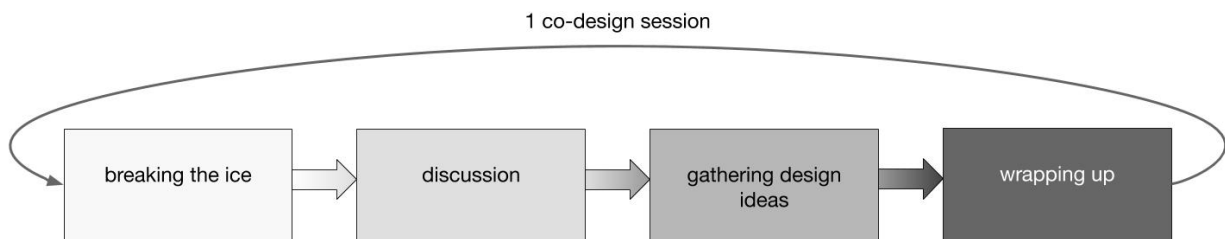

Figure 11, the 4 stages of the co-design session

3.6.3 REALISATION

In this phase, a division was made between the product and the co-design process. Firstly, the final set of requirements was used to develop the final prototype and this prototype was sent to the participants as part of the final follow up of the co-design sessions. Secondly, a conclusion was formed about the expected versus the experienced influence of the characteristics of ASD on the co-design sessions.

3.6.3.1 DISCUSSION AND FUTURE WORK

Lastly, the results of the co-design sessions were discussed. Also, in collaboration with Alan Deuvletian and Wojtek Jarosinski, two different discussions will be held: about the differences in the co-design approaches and about the different outcomes of the online platform per user group. Out of the first, a concluding comparison of the advantages and disadvantages of the different approaches was made.

CHAPTER 4 CO-DESIGN RESULTS

In this chapter, the 3 different sessions/iterations are elaborated and discussed. More detailed screenshots of the prototype and the tables with results can be found in the Appendix.

There was chosen to not make any pictures during the sessions, as this could evoke the feeling of being 'tested' by the participants. Furthermore, pictures because of the characteristic of preference for solitude, there was no other person in the room expect for the participant and the designer to take the pictures and the designer needed to focus on the session.

Before the first session/iteration, a meeting with a teacher/mentor of the participants took place. In this meeting, the vision for the sessions was discussed, dates for the sessions were planned and the approach was talked through. The notes of this meeting can be found in Appendix C.

4.1 ITERATION 1

4.1.1 PREPARATION

For the first co-design session, the following plan was made:

Table 6, planning co-design session 1

phase	activities
Breaking the ice	General opening.
	Getting to know each other.
	Why did you sign up for the co-design?
	What to expect next sessions (visual schedule)
Discussion	What social media do you use and how?
	What do you think of the idea for this platform?
	How would you use it?
	Website or mobile application?
Gather design ideas	Paper prototype assignment (toolkit/probe (Sanders & Stappers, 2013)):
	▪ A4 paper, pens/pencils, markers, sticky notes.
	▪ What would the platform look like?
	▪ If we click on X, what will happen?
	▪ User scenario (creating a post).
Wrapping up	Conclusion.
	Introducing the next session.

The materials for the paper prototype assignment were gathered (Figure 12) and the visual schedule was made (Appendix D) and printed. Before the session started, the designer met with the teacher of the participants to go through the plan and set up the room.

Figure 12, materials used for paper-prototyping

4.1.2 COLLECTING

The gathered information was processed into 3 different tables (Appendix E). In the first one, the general information about the participants was gathered. In the second table, the input about the online platform was collected. In the last table, the different characteristics of ASD that influenced the co-design session were evaluated.

4.1.3 PROCESSING

With the use of the table of results for the online platform that resulted out of the first co-design session, the first Lo-Fi prototype (Figure 13 and Appendix F) was developed.

The initial idea was that an online website developer tool would be used to create the first iterations of the platform. However, some of the functionalities as described by the participants were so specific, that this could not be achieved with such a tool. For this reason, it was decided that the software program "Adobe XD" [14] would be used to make mock-ups of the platform. This
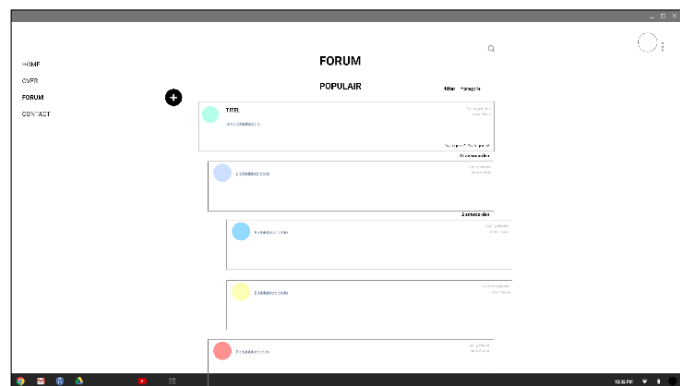

Figure 13, screenshot of the Lo-Fi prototype

program is a vector-based tool that is aimed at designing and prototyping the user experience of a website/application. By using this tool, the platform could not really be used, but a better idea of the specific functionalities could be provided for the following co-design sessions.

Although one of the participants said to prefer the mobile version or application for the platform, it was not possible to create both for the next session because of time constraints. This was discussed

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[14] https://www.adobe.com/products/xd.html

with the participant and explained, to prevent any unexpected events for him. However, for the final prototype, a mobile version would be developed as well.

4.1.4 EVALUATION

In Appendix E, the experienced influence on the co-design session of certain characteristics of ASD are elaborated. In Figure 14, an example of a row in this table is given (with the solution in *cursive*).

Characteristics (EN)	A	B	C
Difficulties in communication	Found it sometimes hard to express the ideas that he had in his head. *Helping him communicating these by drawing examples and letting him choose the best fitting.*	Got stuck many times while trying to express his opinions and ideas, he got very stressed when this happened. *Comforting him by saying that it did not matter and it was ok to take his time and being very patient. When he really got stuck, giving him examples or drawing things out helped.*	Found it very difficult to focus on the topics and wandered off a lot of times. *Going with the unrelated topic a little bit and then bending it into something that was on-topic again made him engaged again without provoking the feeling that the designer was not interested in his stories.*

Figure 14, example of a row, taken from Appendix E

Out of this, the following things could be concluded:

The choice to conduct the sessions individually rather than in groups turned out to be a good choice. The participants seemed to get comfortable with the designer, after breaking the ice and bonding and opened up. Also, the participants each had different ideas and because of the individual sessions, they were not influenced by the opinions of the other participants.

As can be seen in the table (Appendix E), the characteristic of unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours was not very problematic because of the quiet room where the participant had as little distractions and stimuli as possible. Also, because this environment was already very familiar to the participants, this could have helped them to open up easier because of the minimalization of routine and environment changes.

Even though the designer tried to give very clear instructions, ask for opinions carefully and ask closed rather than open questions, there were still some difficulties in communication. Especially one participant got stuck many times while trying to express his opinions and ideas and got very stressed when this happened. Comforting him by saying that it did not matter and it was ok to take his time and being very patient helped and when he really got stuck, giving him examples or drawing things out worked as well.

As recommended by Benton & Johnson (2015) in their IDEAS method to help create a clear structure for the participant, a visual schedule that displayed the sequence of activities for that session (and

the following) was used. However, none of the participants paid a lot of attention to it and they were not interested in crossing things out. The visual schedule would still be used in the following sessions, but more passively.

4.2 ITERATION 2

4.2.1 PREPARATION

For the second co-design session, the following plan was made:

Table 7, planning co-design session 2

phase	activities
Breaking the ice	General opening.
	Where are we in the process (visual schedule).
Discussion	Showing the first prototype.
	What are your thoughts?
	What do you want to see different?
Gather design ideas	User testing assignment (user scenarios).
	What is missing?
Wrapping up	Conclusion.
	Introducing the next session.

The prototype that was developed in the processing phase of the first iteration was prepared and set up at a laptop in order to show to the participants. The visual schedule was printed and brought to the session. Pen and paper were also available, to sketch something out if this would be necessary. No other materials were needed.

4.2.2 COLLECTING

The gathered information was processed into 2 different tables (Appendix G). In the first table, the new input about the first (Lo-Fi) prototype was collected. In the second table, the characteristics of ASD that influenced the co-design session this time were evaluated again.

PROCESSING

For the second version of the prototype (Appendix H and I), it was decided to stop using Adobe XD. During the co-design session, it became clear that the participants had a hard time accepting that the prototype did not function (and look) as a 'normal' website yet (e.g., they were not able to test out posting a new message or editing their profile) and realizing this in Adobe XD
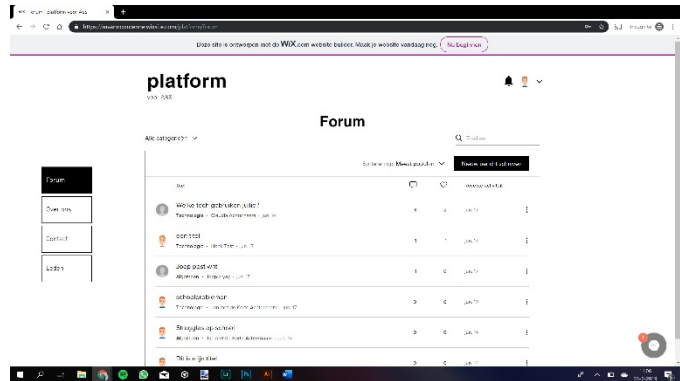

Figure 15, screenshot of the Hi-Fi prototype

simply would not be possible. For this reason, it was decided to develop the second version in the online website development tool "Wix" [15]. In this tool, it is also possible to use code to add functionalities, a feature that could be very essential for this project.

The changes that were implemented in the new version of the prototype can be seen in Table 8.

Table 8, new implementations in the Hi-Fi prototype

feature	implementation
Chat	The functionality of private messaging was added with a floating "bubble" which makes the chats accessible from every place at the platform.
Menu	The forum button in the menu was moved to the top. A member page was added to the menu. At this page, all the members of the platform are displayed. A search function to find someone was implemented here as well.
Friends	The names of followers (friends) are now displayed beside their picture. They are also displayed in a listed view instead of a grid.
Notifications	The notifications feature was added, it is now possible to receive a notification when someone sends a message or reacts to a post. This can be turned on or off individually for each type of notification in the settings menu.
Profile	It is now possible to see a users' posts at their profile page. A log out button was added in the profile menu at the top.
Functionality	The overall functionality of the prototype was improved. It is now possible to create a real profile and write posts. It now is basically a functioning website.
Other	The overall design was improved. A mobile version for the platform was developed (Appendix I).

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[15] https://www.wix.com/

4.2.4 EVALUATION

One of the participants' final class got cancelled, so he was at the point of going home when the teacher reminded him of the co-design session. He got really confused and stressed about this, so it was decided to keep the session very short and only show him the prototype. This was a good example of the characteristic of difficulties in changes in routine, environment, and situations.

As discussed in the previous paragraph, the participants had a hard time accepting that the prototype did not function (and look) as a 'normal' website yet (e.g., they were not able to test out posting a new message or editing their profile) and found it therefore difficult to visualize how this would turn out in the end. For this reason, it was made sure that the second prototype that was used for the following session was completely functional.

4.3 ITERATION 3

4.31 PREPARATION

For the third, and last, co-design session, the following plan was made:

Table 9, planning co-design session 3

phase	activities
Breaking the ice	General opening.
	Where are we in the process (visual schedule).
Discussion	Showing the second prototype.
	What are your thoughts?
	What do you want to see different?
Gather design ideas	User testing assignment (functionality and interface).
	Design: colours, themes, layout (show examples).
Wrapping up	Conclusion.
	Follow-up?

4.3.2 COLLECTING

The gathered information was again processed into 2 different tables (Appendix J). In the first table, the new input about the second (Hi-Fi) prototype was collected. In the second table, the characteristics of ASD that influenced the co-design session this time were evaluated.

4.3.3 PROCESSING

The changes that were made for the final prototype can be seen in Table 10. Implementations that are recommended for future work are displayed in *cursive*.

Table 10, implementations for the final version of the prototype

feature	implementation[16]
Background	*Give the user the option to change the background colour to their own preferred theme in the profile section.*
Font title	Gill Sans MT.
Font text	Proxima Nova (a nice combination of the different options that received votes).
Colour theme	The buttons and notification colours were changed to blue.
Placement logo	The current position received the most votes, so was maintained.
Chat	The chat icon was repositioned to the left side and the colours were changed to blue to make it stand out more.
Feed	Before the list with posts is shown, a page with the different categories is entered *Clicking on the whole area of the post will open the post page (mobile version).* *Create a separate feed for friends/following.*
Profile	*The user will see a menu with all the different language choices if he wants to change the header (instead of uploading it themselves).* 'Account' was removed from the top right menu.
Functionality	Bugs were fixed.
Other	The focus of the platform was changed from ASD to Neurodiversity. The name was changed to DiversiChat.

4.3.4 EVALUATION

One of the participants was very early for the session, so everything still had to be set up. This seemed to make him uncomfortable, which could be recognized as the characteristic of difficulties in changes in routine, environment, and situations. Having a casual conversation with him until everything was ready for the session made him feel comfortable again and the session could be continued as normal.

To prevent the sessions from taking too long this time, it was made clear that the session could only take up to 30 minutes and a timer was set. After the 30 minutes, the session was ended. Because the participant knew that there was a time limit for the session beforehand, it was expected when the session had to be rounded off.

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[16] Cursive implementations were not finished due to time constraints, so remain as a recommendation for future work.

Giving examples of the different design choices made it easier for all of the participants to visualize these and give their opinions, this helped with the characteristic of lack of imaginary skills.

The overall reactions from the participants on the Hi-Fi prototype were very positive. They all expressed that they were very happy about the full functionality and they were enthusiastic while testing all the features of the platform out.

4.4 FOLLOW UP

After the final co-design session with the participants, the participants were asked if they would like to give the designer their contact information for the follow-up. All the participants signed up for this. After the designer processed the final iteration and developed the final prototype for this project, the results were sent to the participants. This included a list of possible names for the platform (besides the pre-picked "DiversiChat") as well, where the participants could vote for their favourite one.

As part of the follow-up, the designer also sent the results and a summary of the project to the teacher and the other interested parties at the school.

CHAPTER 5 CONCLUSION

In order to answer the research question:

"How could an online platform be developed with the use of a co-design approach for and with adolescents on the autism spectrum?"

Two sub-questions were formed. The first sub-question that was answered was:

"Which characteristics of ASD have an influence on the co-design process?"

In the table below (Table 11), the characteristics of ASD that were expected to have an influence on the co-design process can be seen. In the middle and right column, the differences between the expected and the experienced influence on the co-design process are elaborated.

Table 11, expected vs experienced influences of the characteristics of ASD on co-designing

characteristic of ASD	expected influence on co-design	experienced influence on co-design
Persistent preference for solitude	Could be an issue while working together, because of the presence of the designer, teacher, other participants, etc.	The sessions were conducted individually with only the participant and the designer being present in the room, so this was not an issue.
Difficulty understanding other people's feelings	May be a bigger issue when working in a group than individually. Also, could prove difficulties in the relationship between the designer and participant.	The sessions were conducted individually, so this was not an issue between participants. The designer had to work hard in the first session to create a 'bond' with the participant, but after this, there were no significant problems in this relationship caused by this characteristic.
Delayed language development *(difficulties in communication)*	Could cause difficulties in voicing their opinions, understanding instructions from the designer and interacting with other participants.	This characteristic proves to cause some difficulties at time with the communication between the participant and the designer, especially when the instructions were not formulated very clear. The designer needed to reformulate the instructions in these cases or give examples. Furthermore, in general communication, there were no significant difficulties and the participants had no problem with opening up.

Persistent repetition of words or phrases (echolalia)	Could cause difficulties in voicing their opinions.	None of the participants experienced this characteristic.
Resistance to minor changes in routine or surroundings *(difficulties in changes in routine, environment, and situations)*	Could cause difficulties when working together in an unfamiliar environment and with a badly planned out schedule, also, makes it difficult to open up to people they have never met before which could prevent the participant from opening up.	The familiar environment and the timing of the sessions (during school hours) minimized the influence of this character significantly. The use of a tight schedule helped as well. In the beginning, the designer had to put effort in 'bonding' with the participant, but after this, they opened up a lot. However, it still occurred once that a participant had trouble with a changed routine (due to unforeseen circumstances).
Restricted interests *(exclusive motivation for only their specific interests)*	Could have an influence on the concentration and motivation of the participant during the session.	After finding out what their interests were and using these in the conversation when the participant got distracted, this characteristic did not cause any difficulties.
Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colours	Could distract the participant during the session or cause distress which has a negative influence on the general atmosphere of the session or even the wellbeing of the participant.	The environment where the sessions took place was quiet and contained as little distractions as possible. However, the participants got quite distracted at times due to outside noises (e.g. rain or the cleaning lady walking past).
Lack of imaginary skills	Affects the ability to play a role and imagine hypothetical situations and could cause difficulties with the use of lo-fi prototypes, because this requires a high use of imagination by the participant.	This characteristic did cause some difficulties while co-designing, especially when the participant was asked to envision certain design or interface choices and when conducting user scenarios. In these cases, speed sketching and giving clear examples helped a lot.

As can be seen in Table 11, there were only 2 out of the 8 characteristics that turned out to cause difficulties during the co-design sessions (in **bold**). However, even these challenges could be dealt with very well and did not cause any significant negative outcomes on the general co-design process.

The second sub-question, or tool to answer the research question, was:

"What would a designated online platform for ASD look like?"

After 3 iterations of co-designing with participants on the autism spectrum, the final prototype could be made. This results can be seen in Figures 16 and 17 and Appendix K and L. This prototype shows a potential outcome of an online platform designed specifically for and together with adolescents on the autism spectrum.
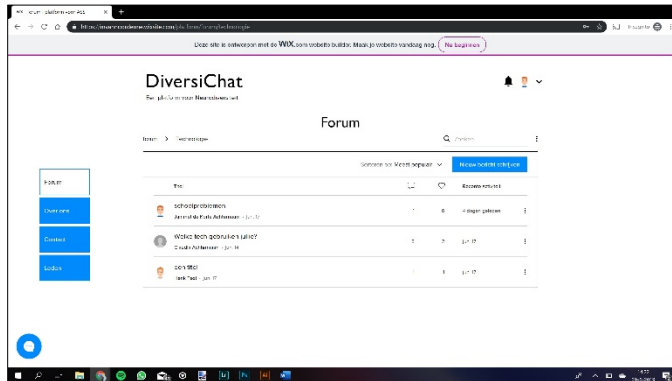

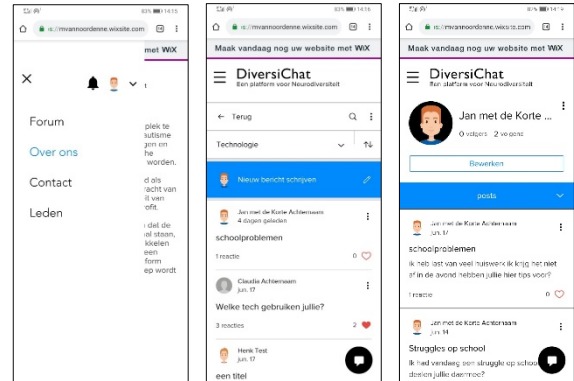Figure 16, screenshot of the final prototype

Figure 17, screenshots of the mobile version

To conclude and in order to answer the research question:

"How could an online platform be developed with the use of a co-design approach for and with adolescents on the autism spectrum?"

it can be stated that initial research on the influence of the characteristics of ASD on the co-design process, does not give an accurate starting point for the designer. A better way to conduct the co-design sessions with the participants on the autism spectrum is for the designer to approach the sessions with a very open and flexible mind and put extra effort in getting to know and understanding the participants on an individual level. As the autism spectrum is very broad and diverse and the characteristics that come with it express very differently in each individual, it turned out to be the most effective to figure out the best suitable approach for each individual participant by investing in creating a bond with them, instead of trying to hold on to the research that was executed in advance.

CHAPTER 6 DISCUSSION AND RECOMMENDATIONS

The work presented in this paper showed the expected versus the experienced influence of multiple characteristics of ASD on the co-design process and a potential outcome of an online platform for adolescents on the autism spectrum. For this research project, a method that incorporated elements of the Creative Technology Design Process by Mader and Eggink (2014) and the 3 phases of co-design by Holmlid et al. (2015) was formed. The co-design sessions of this project were conducted at a high school for special education with 3 voluntary participants, ranging from age 13 to 15, on the autism spectrum. The end results of this research give a good representation of how broad the autism spectrum is and how the characteristics that come with this are different for each person, which makes it impossible for a designer to fully prepare for co-designing with this target group. Thus, this research shows the importance of getting to know the participants.

6.1 ON THIS PROJECT

6.1.1 CHARACTERISTICS OF ASD

Looking at the influences of the 2 characteristics that were concluded to have the biggest impact on the co-design, it could be argued that the difficulties that were observed, do not necessarily have to be caused by ASD. For example, the characteristic of lack of imaginary skills, a characteristic that was stated to be one of the more challenging characteristics by Francis, Balbo and Firth (2009). In this project, it was observed that this characteristic indeed sometimes led to difficulties with visualising more abstract ideas, but it may be said that this problem also arises by many neurotypical people as well. Furthermore, when the right approach was taken during the sessions (e.g. with the help of speed sketching), the participants showed quite some imaginative skills. This was also observed by Frauenberger, Makhaeva & Spiel (2016) when they designed 'smart objects' together with children on the autism spectrum.

Another characteristic that could be questioned, is the characteristic of difficulties in communication as initially stated by Francis et al. (2009) and Millen et al. (2019). In this case, it could be argued that this problem does not necessarily lie within the ones on the autism spectrum, but could also be a two-way problem. This is what Milton (2012) calls the "double empathy problem", where neurotypical people have difficulties in communication with individuals on the spectrum as well. When taking part in a design process created by a neurotypical designer with the characteristics of neurotypical participants in mind, this double empathy problem could indeed cause difficulties in communication

when working with participants on the autism spectrum. However, as observed in this project, these problems could be minimalized when the designer keeps an open and flexible mind and puts extra effort in getting to know the participants.

To answer the question of whether the experienced difficulties were really due to the characteristics of ASD, it is recommended to conduct the same co-design process with a group of neurotypical participants. These results could be compared to the outcomes of this project in order to take a better stance in this inquiry. It would also be interesting to see if the overall design of the online platform itself would turn out differently when working with neurotypical participants.

6.2.2 ASD OR NEURODIVERSITY

In the last co-design session, one of the participants pointed out that he would prefer the platform to be targeted at Neurodiversity instead of specifically at ASD. Neurodiversity is the concept that refers to variations in the human brain, such as Dyspraxia, Dyslexia, Attention Deficit Hyperactivity Disorder (ADHD), Dyscalculia, Autistic Spectrum Disorder (ASD), Tourette Syndrome and others[17]. He made a very valid point, as a lot of characteristics that come with ASD could also be present in other conditions that fall under the concept Neurodiversity. For this project, the target group for the final prototype was changed from ASD to Neurodiversity, but it was not possible to proceed in this new direction due to time constraints. However, the observation seems very interesting and further research in this field is recommended for the continuation of this project or future work.

6.2.3 FOR THE PLATFORM

In order to further develop the final prototype (of this research) of the online platform, the following recommendations for implementations are made:

- An option could be implemented that offers the possibility for the user to change the background and detail colours to their own preferred team in the profile section. This would offer a nice feature of customization.
- It must be made possible to open a post on the forum page by clicking on the whole surrounding area (square), instead of just the title. This would especially be helpful when using the mobile version of the platform.

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[17] https://neurodiversitysymposium.wordpress.com/what-is-neurodiversity/

- Another recommendation regarding the forum is the addition of a separate feed where the activities (posts and reactions) of people that the user is following are displayed.
- For the mobile version, it is also recommended to convert this into a downloadable application instead of just a mobile version of a website. This could increase overall usability.
- Lastly, the option could be added to select your language (country flag) from a list of choices when changing the header of your profile, instead of having to upload the flag yourself.

Furthermore, it should be taken into account that due to time constraints, it was not possible to conduct more iterations or gather more participants. This would be recommended for future research as well.

6.2 COLLABORATIVE DISCUSSION

In collaboration with Alan Deuvletian and Wojtek Jarosinski. A discussion about the differences that were observed between our 3 approaches of the same project.

Initially, 3 students (Alan Deuvletian, Wojtek Jarosinski and Marise van Noordenne) were assigned to this Graduation Project. To make sure that everyone got enough space to put their own spin on it, it was decided to make a division into 3 subgroups of the original target demographic (individuals on the autism spectrum): tech-savvy adults (Wojtek), older adults (Alan) and adolescents (Marise). Alan and Wojtek mainly went for the more quantitative approach, as they chose to conduct the co-design through the internet (web-based), while Marise went for the more qualitative approach and conducted the co-design with a small group of participants in 'real life'. Also, Alan and Wojtek chose to start off with an already functioning prototype of the platform to test out, while Marise chose to start designing from scratch. In Appendix M, interesting observations about the differences in certain subjects between the approaches and on the platform were discussed. Out of this, the final table with advantages and disadvantages of the different approaches was formed:

Table 12, advantages (+) and disadvantages (-) of the different co-design approaches

	web-based co-design	in-person co-design
participants	+ Gives access to a broader range of participants (larger quantity and more diverse). - Capturing interest and encouraging them to take part in the design may be difficult.	+ Deeper bonds and relationships can be formed with the participants which lead to more openness. + High reliability due to real-life interaction with the participants.

	- Participants could stop replying at any moment. - Due to online anonymity, verification of participants is not possible, which could lead to inaccurate information.	+ Participants are less likely to opt-out because of a higher sense of responsibility towards the designer. - More difficult to find participants.
communication	+ Participants are free to provide feedback in their own space and time. + Fewer challenges with overall communication that could come with characteristics of ASD.	- More difficulties with overall communication could arise because of characteristics of ASD.
quality of feedback	- Lack of opportunity to explain ideas extensively and ask for further details. - Possibility for misunderstandings between the designer and the participants.	+ Allows for an in-depth explanation of ideas and concepts and asking for further details. + Overall quality of feedback is higher due to more room for exploration and longer, more intensive sessions.
practical	+ Not having to send out consent forms. + No scheduling conflicts while planning the meetings.	- More time-consuming, for both designer and participants in terms of preparation, conducting the sessions and forming a bond with the participants. Especially when conducting individual sessions.

REFERENCES

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed.

Arlington,   VA: American   Psychiatric   Association;   2013.   doi:

10.1176/appi.books.9780890425596

Benford, P., & Standen, P. (2009). The internet: a comfortable communication medium for people

with Asperger syndrome (AS) and high functioning ASD (HFA)? *Journal of Assistive*

Technologies, 3(2), 44-53. doi: 10.1108/17549450200900015

Benton, L., Johnson, H., Ashwin, E., Brosnan, M., & Grawemeyer, B. (2012). Developing IDEAS:

supporting children on the autism spectrum within a participatory design team. Proceedings

of the SIGCHI conference on Human factors in computing systems (pp. 2599-2608). ACM. doi:

10.1145/2207676.2208650

Benton, L., Johnson, H., Brosnan, M., Ashwin, E., & Grawemeyer, B. (2011). IDEAS: an interface design

experience for the autistic spectrum. In CHI'11 Extended Abstracts on Human Factors in

Computing Systems (pp. 1759-1764). ACM. doi: 10.1145/1979742.1979841

Bossavit, B., & Parsons, S. (2016). This is how I want to learn: High functioning autistic teens co-

designing a serious game. Proceedings of the 2016 CHI Conference on Human Factors in

Computing Systems (pp. 1294-1299). ACM. doi: 10.1145/2858036.2858322

Davidson, J. (2008). Autistic culture online: virtual communication and cultural expression on the

spectrum. *Social & cultural geography*, 9(7), 791-806. doi: 10.1080/146493608023825 86

Francis, P., Balbo, S., & Firth, L. (2009). Towards co-design with users who have autism spectrum disorders. *Universal Access in the Information Society*, 8(3), 123-135. doi: 10.1007/s10209-008-0143-y

Frauenberger, C. (2015). Rethinking autism and technology. *interactions*, 22(2), 57-59. doi: 10.1145/2728604

Frauenberger, C., Makhaeva, J., & Spiel, K. (2016). Designing smart objects with autistic children: Four design exposès. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (pp. 130-139). ACM. doi: 10.1145/2858036.2858050

Holmlid, Stefan & Mattelmäki, Tuuli & Sleeswijk Visser, Froukje & Vaajakallio, Kirsikka. (2015). Co-creative Practices in Service Innovation. doi: 10.1007/978-1-4471-6590-3_25.

Jordan, C. J. (2010). Evolution of ASD support and understanding via the World Wide Web. *Intellectual and developmental disabilities*, 48(3), 220-227. doi: 10.1352/1934-9556-48.3.220

Mader, A., & Eggink, W. (2014). A design process for creative technology. DS 78: Proceedings of the 16th International Conference on Engineering and Product Design Education (E&PDE14), Design Education and Human Technology Relations, University of Twente, The Netherlands, 04-05.09. 2014. Retrieved from: https://ris.utwente.nl/ws/portalfiles/portal/5362930/140509_ADesignProcesForCT_EPDE14.pdf

Millen, L., Cobb, S., & Patel, H. (2011). Participatory design approach with children on the autism spectrum. *International Journal on Disability and Human Development*, 10(4), 289-294. doi: 10.1515/IJDHD.2011.048

Millen, L., Edlin-White, R. & Cobb, S.V.C. (2010). The Development of Educational Collaborative Virtual Environments for Children on the autism spectrum. Proceedings of the 5th Cambridge Workshop on Universal Access and Assistive Technology, Cambridge 2010. Retrieved from: https://pdfs.semanticscholar.org/0c41/a13f746e844ef813c059379eeb04e 78b4019.pdf

Milton, D. E. (2012). On the ontological status of autism: the 'double empathy problem'. Disability & Society, 27(6), 883-887. doi: 10.1080/09687599.2012.710008

Nguyen, T., Phung, D., & Venkatesh, S. (2013). Analysis of psycholinguistic processes and topics in online ASD communities. 2013 IEEE International Conference on Multimedia and Expo (ICME) (pp. 1-6). IEEE. doi: 10.1109/ICME.2013.6607615

Putnam, C., & Chong, L. (2008). Software and technologies designed for people on the autism spectrum: what do users want? Proceedings of the 10th international ACM SIGACCESS conference on Computers and accessibility (pp. 3-10). ACM. doi: 10.1145/1414471.1414475

Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-design,* 4(1), 5-18. doi: 10.1080/15710880701875068

Sanders, E. B. N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. *CoDesign*, 10(1), 5-14. doi: 10.1080/15710882.2014.888183

Schall, C. M., & McDonough, J. T. (2010). autism spectrum disorders in adolescence and early adulthood: Characteristics and issues. *Journal of Vocational Rehabilitation*, 32(2), 81-88. doi: 10.3233/JVR-2010-0503

Sleeswijk Visser, F., Stappers, P.J., van der Lugt, R. & Sanders, E.B.N. (2005). Contextmapping: Experiences from practice. *CoDesign*, 1(2), 119-149. doi: 10.1080/15710880500135987

APPENDICES

APPENDIX A: INVITATION CO-DESIGN

Betreft: DEELNAME CO-DESIGN ONLINE PLATFORM VOOR ASS   *16/05/2019*

Beste ouders/verzorgers,

Mijn naam is Marise van Noordenne en ik ben aan het afstuderen in de Bachelor Creative Technology aan de Universiteit van Twente. Voor mijn afstudeeropdracht wil ik een online platform/website/applicatie gaan bouwen voor en samen met adolescenten met Autisme Spectrum Stoornissen om ideeën, ervaringen en praktische oplossingen op te kunnen delen.

Ik dat het ontzettend belangrijk is dat de toekomstige gebruikers centraal staan in de ontwikkeling van dit platform. Om deze reden wil ik dit graag doen door middel van co-design, een ontwerp vorm waarbij ik samen met de doelgroep aan de slag ga om dit vorm te geven. Hiervoor heb ik leerlingen nodig die mij hierbij zouden willen helpen door in een paar sessies hun mening te geven.

De (individuele) sessies zullen 3 keer plaatsvinden tussen 27 mei t/m 7 juni op het Panta Rhei College Enschede onder schooltijd en zullen zo'n 15 tot 30 minuten per persoon in beslag nemen. Tijdens de sessies zal ik de deelnemers het platform voorleggen, laten uittesten en in gesprek gaan over de eisen waar het platform aan zou moeten voldoen, de gebruiksvriendelijkheid en het design.

Bij interesse in deelname, vraag ik u via het onderstaande formulier toestemming te geven voor aanmelding van uw zoon/dochter. Uiteraard is deelname volledig anoniem, wordt er discreet met informatie omgegaan en is de leerling te allen tijde vrij om zich terug te trekken.

Verdere informatie over de sessies zal nader volgen, tot die tijd kunt u mij voor vragen telefonisch bereiken op 0630071849 of per e-mail via m.vannoordenne@student.utwente.nl.

Met vriendelijke groet,
Marise van Noordenne

_____

Graag dit strookje invullen en inleveren bij Robin van Emmerloot (Informatica, ICT), vóór 24-05-2019.

Ik, _____, geef toestemming voor deelname van mijn zoon/dochter, _____, uit klas _____ voor het co-design van het online platform voor adolescenten met ASS.

Daarnaast geef ik toestemming voor het maken van:
☐ Beeldopnames (foto's) *
☐ Geluidsopnamens *
☐ Video opnames *

Datum: *Datum:*

Handtekening leerling:	Handtekening ouder/verzorger:

* Deze zullen alleen gebruikt worden voor onderzoeksdoeleinden en in geen enkel geval gepubliceerd worden.

APPENDIX B: SCHEMATIC OVERVIEW OF METHOD
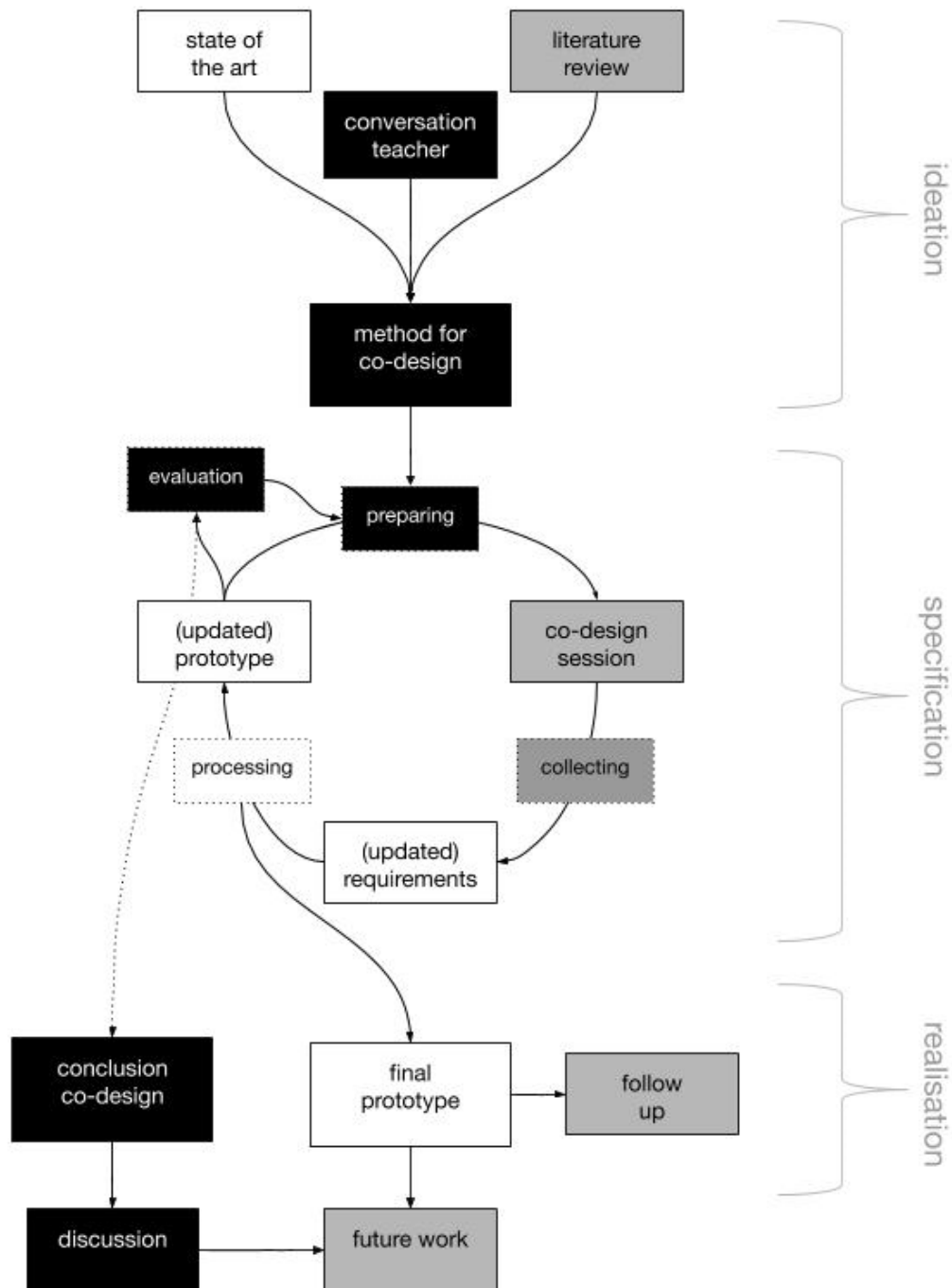
APPENDIX C: MEETING WITH TEACHER

Participants:
- A, 13 years old, 2 havo
- B, 14 years old, 3 VWO
- C, 15 years old, 3 havo

Dates:
- Session 1, 07-06-2019, 13:25 - 14:15
- Session 2, 12-06-2019, 12:35 - 14:15
- Session 3, 17-06-2019, 12:35 - 13:25

Location:
The computer science classroom can be used for the sessions. This room is already very familiar for the participants and is quiet and structured.

Notes:
- Participants do not know each other, so it is strongly advised to not do group sessions.
- Due to difficulties in schedules and the ability for the participants to only do one session per week, the dates were planned like above. Unfortunately, this timing is not ideal for the designer, but this has to be accepted either way.
- The teacher stressed the importance of structure and asking closed rather than open questions to the participants.

APPENDIX D: VISUAL SCHEDULE
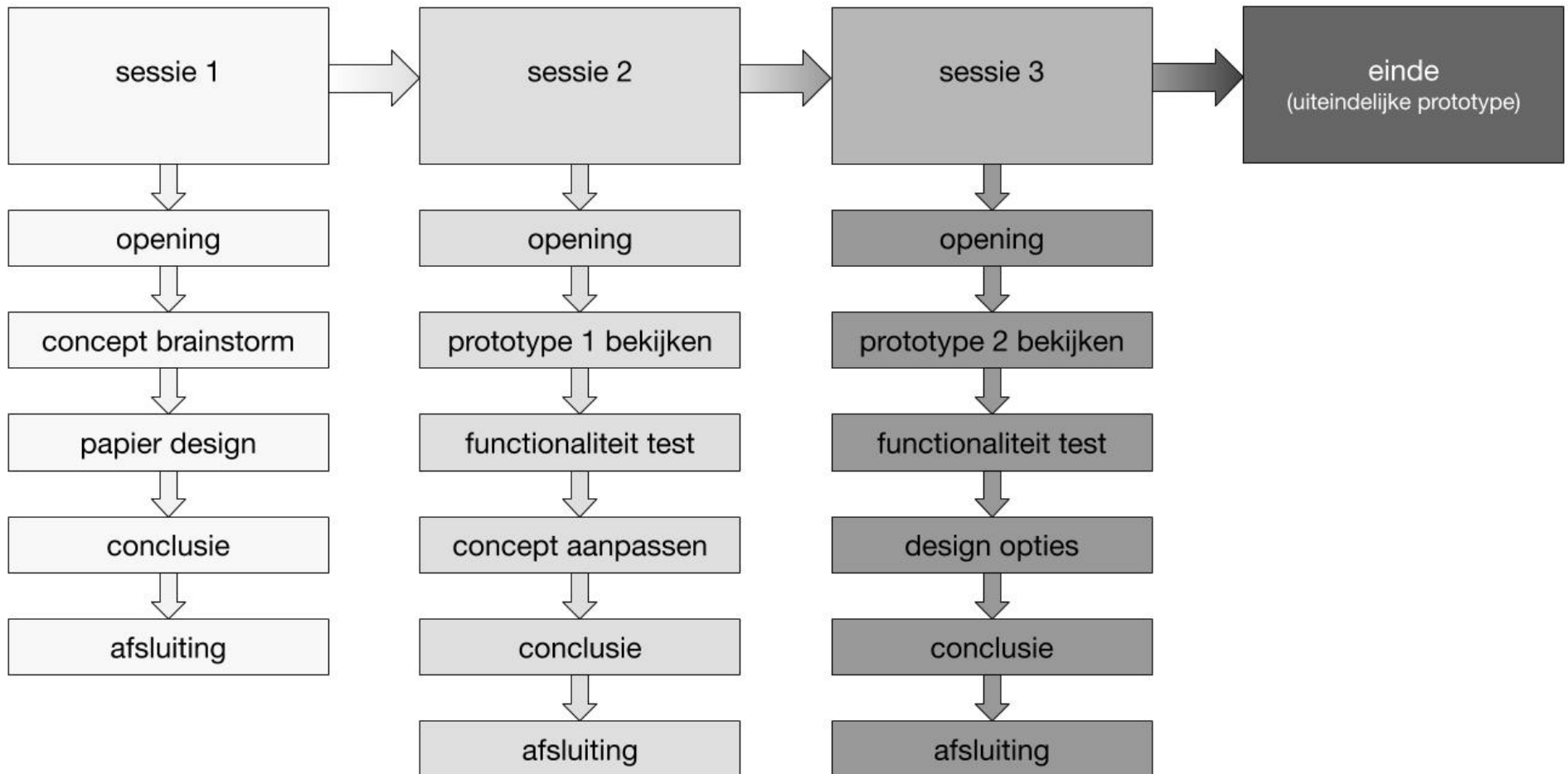
APPENDIX E: RESULTS SESSION 1

Table 1.1, general information about the participants

Algemeen (NL)	A	B	C
Leeftijd	13	14	15
Waarom meedoen?	Een ander helpen + platform voor ASDe is uniek	Nieuwsgierig naar co-design proces + idee voor het platform sprak aan	Nieuwsgierig naar co-design + idee achter het platform
Interesse		Gamen, animaties	
Huidige social media gebruik	Instagram + YouTube (beide passief) + bekend met Reddit (passief, geen account)	YouTube (actief, eigen kanaal), Discord (actief, gaming) + Twitter (passief) + bekend met Reddit (passief, geen account)	YouTube (passief) + bekend met Reddit (passief, geen account)
Gebruik social media voor communicatie	WhatsApp	Discord (wereldwijd) + WhatsApp	WhatsApp
Website of mobiele applicatie?	Beide (applicatie voor paper prototype, makkelijker visualiseren)	Beide (website voor paper prototype)	Beide (website voor paper prototype)

Table 1.2, results in discussion and gathering design ideas for the platform

Platform (NL)	A	B	C
Type (pp opdracht)	Mobiel	Computer	Computer
Startpagina	Profiel maken / inloggen	Over de website (uitleg icoontjes)	Over de website + populairste topics
Menu	Zijkant, uitschuiven	Zijkant, altijd zichtbaar (oriëntatie)	Bovenaan, altijd zichtbaar (oriëntatie)
Account	Profiel Foto Hobby's Openbaar account Account is verplicht Uitloggen!	Profiel Foto Hobby's Links naar andere social media Mogelijkheid tot afschermen account (voor niet-vrienden) Account niet verplicht (anoniem bekijken is een optie)	Profiel Foto of vlag van land Icoontjes met talen Mogelijkheid tot afschermen account (voor niet-vrienden) Account is verplicht (i.v.m. misbruik)
Connecties	Vrienden toevoegen (verzoek)	Vrienden toevoegen (verzoek)	Vrienden toevoegen (verzoek)

		Vrienden beheren via profiel	Vrienden beheren via profiel
		Anderen kunnen blokkeren	Anderen kunnen blokkeren
Feed	Onder elkaar	Onder elkaar	Onder elkaar
	Post: titel, optie foto's	Post: titel, meer lezen	Post: titel, Reddit systeem voor reacties
	Filter op categorieën (hashtag)	Filter op tags	Filter op categorie + topic + taal
	Zoekfunctie als filter voor categorieën, rechtsboven	Zoekfunctie tags, rechtsboven	Zoekfunctie op trefwoord (goed algoritme)
	Optie post schrijven aan de onderkant (uitgeklapt)	Optie post schrijven als pop-up (plusje)	Populairste posts bovenaan weergeven (bepalen op reacties i.p.v. likes)
			Comments automatisch ingeklapt, zelf uitklappen
			Off-topic moet gereguleerd
Overig		Icoontjes!	Contactpagina + laatst bekeken optie

Table 1.3, evaluation of the influences of the characteristics of ASD on the co-design session

Characteristics (EN)	A	B	C
Difficulties in communication	Found it sometimes hard to express the ideas that he had in his head. *Helping him communicating these by drawing examples and letting him choose the best fitting.*	Got stuck many times while trying to express his opinions and ideas, he got very stressed when this happened. *Comforting him by saying that it did not matter and it was ok to take his time and being very patient. When he really got stuck, giving him examples or drawing things out helped.*	Found it very difficult to focus on the topics and wandered off a lot of times. *Going with the unrelated topic a little bit and then bending it into something that was on-topic again made him engaged again without provoking the feeling that the designer was not interested in his stories.*
Difficulties in changes in routine, environment, and situations	Did not have a very hard time opening up after 'breaking the ice'. *Trying to form a bond in the first minutes of the session helped to achieve the openness of the participant.*	Had quite a hard time opening up at the beginning of the sessions. *Putting extra effort in 'breaking the ice' and showing a lot of interest in getting to know him got the participant to really open up.*	Did not have a very hard time opening up after 'breaking the ice'. *Trying to form a bond in the first minutes of the session helped to achieve the openness of the participant.*

	The audio recorder did not work so the participant got a little uncomfortable. *Stopped trying to fix it and continued with the session as fast as possible (without recording).*		
Restrictive interests	Was not an issue.	Told that he made animations and aspired to be a graphic designer, this kept him really motivated for the session.	Was not an issue.
Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colors	The environment of the session prevented this from being an issue.	Noises from outside and the hallway (the window and door were open because of the heat) still distracted the participant. *The window and door were closed*	His friends walked past the room, so he got really distracted. *Taking a small break to talk about random stuff and continuing after helped.*
Lack of imaginary skills	Had every now and then difficulties with visualising things, especially with envisioning the user scenario. *Giving him examples and helping him to draw out his ideas worked well also, walked through the user scenario stepwise together.*	Got stuck when having to imagine an 'open' concept and got stressed about the many options. *Encouraging him to try drawing it out, this helped most of the times because he loved drawing*	Had every now and then difficulties with visualising things. *Giving him real-life examples and helping him to draw out his ideas worked well. Also, gave him room to draw things himself when he initiated this.*
Other		Sometimes he got really excited about an idea and got really focused on it. *Letting it happen and encouraging him to keep exploring every idea. Although this took a lot of extra time, it may help him to be even more open and participating in the following sessions.*	Really put an emphasis on privacy and being afraid to be followed during the whole session. *Giving options to ensure privacy set him at rest.* The session took really long because near the end of the session, the participant kept coming up with new remarks and ideas.

			Giving him the freedom to continue and trying not to cut off his motivation. After 45 minutes, the designer decided to end the session and ensured that participant to write all his new ideas down to talk about in the next session.

APPENDIX F: LO-FI PROTOTYPE
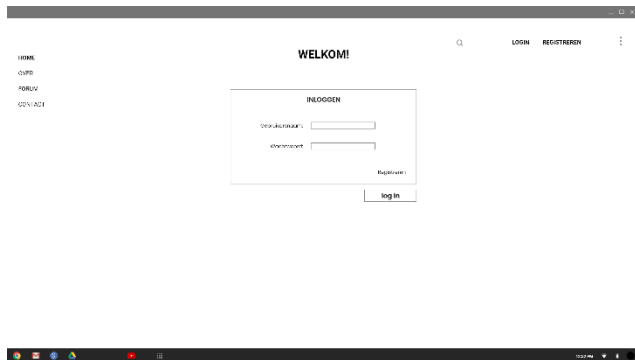
Figure 1, login page
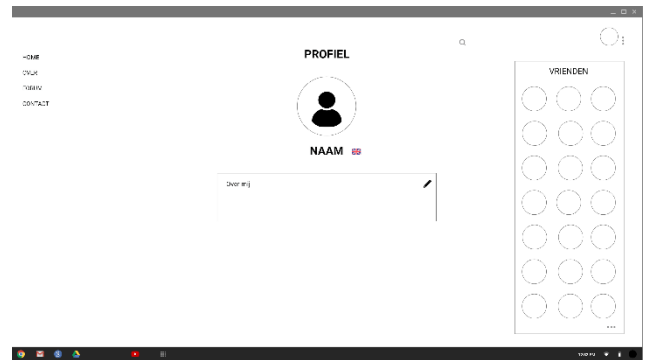
Figure 2, profile page
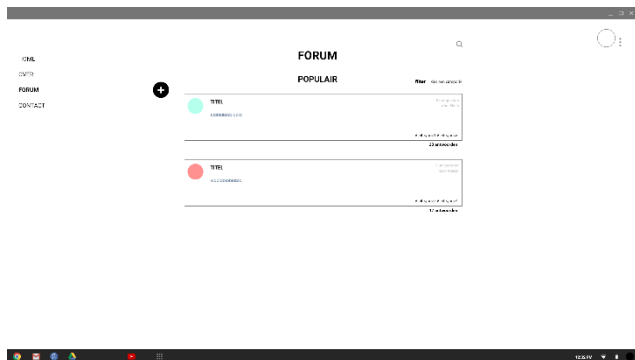
Figure 3, forum page (when logged in)
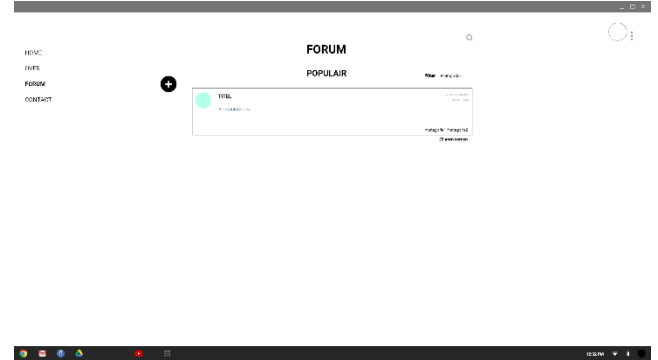
Figure 4, forum page with the filter active
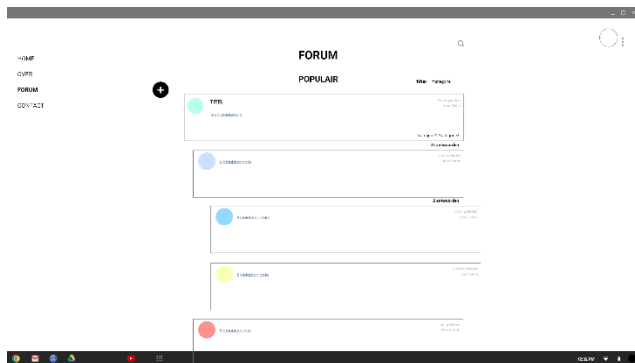
Figure 5, forum page with comments expanded
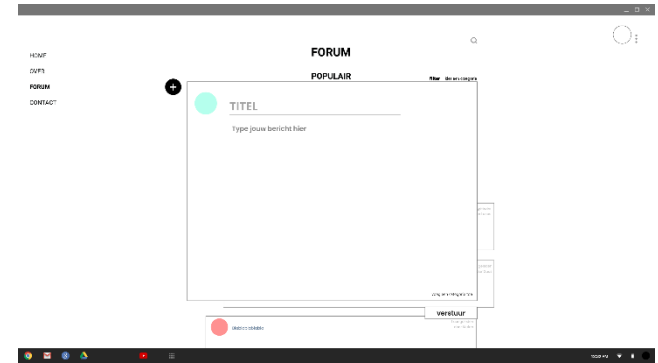
Figure 6, forum page, writing a new post

APPENDIX G: RESULTS SESSION 2

Table 2.1, results discussion and gathering design ideas about the first prototype

Platform (NL)	A	B	C
Profiel inhoud	Naam, interesses, hobby's Laatst gepost/gereageerd	Naam, zelf bepalen	Naam, zelf bepalen
Menu	Meldingen (zelf bepalen waarvoor ontvangen)		Forum boven home (belangrijker) Bij automatisch inloggen, gelijk door naar forum Uitloggen
Vrienden	Naam eronder Privé berichten (altijd zichtbaar) (pop-up)	Naam als hover over Privé berichten	Naam ernaast (lijst) Privé berichten
Leden		Zoekfunctie voor leden	Leden filteren
Forum	Populair = meeste likes Wat vrienden hebben gepost Reactiestructuur duidelijker Algemene categorie	Zo simpel mogelijk houden, geen foto's	Categorieën + tags Eigen feed Nieuwe post toevoegen moet duidelijker Opties reageren, profiel bekijken, privé bericht bij reageerder
Overig	Inbox: 2 delen: meldingen, privé berichten		Google resultaten: inhoud mag niet zichtbaar zijn Tekst groter

Table 2.2, evaluation of the influences of the characteristics of ASD on the co-design session

Characteristics (EN)	A	B	C
Difficulties in communication	Found it sometimes hard to express the ideas that he had in his head. *Helping him communicating these by drawing a lot of ideas and examples together.*		Found it very difficult to focus on the topics and wandered off a lot of times. *Going with the unrelated topic a little bit and then bending it into something that was on-topic again made him engaged again without provoking the*

			feeling that the designer was not interested in his stories.
Difficulties in changes in routine, environment and situations		His last class got cancelled, so he was at the point of going home when the teacher reminded him of the co-design session. He got really confused and stressed about this, so it was decided to keep the session very short and only show him the prototype.	
Unusual and intense reactions to sounds, smells, tastes, textures, lights and/or colors			Got really distracted by the rain outside. *There was not really much that could be done to solve this, so talked a little bit with him about the rain and then got back to the topic*
Lack of imaginary skills	Had a hard time with trying to visualize what the designer tried to explain. *Sketching things out helped a lot.*		Had a hard time with trying to visualize what the designer tried to explain. *Sketching thing out helped a lot.*
Other			Again, the session took a lot of extra time because of the participant telling a lot of extra stories. *Trying to find a good mix between letting him finish the stories and getting back on topic was hard. Talked with the teacher about this afterwards.*

APPENDIX H: HI-FI PROTOTYPE (WEB)
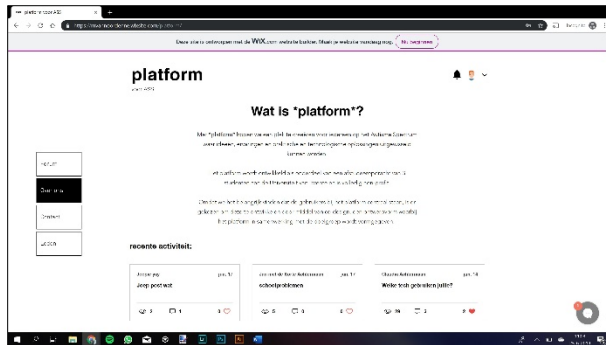
Figure 2.1, home page 'about'
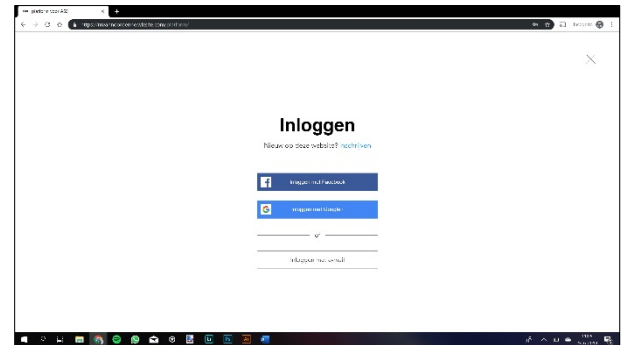
Figure 2.2, login screen when trying to enter the forum
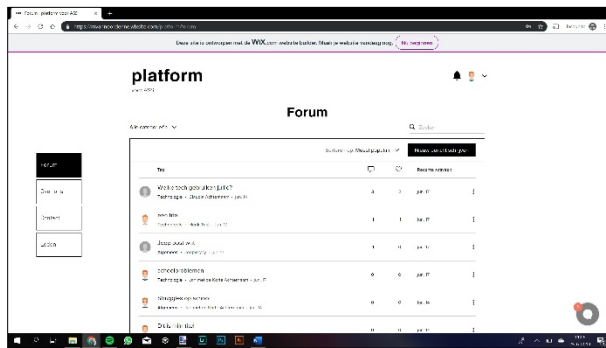
Figure 2.3, forum page
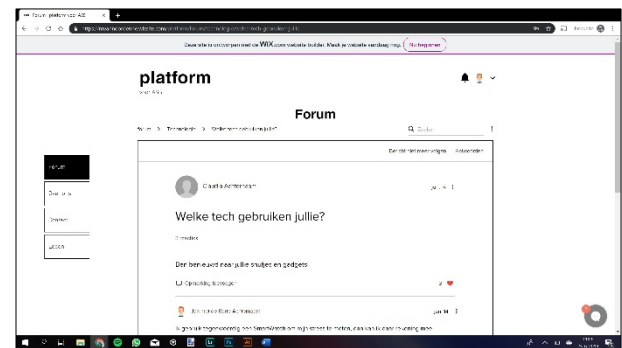
Figure 2.4, forum post
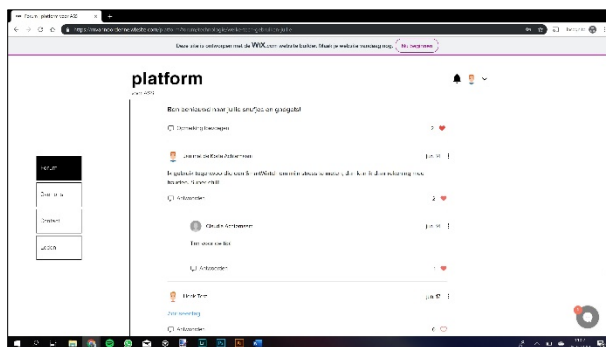
Figure 2.5, forum post with reaction
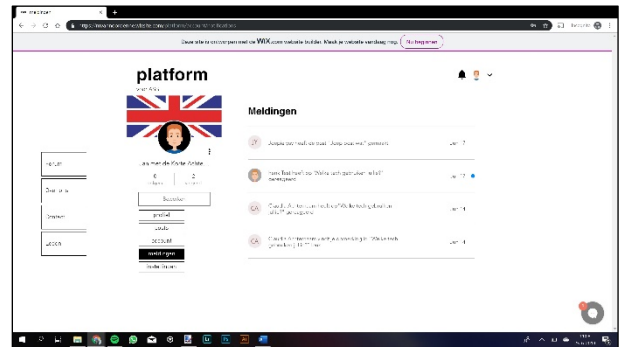
Figure 2.6, notifications
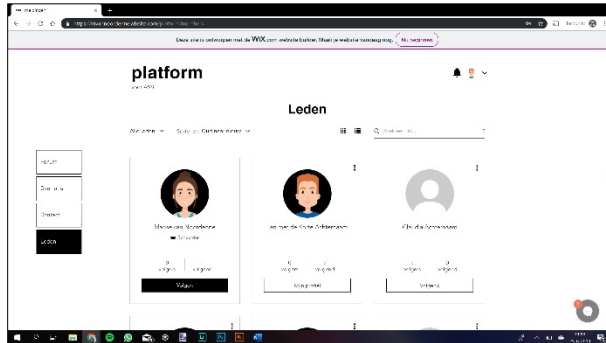
Figure 2.7, members page
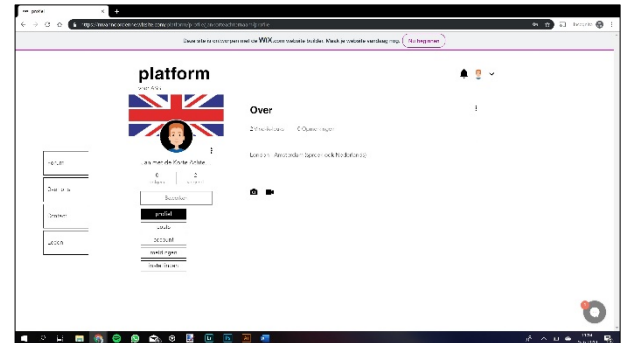
Figure 2.8, user profile page

APPENDIX I: HI-FI PROTOTYPE (MOBILE)

Figure 2.1, log in page

Figure 2.2, menu
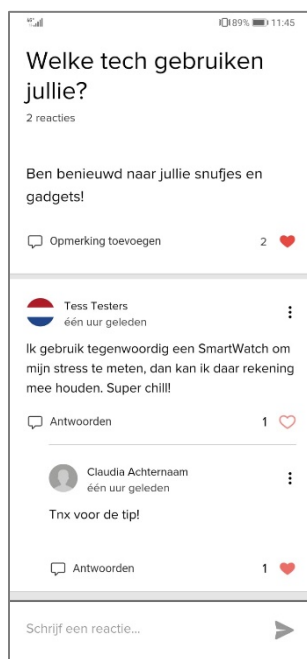
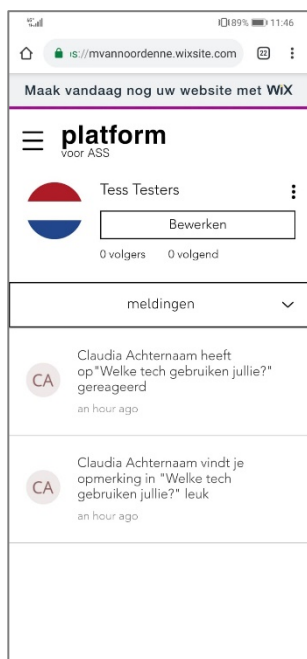Figure 2.3, about page (start)
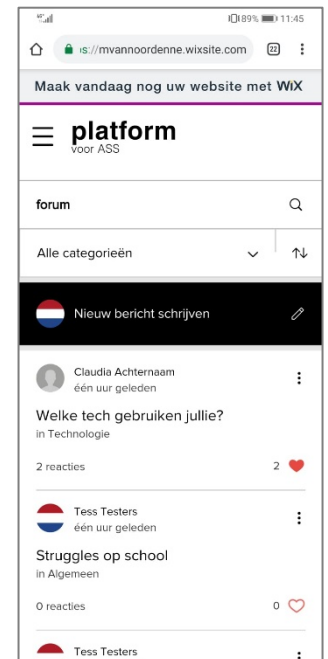
Figure 2.4, forum

Figure 2.5, forum post

Figure 2.6, notifications

Figure 2.7, members page

2.8, user profile page

APPENDIX J: RESULTS SESSION 3

Table 3.1, results discussion and gathering design ideas about the first prototype

Platform (NL)	A	B	C
Achtergrond	Lichte kleur Verschillende kleur menu balk (donkerder) Groen/blauw	Mogelijkheid tot customizen achtergrondkleur	Mogelijkheid tot customizen achtergrondkleur (via account)
Font titel	Gill Sans MT	Gill Sans MT	Verdana
Font tekst	Century Gothic (sans serif)	Century Gothic, Minion 3 (sans serif)	Baskerville Old Face (serif)
Kleurthema	Blauw, blauw	Zwart, blauw Zelf kiezen (customize optie)	Blauw, blauw
Plaatsing logo	Links	Links	Links
Chat	Niet opgemerkt (duidelijker icoontje)	Verzonden/gelezen toevoegen	Niet opgemerkt (chaticoontje naar links)
Feed	Mooi en overzichtelijk	Klikken op vak moet ook het bericht openen Optie vrienden feed	Het is onduidelijk wat de forums zijn en wat de posts
Profiel	Vlaggen in een keuzemenu ipv zelf uploaden	"Account" alleen toevoegen in profielmenu, niet rechtsboven	"Account" alleen toevoegen in profielmenu, niet rechtsboven
Functionaliteit		Profielmenu werkt niet op mobiele versie Profielfoto rechtsboven verdwijnt af en toe	Profielfoto rechtsboven verdwijnt af en toe Na het inloggen verdwijnen sommige pagina's uit het profielmenu, na refreshen komen deze weer terug
Overig		Neurodiversiteit?	

Table 3.2, evaluation of the influences of the characteristics of ASD on the co-design session

Characteristics (EN)	A	B	C
Difficulties in communication	Found it sometimes hard to express the ideas that he had in his head.		Found it very difficult to focus on the topics and wandered off a lot of times.

	Helping him communicating these by speed sketching his ideas.		*Going with the unrelated topic a little bit and then bending it into something that was on-topic again made him engaged again without provoking the feeling that the designer was not interested in his stories.*
Difficulties in changes in routine, environment and situations	He was very early for the session, so everything still had to be set up. This seemed to make him uncomfortable. *Having a casual conversation with him until everything was ready for the session made him feel comfortable again.*		
Lack of imaginary skills	*Giving examples of the different design choices made it easier to visualize these and give his opinion.*	*Giving examples of the different design choices made it easier to visualize these and give his opinion.*	*Giving examples of the different design choices made it easier to visualize these and give his opinion.*
Other			*To prevent the session from taking too long again, it was made clear that the session could only take up to 30 minutes and a timer was set. After the 30 minutes, the session was ended.*

APPENDIX K: HI-FI PROTOTYPE (WEB)
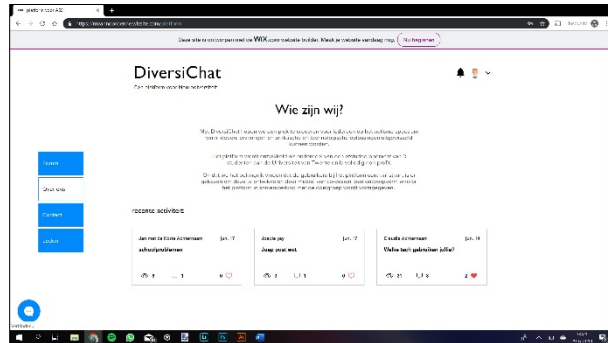
Figure 3.1, home page "about"
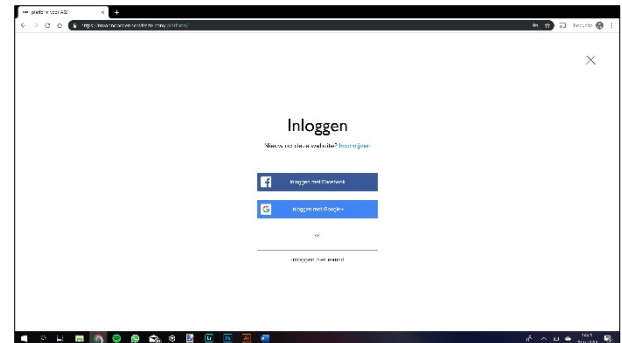
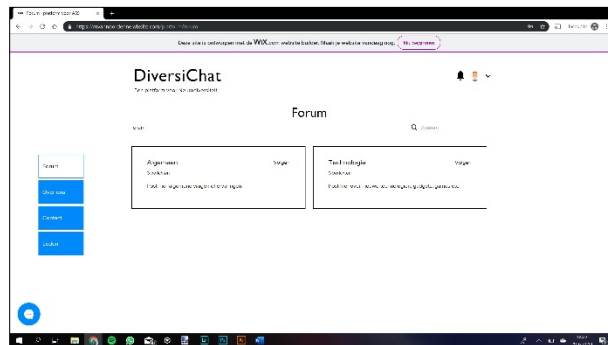Figure 3.2, login screen when trying to enter the forum
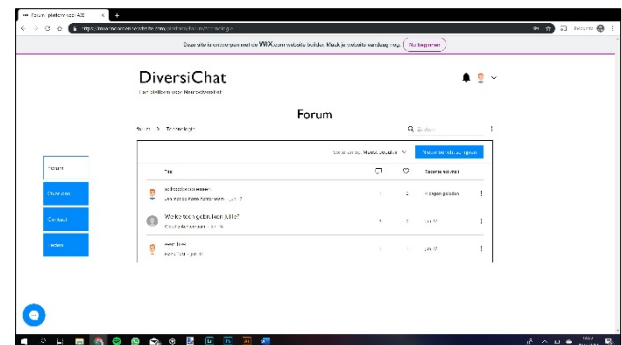

Figure 3.3, forum page with categories
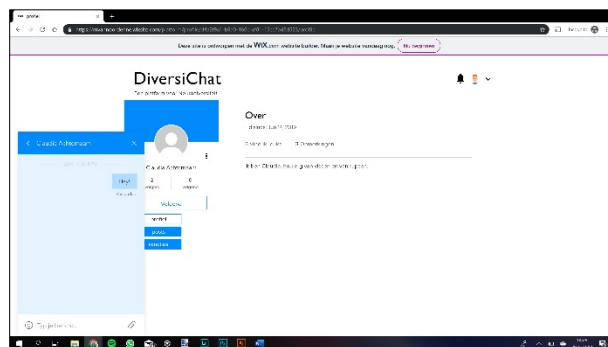

Figure 3.4, forum post
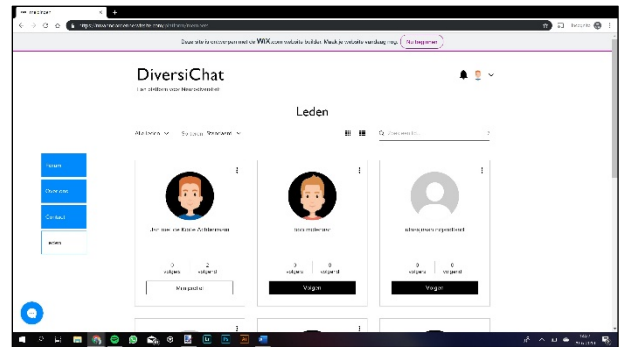

Figure 3.5, chat

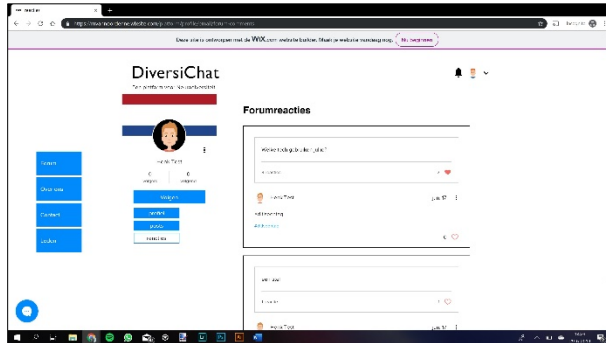
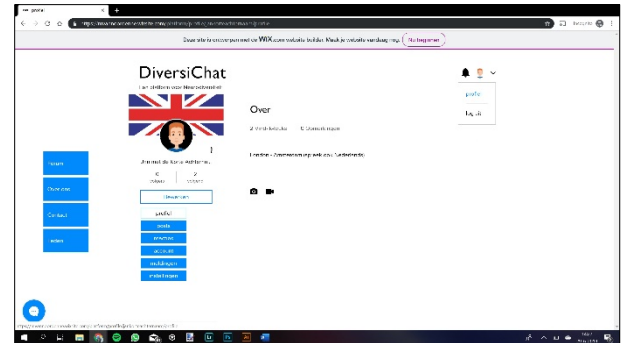Figure 3.6, members page

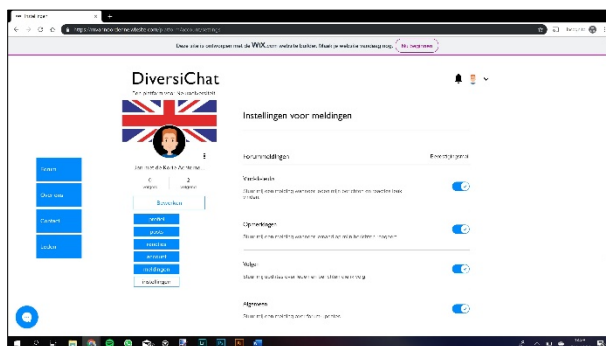Figure 3.7, user profile page

Figure 3.8, profile page
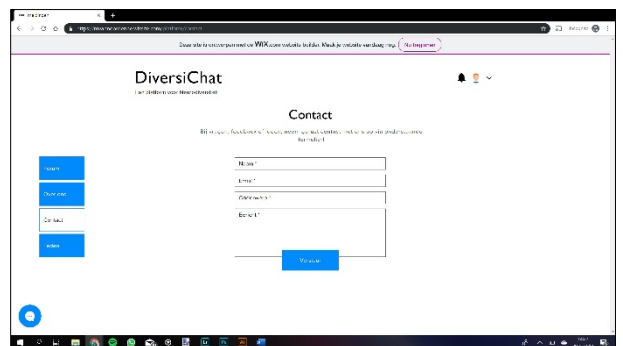

Figure 3.9, user profile page

Figure 3.10, contact page

APPENDIX L: FINAL PROTOTYPE (MOBILE)

Figure 3.1, log in page

Figure 3.2, menu
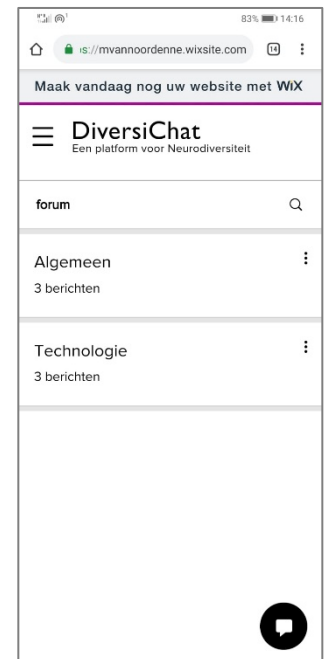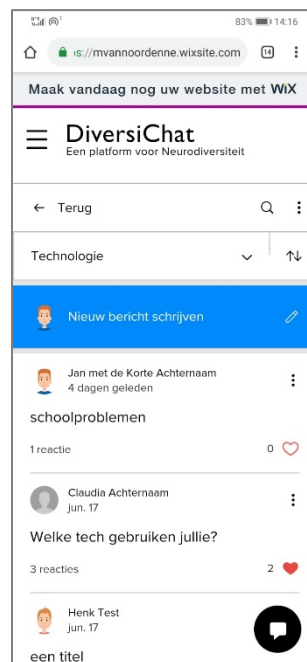

Figure 3.3, about page (start)
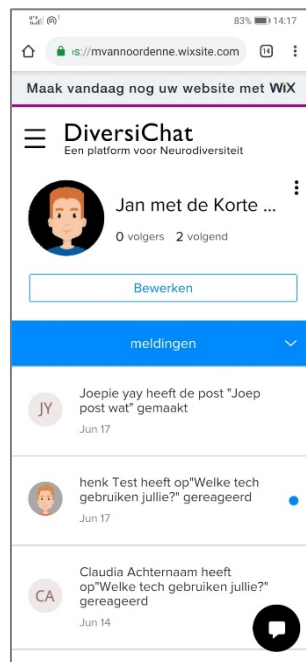

Figure 3.4, forum

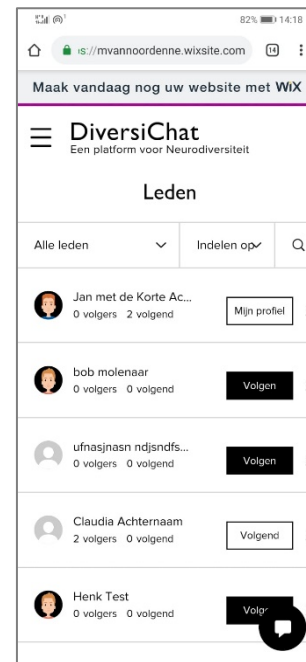Figure 3.5, forum(category)

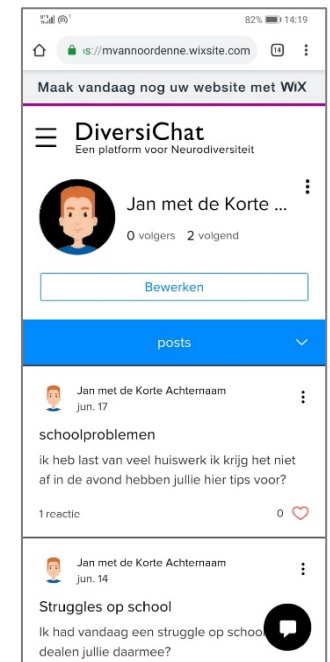Figure 3.6, notifications

Figure 3.7, members page

3.8, profile page

APPENDIX M: COLLABORATIVE DISCUSSION

1 ON CO-DESIGN

Initially, 3 students (Alan Deuvletian, Wojtek Jarosinski and Marise van Noordenne) were assigned to this Graduation Project. To make sure that everyone got enough space to put their own spin on it, it was decided to make a division into 3 subgroups of the original target demographic (individuals on the autism spectrum): tech-savvy adults (Wojtek), older adults (Alan) and adolescents (Marise). Alan and Wojtek mainly went for the more quantitative approach, as they chose to conduct the co-design through the internet (web-based), while Marise went for the more qualitative approach and conducted the co-design with a small group of participants in 'real life'. Also, Alan and Wojtek chose to start off with an already functioning prototype of the platform to test out, while Marise chose to start designing from scratch. In the following paragraphs, interesting observations about the differences on certain subjects between the approaches were discussed.

1.1 OBTAINING PARTICIPANTS

Throughout the co-design process, various similarities and differences were witnessed in terms of obtaining participants.

In order to acquire voluntary participants, Wojtek chose to primarily rely on Twitter's social network. At first, the approach taken was to post public tweets in order to reach the widest audience as possible, but it was quickly noted that no one replied to the tweets to show a willingness to participate. Thus, a new approach was attempted, in which he started to directly reach out to individuals who had liked the original public tweets, as well as prominent members of the autistic Twitter community, through private, direct messages. This was a substantial improvement in the participation rate.

Alan took a similar approach in in which he used Reddit as a platform for sourcing participants. As also seen in Wojtek's case, Alan experienced very little replies or interest. This could potentially be attributed to the lack of intimacy of public broadcasting, being that it is perceived as a more corporate and less personal approach. Therefore, he also decided to reach out directly to people through private messages. This did not seem to work as well, maybe due to the demographic of mainly older autistic adults, so he decided to reach out to people in his personal network that could put him in touch with his target group. This led to a small improvement in the participation rate.

On the contrary, Marise went with a more direct method for sourcing participants which did not involve finding people online. Instead, the participants were gathered through a collaboration with a high school for special education. However, even in this case, the rate of participants were quite low, as only 3 out of 90 students signed up for the co-design collaboration. This could be partly due to the fact that real-life co-design sessions could be seen as more intensive for not only the designer, but the participants as well.

To conclude, the observations demonstrate that there is a high reluctance and scepticism on behalf of individuals on the autism spectrum to participate in such a co-design process. This could very well be due to the fact that the developers themselves were not on the spectrum and it could be the case that the inclusion of autistic individuals in the development team would improve peoples' willingness to participate. This may be useful for future development of such a project.

1.2 COMMUNICATION

Throughout the co-design process, various similarities and differences were witnessed in terms of communication and interaction.

In Wojtek's case, it was observed that once communication was established via direct messages on Twitter, communication went relatively smoothly with little to no hindrances. It was also noted that explicit language and wording were often needed to clarify certain tasks in order to be clear of what was asked of the individuals in question. This is especially true since vagueness can lead to confusion and as a result have a detrimental effect on the evolution of the project and participants' willingness to partake in the co-design process.

In Alan's case, communication was partially mediated by the mutual personal connections who put both parties in touch, especially initially. Later on, communication took place through email correspondences. Within these interactions, it was important to keep the participants highly motivated and engaged by making sure they felt valued and heard. Comparatively to Wojtek's observations of communication and interaction, it became apparent that thorough instructions were needed to properly explain and elaborate on what was required of the participants. Once this was done, communication was relatively straightforward and successful.

Moreover, Marise found that it was difficult to get participants to open up at first, but that once a bond was established, interaction went fairly natural. Instances arose in which participants had

difficulties properly communicating their ideas and thoughts, however the use of fields of interest were used to appease the situation and get back on track. This indicates that once a relationship is established, the interaction can flourish and communication becomes easier with time.

1.3 QUALITY OF FEEDBACK

Throughout the co-design process, various similarities and differences were witnessed in terms of the quality of feedback obtained.

In Wojtek's case, the feedback acquired was very good in general. Participants were not hesitant to share their opinions extensively since they answered all questions well, especially open-ended questions with meticulous detail.

Contrastingly, in Alan's case, the feedback offered in open-ended questions was not as extensive, but the quality of feedback was not sacrificed. This was especially true in terms of the creativity offered when asked for additional features and aspects of the website that the participants would enjoy. It must be taken into consideration that since the participants were sourced through personal connections, the feedback offered could be slightly biased and influenced. The participants could have been afraid or hesitant to give their unfiltered feedback for fear of being offensive or overly critical.

In Marise's case, the quality of feedback obtained was very high. The small pool of participants allowed for a greater investment of attention and focus per participant during the co-design sessions. When occasions occurred in which the participants had difficulties with visualization and imagination, it was helpful to draft quick sketches and drawings to help support explanations and evoke thought processes. This method is drastically different to Wojtek and Alan's approach, since this method of supportive sketches was not possible online given the technological and time constraints.

Regardless, Marise's predicament was quite similar to Alan's in the sense that dealing with participants in-person could have influenced the feedback granted. This could be because the pressure of being on the spot and expecting an instant answer could result in more skewed feedback than when interaction with people online. In the latter case, people could pay less attention to political correctness and act more on their true feelings and emotions.

1.4 PROS AND CONS

In the following table (Table 1), the advantages and disadvantages of both web-based and in-person co-design, as observed by the project team, are elaborated.

Table 11, advantages (+) and disadvantages (-) of the different co-design approaches

	web-based co-design	in-person co-design
participants	+ Gives access to a broader range of participants (larger quantity and more diverse). - Capturing interest and encouraging them to take part in the design may be difficult. - Participants could stop replying at any moment. - Due to online anonymity, verification of participants is not possible, which could lead to inaccurate information.	+ Deeper bonds and relationships can be formed with the participants which lead to more openness. + High reliability due to real-life interaction with the participants. + Participants are less likely to opt-out because of a higher sense of responsibility towards the designer. - More difficult to find participants.
communication	+ Participants are free to provide feedback in their own space and time. + Fewer challenges with overall communication that could come with characteristics of ASD.	- More difficulties with overall communication could arise because of characteristics of ASD.
quality of feedback	- Lack of opportunity to explain ideas extensively and ask for further details. - Possibility for misunderstandings between the designer and the participants.	+ Allows for an in-depth explanation of ideas and concepts and asking for further details. + Overall quality of feedback is higher due to more room for exploration and longer, more intensive sessions.
practical	+ Not having to send out consent forms. + No scheduling conflicts while planning the meetings.	- More time-consuming, for both designer and participants in terms of preparation, conducting the sessions and forming a bond with the participants. Especially when conducting individual sessions.

2 ON THE PLATFORM

This section of the discussion will describe some of the key differences which were observed amongst the different user groups with regard to the platform itself.

One area that illustrates the differences amongst the users is that of technical aspects of the platforms. Prior to the development of the project, it was assumed that Wojtek's target group of tech-savvy adults would have the most to say in this regard. However, the technical comments made by

users were rather limited. In the case of Alan's user group, being older autistic adults, similarly, not many technical details and improvements were identified. On the other hand, Marise's group of adolescents placed a large focus on certain technical features not working or being buggy. The information obtained in this regard is too limited to draw concrete conclusions, especially given the fact that both Wojtek's and Alan's platforms were functioning websites from the beginning of the iteration process, as compared to Marise, who developed the platform from scratch during the process.

The functionalities of the website were another area where both similarities and differences amongst user groups could be identified. Both older adults and adolescents noted that they would like to see a chat function implemented within the platform. This was not observed with the tech-savvy adults. On the other hand, all user groups highlighted the fact that they would like a better way to categorize and filter posts, potentially based on the different topics of discussion.

With regards to design, all three target groups seemed to lean towards a clean and functional design. The adolescents emphasized that they would like to include an option for personalisation of the colour theme. Tech-savvy users made an interesting observation regarding this subject, as they wanted to ensure that the colour scheme of the website was suitable for visually impaired users. This improvement was not identified by the other user groups.

Another noticeable observation, was the fact that the group of older adults asked for more pictures and illustrations, while the adolescents put an emphasis on the preferred absence of those and a very clean and minimal look. This showed in the general comments regarding design and aesthetics as well.

The content of the website is the area in which the differences between user groups were most present. The two adult user groups emphasised the need for clear and specific site rules, while the adolescent group did not identify this need, stating only that they would like the option to block other users. All of the user groups differed in their preferences for categories within the forum functionality of the website. Tech-savvy users wanted to see: 'Ask for Advice', 'Communication', 'Future Product Ideas', 'How-To', 'Legal Help', and 'Technology.' Older adults, on the other hand wanted: 'Advice', 'How-To', 'Communication Support', 'Technology', 'Success Stories', 'Community Blog', and 'Feature

Requests'. Meanwhile, adolescents wanted only 'General' and 'Technologies' to start with, with the option to add new ones later, as they were needed.

Furthermore, both the adolescents and the older adults had a lot of concerns about privacy. The adolescents highlighted that they preferred the forum to be completely inaccessible for people who are not logged into the website. This was also the case for the 'Members' page.

To conclude, it could be observed that there were quite some differences. Some of them were surprising, for example the fact that the adolescents were the ones to point out that they preferred the absence of pictures, while the adults emphasised that they would like to include more. In this case, the opposite was expected. On the other hand, a lot of similarities were observed as well, such as the preference for a clean and functional design of the platform.