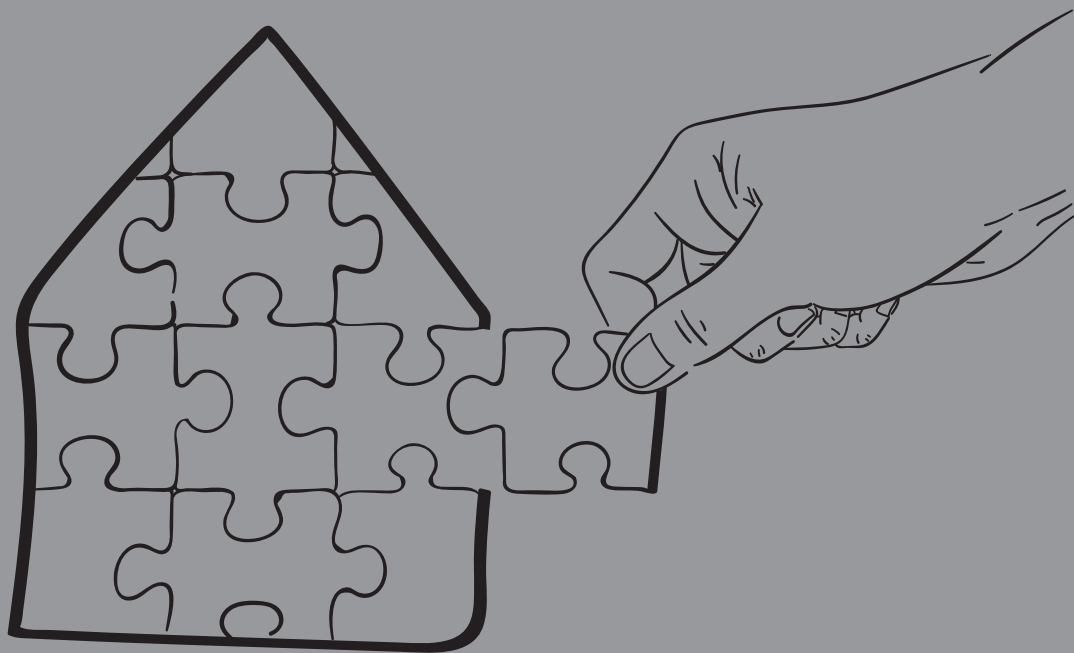# A perfect fit

creating supportive housing for the autistic

Master thesis
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Master thesis Explore Lab
january, 2018

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Master Architecture, Urbanism and Building Sciences

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Board of examinors: Daan Vitner

"I knew I had to say 'thank you', but my voice retreated in my throat. In my mind I did say it. I thanked miss Marleen so loudly in my head that she just had to hear it.
But, like any other day, she walked away after she'd waited for an answer expectantly for a couple of seconds."
— Judith Visser, 2018

Preface

fig. 1: me and my twin sister, Anne (own photo)

This graduation thesis is the result of my research I have conducted during my work in the Explore Lab studio. It is part of a project that is very close to my heart, namely housing for people with autism. This subject is personal to me, since I have a twin sister who has autism (figure 1).

The research itself and conclusive guidelines from it will form the starting point of my design project. Furthermore, I hope that these guidelines might help any future designer who takes interest in designing for this very special part of society.

Eventually, this research and design combined, will result in me acquiring the title of Master of Science in Architecture, Urbanism, and Building Sciences.

First of all, I would like to thank my research mentor Luc Willekens, who very enthusiastically guided me through this research process which made me even happier to continue to work on it. I started my architecture study with Luc during my first ever design project (BK1ON1) and I am happy to end it with him as well.

Furthermore, big thanks to Roel van de Pas and Pierre Jennen for guiding me during the design process.

This research could not have been possible without the amazing help of two tutors who work with and for people with autism. Thank you very much for your time when you were already very busy with your normal work! Adding to this, I want to thank the six

Summary

In contemporary society, a large part of the housing stock for people with autism focuses on living with house mates and in-house support (Berger et al., 2005). It seems, through several extensive questionnaires, that 65% of those individuals seek another housing situation, namely independent housing of some sort (Begeer et al., 2013).

Design of these types of apartments should be done with great care, since individuals with autism can suffer extensively from ill-designed surroundings (Schrameijer, 2013; Alexa, 2017).
Nowadays, most housing that is available, still feels very institution-like and is scarely furnished.

For this research, the following main question will serve as guidance:

> *Which architectural elements can increase the well-being of people with autism within their home environment?*

The research focuses on three elements: literature study, typological research, and questionnaires/interviews with residents and personal tutors. The results deriverd from this research, are divided in **problems** and **solutions**, which then are further categorised in themes: **sensory**, **social**, and **spatial**.

As a conclusion, I have strived towards creating conclusive guidelines for design.

I have applied these design principles in my graduation project which contains a new modern little courtyard, as well as the transformation of an old school building. In these designs, I aim to show how the principles can be applied in several ways: more rigorously in the new development, while being more restrained and subtle in the transformation project.

Firstly, sound appears to be the most disturbing factor in housing situations: this notion kept reoccuring in the research. Other annoyances were:
- glare and reflection of sunlight;
- abundance of darkness during the night;
- an unlogical routine space;
- lack of personal space;
- feelings of unsafety;
- forced social interaction;
- problems with wayfinding;
- lack of personalisation opportunities.

To solve these problems, several solutions have come up during the research. These solutions have been summarised with addition of design suggestions, including:
- application of a high amount of sound insulation materials;
- use of matte finishes;
- providing a spatial layout that supports (and creates expectations for) routine;
- design fully equipped houses with addition of common rooms in the building;
- allow for social interaction, both planned as well as accidental;
- create opportunities for personalisation;
- design transitions thoughtfully.

Index

1. Introduction

"Her mother was talking to someone in the kitchen. Her weird, foreign words jumped around in my head, someone turned up the music, Diane's smacking got louder, and the chatter turned into an enormous noise of which I couldn't understand anything anymore.

I blinked. The red-green-blue-yellow of the banners bumped against my eyes, bright like a flickering flash light. I put my fork down before I would drop it. Why was everybody screaming like that? Was I the only one who felt like burning? The smells from the kitchen packed together into a pressing chunk in my head. All smells, colours, and sounds were crashing in my head so hard I thought that my skull would crack".

– Judith Visser, 2018

1.1. Incentive

This thesis will investigate how architectural elements can improve the home environment of those diagnosed with autism, and through that, increase their well-being and stimulate their development.
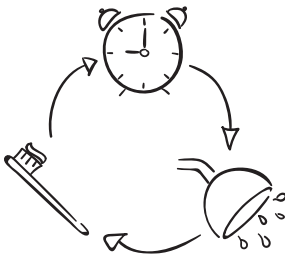

fig. 2: dislikes loud sounds

My fascination for this subject stems from my experience of having a twin sister who has Autism Spectrum Disorder (ASD), commonly named autism. For her, this means that she is very sensitive to sound: she hates loud and unexpected noises like fireworks or barking dogs (figure 2). In September, she already gets nervous for New Year's Eve and on the day itself, she prefers to walk around with earplugs, covered by headphones made for the construction sector. If possible, she will also close the curtains to prevent herself from getting surprised by the sudden ligh flashes.

fig. 3: loves a clear routine

Other than that, she loves a clear planning, order, and routine: she can get a bit upset when she has to go somewhere or do something unexpectedly (figure 3).

Contrary to the 'common known' aspects of autism, my sister does not have problems with social interaction. She talks very easily to people, isn't shy and doesn't mind telling random strangers that we are twins (figure 4).

fig. 4: is socially skilled

She is very creative, which is clearly her "talent." She works in an art studio which is run (by an organisation) especially for people with disabilities. Here, she makes beautiful things, from cartoons to silk scarfs

to ceramics. These are then sold in the shop or online. When she is home or anywhere really, you will always find her drawing or painting (figure 5).

When she gets overwhelmed or over demanded by a series of questions, she tends to shut down. It works best if she's asked one thing at a time, otherwise "it will get all cluttered in her head," she always says (figure 6).

Although she is quite socially skilled, she feels uncomfortable in larger groups where a lot of people talk at the same time. At birthday parties, she always takes (drawing) stuff with her. She does this so that when she gets overwhelmed, she can exclude herself from the crowd and do something in peace (figure 7).

In the last four years, my sister lived in a group home. This should have been a temporary situation, since she was waitlisted for an independent apartment with a 24-hour support point, but there is a lot of demand for this kind of housing and not much on offer. So this temporary situation became permanent. While waiting for an apartment, I came to notice that her development came to a standstill and, at some point, even regressed. In my opinion, the home environment is already very important for you and me, but can be of even greater meaning for people with autism. I think with a fitting environment they can develop themselves further and get more independent. That is why I have been investigating this further to finally create a sort of architectural toolbox with elements that contribute to the living environment of the autistic individual.
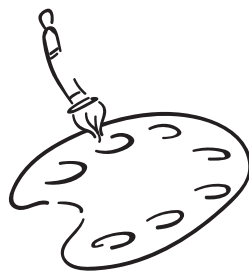

fig. 5: creativity as talent

fig. 6: can get overwhelmed

fig. 7: discomfort in groups

1.2. Overview

In today's society, great focus lies on designing schools for special education. These schools are very well equipped and designed for, which leads to a perfect environment for the autistic children to learn and develop themselves (figure 8 - 10).

Housing for this focus group, on the other hand, seems to lag behind. These houses have a very practical appearance, which immediately causes an institution-like feeling. Linoleum flooring and a sterile look seem to dominate, cosiness is a rarity in these kinds of houses (figure 11 - 12).

fig. 8: Specially designed school [1]

fig. 9: School library for autistic kids [2]

fig. 10: Playing area for autistic kids [3]

fig. 11: sterile looking living room [4]

fig. 12: lack of cosiness in dining room [5]

In my opinion, this should be different. Housing for people with autism should be recognisable, cosy, home-like, and supportive (figure 13 - 15). From birth, people with autism are supported through special education and in activity centres. But regarding the home environment, they hit a wall: support stops (figure 16).

The way I have observed it with my sister, the development of a person with autism follows a different line than of a neurotypical (NT) person; in other words, a "normal" person.

For NT-people, development can be visualised by a graph of which the line is constantly increasing. Even if a negative experience is encountered, lessons can be learned from this which causes further development (figure 17).

With people with autism, as I have also noticed and heard from several professionals working with this focus group (PT1 - PT2), this is different. Their hypothetical graph can be characterised by bumps: their development rises and decreases with several experiences (figure 18).

Leading from this problem statement, I have formulated the following research question:
- *Which architectural elements can increase the well-being of people with autism within their home environment?*

From that point, I have set up some sub-questions, which are as follows:

- *In what manner should sensory architecture come into play?*
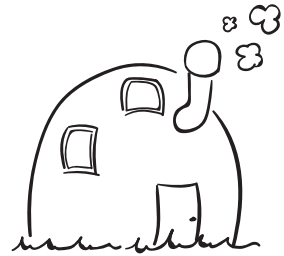

fig. 13: cosy housing for autism
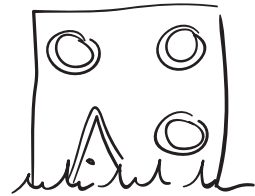

fig. 14: recognisable housing for autism

fig. 15: supportive housing for autism

- *Which measures considering privacy should be taken?*

- *In which way should social interaction be supported?*

- *How should the balance be found between generalisation and personalisation?*

- *How should the connecting outdoor space make a contribution?*

Designing for the senses is a very important element of this research. People with autism are known to have sensory filter deficits and tend to be overstimulated (source). To create a tranquil but still stimulating environment, should be an important goal of design.

The method used for this research is threefold. At the base of the research, extensive literature study has been done. Additionally,
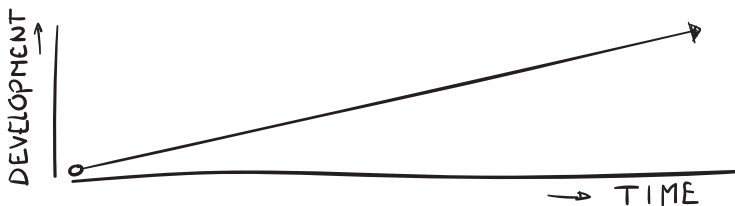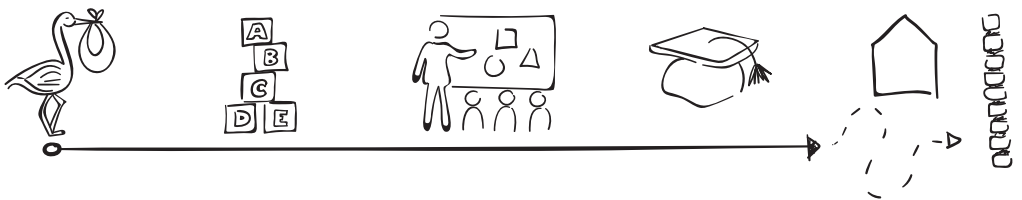
from the top down:
fig. 16: development comes to a standstill after graduation.

fig. 17: schematic visual of the development of a Neurotypical person.

fig. 18: schematic visual of the development of an autistisc person.

I have done a typological research of existing housing projects for autistic people.
Thirdly, people from the focus group filled out a qualitative questionnaire, some of which are combined with interviews with their corresponding personal tutors.

The results are separated in different categories which concern the overlapping themes **sensory**, **social** and **spatial**. Within these categories, the former established sub-questions will indirectly be answered.

All these categories aim to support the overall goal: independence. For this, I have formulated three sub-themes which in my opinion support independence. These are: **comfort**, **routine** and **confidence** (figures 19 - 21).

Finally, the results are defined in a hierarchy which highlights the importance of different elements.
From here, the conclusion is presented in the form of architectural guidelines. These can be used by architects while designing homes for autistic people.

With these conclusions in mind, notion has to be taken of the variety of individuals and characteristics of this focus group. The guidelines aim to be applicable for several levels of needs.
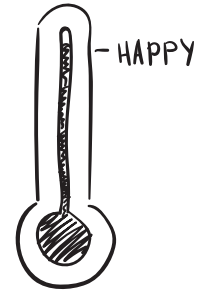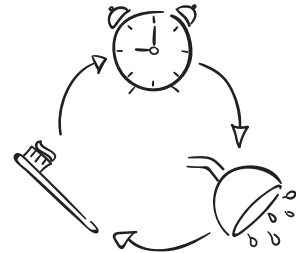

fig. 19: comfort

fig. 20: routine

fig. 21: confidence

1.3. Research
1.3.1 Relevance

"The surrounding environment has a strong influence over people with ASD, but there is very little information on how to design spaces for these individuals" – K. Gaines, 2013.

A few decades ago, architecture practices began to take notice of individuals with different types of disabilities. This resulted in the implementation of design strategies that take into account the needs fitting for peope with mainly visual, hearing, and motoric disabilities, so that these spaces can be also inhabited by those people. The term accessibility is used in this context, but only conveys these people mostly physical access to a building or spaces (Sánchez, 2011).
Other disabilites might not be so visible or noticeable, which get ignored in this aim of making the environment accessible. Among this range of disabilities are individuals with autism. For them, seemingly unimportant elements like loud music or neon signs can become a barrier. These elements can result in frustration and strange behaviour by the individual (Sánchez, 2011; Shell, 2017).

Several studies state that for people with autism, it is of very big importance to find a fitting home environment, for that it influences them even more then it influences us (Schrameijer, 2013; Gaines, 2016).

Furthermore, the study of autism has a relatively short history, and the studies that focus on environmental factors are even shorter. Most of these are limited to the

educational environment, and even within this limited category the findings are far from conclusive.

To add to the complication, people with ASD are often hypersensitive to one sensory factor while hyposensitive to the other, and the combination and the severity are infinite. It is a stereotypical view of autistic people to dislike being touched, however, in some cases they cannot have enough of it.

Also as it is called "spectrum" disorder, the degree of their functioning varies greatly. The complexity of this issue makes it particularly difficult to provide designers with a set of guidelines.

All these factors make this design challenge very complex: the challenge of designing homes for people on the autism spectrum.
The fact that this is a big challenge for designers, does not have to mean that this focus group should be neglected. On the contrary, autism is a growing phenomenon in society.
Nowadays, it is estimated that the prevalence of autism is between 1 in 68 and 1 in 100 people (Mostafa, 2015). This particular group of people should not be neglected anymore.

Research done by the Dutch Association for Autism (Nederlandse Vereniging voor Autisme, NVA) reviews a number of 3035 filled out questionnaires.
Concerning housing, the report states: "339 people responded that they are dealing with a waiting list. This means that approximately one out of ten respondants is waiting for a (different) housing situation. Mostly, they wait for a spot in a independence housing facility with little support" (Berger, 2005).

Additionally, the report states that there is a need for opportunities for growth and development within independent housing: there should be opportunities for expansion or reduction of the dwelling.
There should be a new view on size of space, the possibility for a seperate peaceful area as well as the need for social contacts should be reconsidered.

1.3.2. Research methodology

For this research, the method is threefold. These three parts will be explained separate and these will also be reviewed separately in the result-part of this thesis.

Literature study

Literature study has formed the foundation of this research. At the moment, most of the examples discussed in literature concern schools. Although that is not the building typology I am after, I have filtered interesting elements and assessed if these are applicable in housing design.

Typological research

For my typological research, I have visited housing projects which are built quite recently. The visited projects are shown in

care facility organisation	name project	location
Gemiva-SVG	Swetterhage	Zoeterwoude
Gemiva-SVG	Zwieten	Zoeterwoude-Rijndijk
Gemiva-SVG	Oude Vest	Leiden
's Heeren Loo	De Villa	Apeldoorn
's Heeren Loo	unnamed	Ermelo

fig. 22: overview of visited typological projects

figure 22, along with their corresponding organisations.

Through these visits, I have seen several architectural measures in practice. The results from this research are analysed on different factors, like accessibility to services and sensory integration. The

outcomes are put in a scheme, just like the one shown in appendix 3.

Questionnaires and interviews
By means of the interviews, I have aimed to get another list of wishes and needs. These wishes have been obtained by asking qualitative questions, e.g. to make the questions as open as possible. The questionnaires and interviews have been conducted with residents amongst autism (figure 23).

Questions like: "With your future home in mind, what do you think is really important to have at present?".
Based on the order things are named while answering the question, I have deducted the importance of these elements.

For the total of questionnaires and interviews: see appendices X to X.

resident (with autism)	current living situation	personal tutor
resident 1 & resident 2 (R1, 2018) & (R2, 2018)	Living with housemates and 24-hours tutoring. Waiting for an independent apartment with support point.	personal tutor 1 & personal tutor 2
resident 3 (R3, 2018)	Currently living with parents, but will be moving to an independent home with support point in September 2018. > Interview instead of questionnaire	-
Resident 4, 5, 6 (R4, 2018), (R5, 2018) & (R6, 2018)	Studying in Delft. Currently living in a studio apartment provided by StumASS with communal areas and support point.	-

fig. 23: overview of visited typological projects

1.3.3. Approach: evaluation of results

The results found in literature often stated problem and solution in one or more, sequential, sentences.

For my research, I have decided to split these problems and solutions. This way, it was possible to collect all the problems that occurred during literature study, typological research and questionnaires/interviews.

The three former defined themes, sensory, spatial, and social, define the found problem. Through these chapters, the problems are stated just as they are: with no hidden referencing behind it. These themes and their subjects are shown in figure 24.

For the solutions however, I have applied another structure, as shown in figure 25.
All the found solutions will refer back to one or more of the indepence-linked themes: routine, comfort, confidence. For example: a clear wayfinding structure supports confidence or a certain spatial layout supports routine.
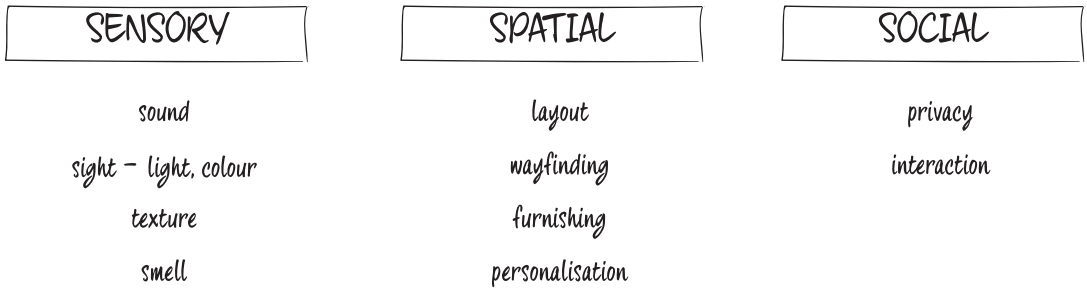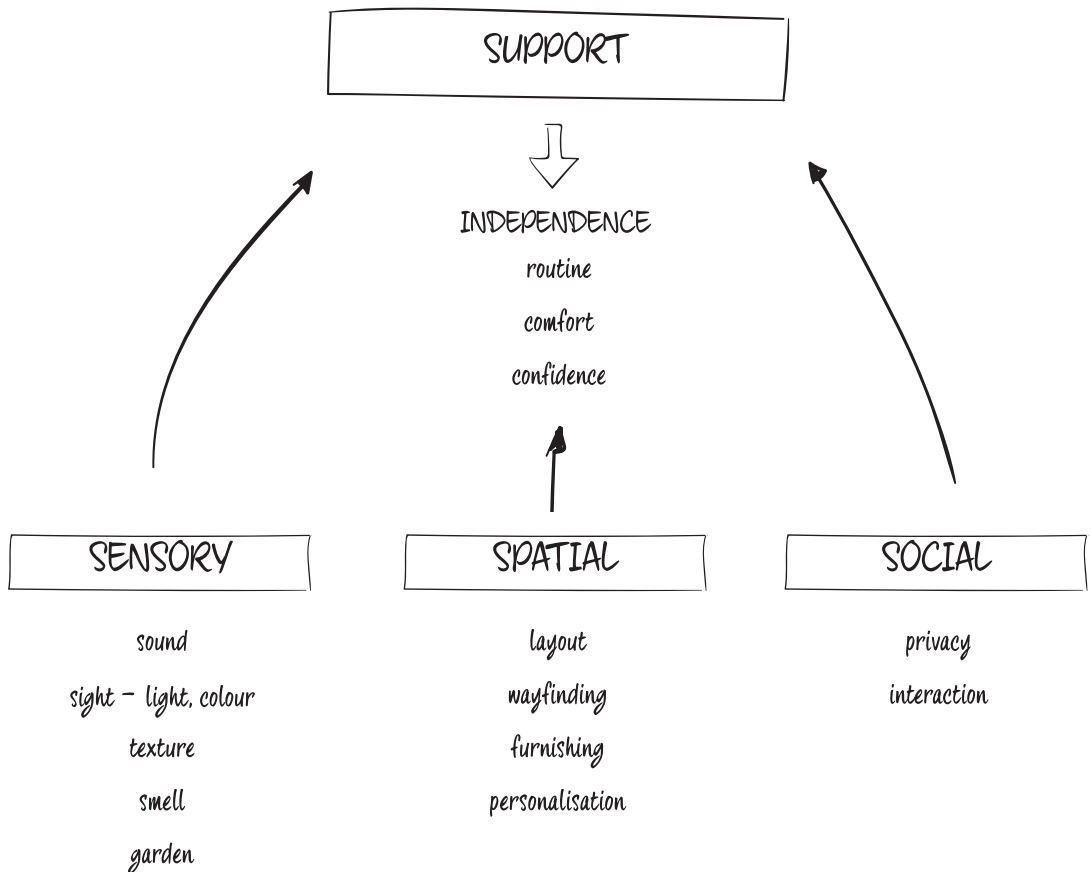
SENSORY	SPATIAL	SOCIAL
sound	layout	privacy
sight – light, colour	wayfinding	interaction
texture	furnishing	
smell	personalisation	

fig. 24: themes and subjects of problems

SUPPORT

⇩

INDEPENDENCE
routine
comfort
confidence

SENSORY	SPATIAL	SOCIAL
sound	layout	privacy
sight – light, colour	wayfinding	interaction
texture	furnishing	
smell	personalisation	
garden		

fig. 25: themes and subjects of solutions

2. Theoretic frame

"Autism isn't like a light switch which you can put on and offig. It's more like a dimmer which can vary in strength"
– BNN & Peters, 2017

"Most people have a mind like a flashlight, with an area of high focus, and a larger area of partial awareness; my mind is more of a laser pointer that highlights only a single small dot"
– K. Gaines, 2016

2.1. Autism: prevalence and explanation

Autism is a (hereditary) brain disorder which often manifests itself in a variety of symptoms and it appears to be caused by genetic as well as environmental influences. Effective interventions for cure are scarce (Schrameijer, 2013; Rodger et al, 2010).
ASD is even viewed upon by several scientists as a "part of natural variation in human biology", and therefore state that this does not require a cure at all (Kapp et al. 2013; Shell, 2017).

In the 1970s, it was estimated that 1 in 10.000 children had autism. In 2011, this number had increased by 78 %, resulting in an estimation of 1 in 88 children (Ahrentzen et al., 2013). See figure 26.
Other studies point out that the current prevalence of autism varies between 1 in 100 to 1 in 68 children (Mostafa, 2015).
Globally, the total number of people with autism is estimated on 1% of the human population (Schrameijer, 2013).
Science has not yet come to a conclusive statement about why this increase is happening, although scientists make two reoccurring remarks. First of all, the diagnosis specifications have changed over the years. Nowadays, also Asperger's Syndrome and PDD-NOS (Pervasive Developmental Disorder - Not Otherwise Specified) are considered within the Autism Spectrum Disorder (Herten et al., 2014), further called ASD.
The other remark that has been made, is the fact that over these past 30 years, society has become more and more demanding, which

1 in 10.000 1943 Leo Kanner diagnoses first case of autism

1 in 500 1998 Lancet article links autism to vaccines, later retracted
1 in 250 2001
1 in 166 2004
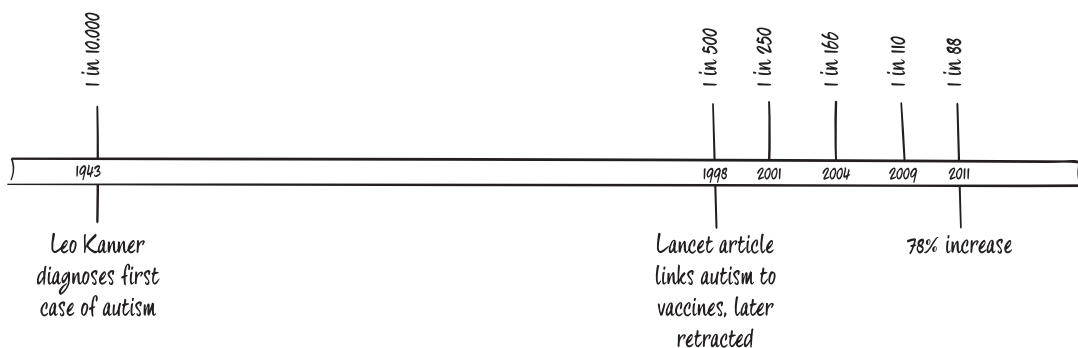1 in 110 2009
1 in 88 2011 78% increase
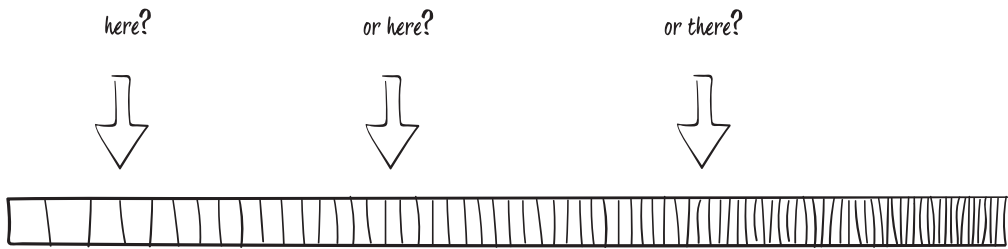
fig. 26: autism development timeline

may have triggered ASD symptoms further or made them more noticeable (Ahrentzen et al., 2013).

Most people think of the autism spectrum as a range: one can be just a little autistic, or one can be very autistic (see figure 27). When most people talk about an individual with autism, they often say things like "oh, she is just a little autistic, because she is very social", or maybe "wow, she must be very autistic, because she won't look me in the eye while speaking!".

But if we regard my sister, where would she fit on the spectrum? She is quite socially skilled, so you would say she is not that far on the spectrum. On the other hand, she tends to exclude herself from big groups and she has sensory sensitivities, especially soundwise. So should we move her further up the spectrum? See figure 27.

My opinion is that it's not correct to regard the autism spectrum this way. I would like to introduce a system which visualises the autism spectrum as a spider web with different pillars. These pillars are:
- Sensory filter
- IQ

here? or here? or there?

she is quite socially skilled, so she can't be THAT autistic

hmm, but she doesn't like unexpected events

and she is very sensitive to noise, she is very SCARED of fireworks

She is very creative and good at telling about WW2 and remembering details

sensory filter

EQ

IQ

talent

motor skills

social skills

executive function

perception

above
fig. 27: current view of the autism spectrum, where would my sister fit?

next
fig. 28: autism spectrum as a spider web
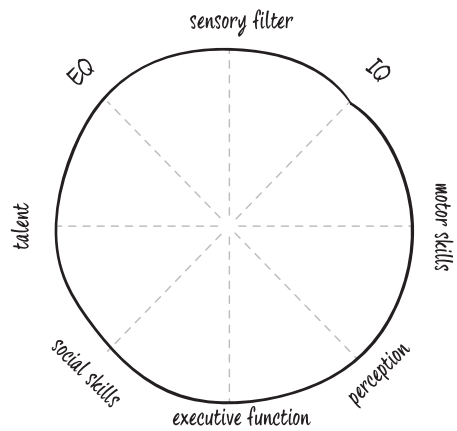
- EQ
- Motor skills
- Talent
- Perception
- Social skills
- Executive function

(see figure 28 on page 35).

For my sister, the web would look something like the one showed in figure 29. But for someone who is a so-called savant, it might look like the option visualised by figure 30. A savant is an autistic person who has several disabilities but is absolutely brilliant in one or more skills (Edelson, 2018). In the documentary series *Het is hier autistisch*, savant is described as: "an island of brilliancy in a sea of disabilities" (BNN & Peters, 2017).

These two examples immediately state the difficulty of this challenge: there is such an enormous range of individuals who fit on the autism spectrum.

So, how to create housing for such a wide range of individuals? In my research, I focus on individuals who are balancing on the verge of independence. These adults are not independent enough to buy or rent a house like we do, but are too independent for full tutoring. They just need little adjustments to their living environment which will make it more liveable. The housing type I focus on, will contain independent apartments and a communal area with support point.

Furthermore, I consider sensory architecture to be very important, because research shows that up to 95% of the people with autism have "any unusual sensory experiences" (Ahrentzen et al., 2013). Adding to this notion, the DSM-5 lists sensory integration

deficits as a second-tier criterion of the ASD-characteristics (Fernández-Andrés et al, 2015. Shell, 2017).

Therefore, sensory stimulation as well as reduction can be an effective compound in developing cognitive regulation skills. Rodger et al. (2010) state that "through spaces that afford control of stimuli, inhabitants can learn to manage sensory overload – a skill that has long-term benefits". Additionally, individuals with autism feel a greater sense of control when they can change the physical environment to their needs (Toftum, 2010. Shell, 2017).

fig. 29: spider web as envisioned for my sister
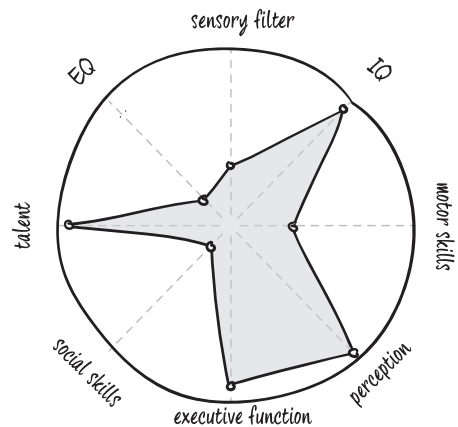
fig. 30: spider web as envisioned for a savant

"Everybody, healthy or not, disabled or otherwise, encounters a positive effect of a nice and fitting physical environment. The same counts for negative effects. For people with autism, these effects are stronger." (Schrameijer, 2013).

The Dutch Association for Autism (Nederlandse Vereniging voor Autisme, NVA) has executed multiple samples, through questionnaires, among their members. The total amount of members of the NVA is almost 14.000 people. The research of 2013 resulted in a sampling of 4.068 filled out questionnaires. According to this research, the housing situation of adults with autism was divided as shown in figure 31 (Begeer et al., 2013)

Next in the research, the question: "Do you wish for another housing situation?" was stated, which gave the results visible in figure 32. (Begeer et al, 2013)

Lastly, the three answers with the highest percentages on the question "what kind of housing situation are you searching for", are shown in figure 33 (Begeer et al, 2013).

These studies indicate that of the individuals with autism that wish for another housing situation, most give preference to some sort of independent housing. This is requested either with tutoring or without tutoring.

This indirectly states the problem: the fact that a lot of them still wish it, indicates that

	percentage of adults (> 18 y.o.)
With parents or family	26%
Independent, alone, without tutoring	19 %
Independent, with partner and/or kids, without tutoring	27 %
Independent, with several hours tutoring	10 %
Within a housing facility with tutoring and/or care	15 %
Other	8 %
Total	100 % n = 1.758

fig. 31: results of the current housing situations of respondents

	percentage of adults (> 18 y.o.)
Yes	41 %
Maybe	29 %
No / not applicable	24 %
I don't know / unknown	6 %
Total	100 % n = 830

fig. 32: results of the question 'do you wish for another housing situation?'

	percentage of adults (> 18 y.o.)
Independent with (partial) tutoring	43 %
Independent without care or support	22 %
Other	35 %
Total	100 % n = 864

fig. 33: results of the question 'what kind of housing situation are you searching for?'

there is not yet an option for them available to actually live in such an environment. In one of my interviews with tutors of a group housing project, they told me that they have a very hard time finding new residents. The regional manager literally has to go to activity centres to inform if there is anyone who would like to live at their housing facility. According to them, this is caused by the wish for independent housing as opposed to what they offer: group housing with full tutoring.

Subsequently, houses that are available, are often very basic. The organisations are often only able to rent or acquire houses which are built for "neuro-typical people": people without any mental disabilities. From my experience, the houses are altered in minor ways, like placing linoleum flooring and adjust bathrooms. No other alterations are made to meet the needs of the residents.

3. Results

"I was scared to death of balloons popping, because the sound was like an explosion in my ear."
— Temple Grandin, 2010

3.1. Problems

3.1.1. Sensory

"Sensory stimulation can prove to be effective in developing cognitive regulation skills. Through spaces that provide control of stimuli, inhabitants can learn to manage sensory overload – a skill that has long-term benefits" (Rodger et al., 2010).
Several scholars state that individuals on the spectrum also feel a greater sense of agency when they perceive control over the physical environment (Toftum, 2010; Shell, 2017).

Sound
In all the aspects of my research (literature, typological research, and questionnaires/ interviews) keeps coming up as the most disturbing factor people with autism encountered.

According to Schrameijer (2013), out of six architectural characteristics, sound (acoustics) was marked by parents and teachers as the most influential, 64% - 79% of them (parents / teachers) ranked this characteristic the first spot.
Second was spatial organisation, which got 14% - 20% of the votes for second place.
Other options, summed up in random order, were: vision (colour / patterns), vision (lighting), surface (texture), and smell.

From the questionnaires, it appeared that sounds of housemates when they were having an anger attack or playing loud music were considered disturbing (figure 34). Additionally, sounds such as drilling holes in the walls or walking on high heels (figures 35 & 36) were found annoying (R1, 2018).
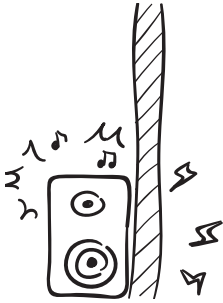
fig. 34: loud music
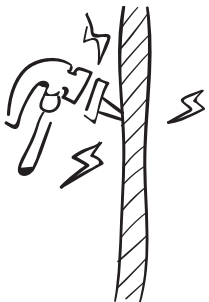
fig. 35: contact noise
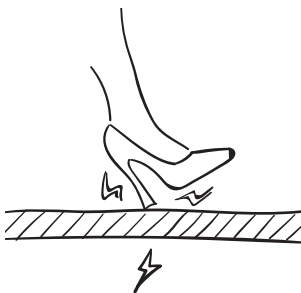
fig. 36: noise from above

Adding to these acoustic nuisances are the sounds of electrical appliances like the dishwasher or laundry machine (R2, 2018), see figure 37.

Literature states that surrounding sounds like the ticking of heating elements, water that streams through pipes or neighbours that are drilling holes in the walls, are considered very annoying (Visser & Verheij, 2018).

fig. 37: electrical appliances

Form literature as well as one of the interviews, sounds from the environment like barking dogs (fig. 38) and loud traffic (figure 39) are recognised as several of the most annoying ones (Visser, 2009; R3, 2018).

fig. 38: barking dogs

Temple Grandin writes that "sounds are better tolerated when the individual initiates them" (2011). This trait is also described in the novel *Zondagskind* by Judith Visser (2018). Here she writes that she always ended her birthday with the tradition of popping the balloons herselfig. Doing this, she had a sort of official ending, while simultaneously being less afraid of the sounds because she was the one popping them, and thus creating the noise.

fig. 39: noisy traffic

Sight
A study shows that visual sensitivities are not as commonly exhibited as auditory or tactile sensitivities by individuals with autism, however, symptoms can be incredibly disruptive and challenging to cope with for individuals that experience them (Gaines, 2016).

fig. 40: only artificial lighting

Individuals on the spectrum may experience visual hypersensitivities by appearing to notice everything in the environment and intensely focusing on the most minute of visual details. Also, they can have difficulties
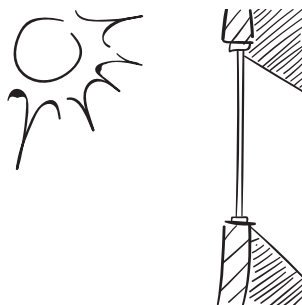
fig. 41: intruding sunlight
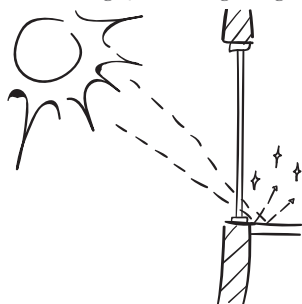
fig. 42: glare and reflection

fig. 43: street lantern light
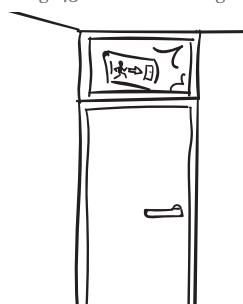
fig. 44: emergency exit light

with making eye-contact because of the intolerance of the movement of another person's eyes (Gaines, 2016; Ahrentzen, 2009).

Visual hyposensitivity is almost like having a visual impairment. Those who have this, may disregard people and objects in the environment, or only see the outlines of objects (Gaines, 2016).

light (sight)

Gaines also states that environments that only have artificial illumination and lack natural light, increase stress and discomfort (2016), see figure 40.

Another note taken from literature, is that day- and sunlight is an important factor for individuals with autism, but has to be implied with consideration in the design. Glare, reflection, and overheating are very disturbing factors caused by sunlight (van Dijk, 2013), see figures 41 and 42.

Bad viewing, for example on passing traffic of which the headlights shine into the room, or on people who walk by the window and are able to look in, is considered an annoying factor. (Visser (5), 2008).

Next to light, darkness is also very important. Artificial lighting disrupts the light-dark environment, which leads to melatonin suppression. This causes sleep problems amongst individuals with ASD (Leu et al. 2011; Shell, 2017).

Out of the questionnaires, I seems that lights shining into the bedroom are considered annoying, such as street lanterns or the emergency exit indicator (R1, 2018; R4, 2018) see figures 43 and 44.

Resident 4 explains that total darkness – and a good bed – is very important to get a good night's rest which enables people with autism to process all the stimuli from that day.

In addition, resident 4 adds that the windows should not be too large, because this causes impracticalities for window coverings and/or curtains which then can cause lack of darkness at night (R4, 2018).

fig. 45: blue enlarges a space

Resident 4 also adds that the stairwells in the building should have large windows and good lighting. This adds to the feeling of safety and a sense of direction when it is dark (2018).

colour (sight)

Dr. Albert Styne's research showed that rooms painted in cool colours resulted in spaces that seemed larger, quieter, and cooler (figure 45). A room with warm colours resulted in a more active space that seemed smaller, warmer, and louder (Gaines, 2016).

fig. 46: red increases stress

In a study of the Minnesota State University, exposure to red causes the heart to beat faster and increases feelings of stress (figure 46). In contrast, blue causes the pulse rate to slow, and the body temperature to lower (Kutchma, 2003). Pink is known to cause the suppression of aggressive behaviour in prisoners (Gaines, 2016).

fig. 47: sharp edges

It is further suggested that autism-friendly designs generally incorporate unsaturated, light earth tones with only small, contained areas of bright color (Mostafa, 2014; Beek (8), 2009).

fig. 48: high thresholds

Bright or dark colours in furnishings were often considered too bright or too dark by the 150 people who filled out the questionnaire set up by Visser & Verheij (2008).

fig. 49: shocks from metals

fig. 50: temperature sensitive
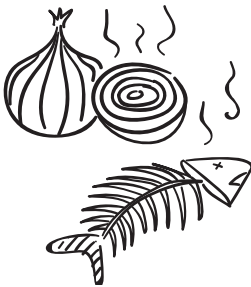
fig. 51: kitchen smells

fig. 52: fragrant perfumes

Touch

People with autism tend to be very clumsy. Zjos Dekker, who herself has autism, says this in her interview for Omroep Gelderland. It often occurs that they bump into coffee tables or trip over (high) thresholds (Dekker, 2018), see figures 47 and 48.

Resident 1 responds with another irritable factor, which is the fact that metal objects tend to trigger electroshocks in winter (figure 49). This makes the people with autism wary to touch these objects. This can vary from door handles to a brushed metal counter top (R1, 2018).

Brand writes that individuals with autism are also temperature sensitive (figure 50). They can perceive temperature different than NT-people and this fluctuates quicker (2017).

Smell

"Smell might be the most associative sense that humans have got. It immediately brings us in a certain mood. Smells can activate or calm people, or can focus on a certain product, like coffee or food. Smell can be a helping tool for orientation, remembering chores, memory, etc." (van Dijk, 2013).

In several studies, it appears that strong smells of food (onions, garlic, fish), transpiration and perfume are considered as a negative influence, both in the house and environmental (Visser, 2008, 1), see figures 51 and 52.

3.1.2. Social

Privacy
One of the biggest factors in discomfort and Quality of Life (QOL) is a lack of privacy, personal space and a feeling of infringement on one's territory (Gaines, 2016).

Temple Grandin (2010) explains: "all of us need a private space. Autistic people need their secret places too, in which they can hide and retreat to their own world. After all, autism is a 'withinness disability', and autistic people need the security of their own hideaways".

Adding to this notion, I was told that before the renovations works in the buildings of the Swetterhage facility as well as the 's Heeren Loo facility in Ermelo, the residents were very quickly annoyed and showed signs of stress, see figure 53. During this period, they had only a small private (bed)room of 10 - 13 m². The residents had no other choice than to eat, mingle with, and host visitors while in the common rooms (Zoeterwoude, 2018; Ermelo, 2018).

Feelings of unsafety also reoccurred in several questionnaires caused by several break-ins and the known fact that doors could be fairly easily opened (R4 - R6, 2018), see figure 54.

Additionally, literature states that passersby looking into homes located on the ground floor, were found to increase uncomfortable feelings (van Dijk, 2013), to be seen in figure 55.

fig. 53: insufficient private space

fig. 54: feelings of unsafety
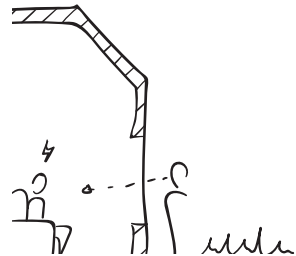
fig. 55: passersby looking in
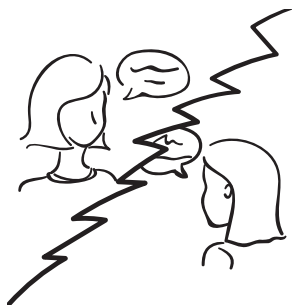
fig. 56: afraid to conversate

fig. 57: misinterpreting things

fig. 58: inappropriateness
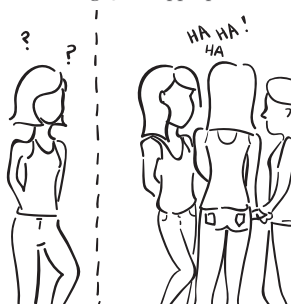
fig. 59: social exclusion

Interaction

Problems with the ability to socially interact with someone is one of the core aspects of autism (figure 56), it seems.

Several studies explain that these problems can vary from an inability to engage in conversation to completely monopolising the conversation without showing any interest in the other person (Bellini, 2018).

Examples of the most common social skills problems are:

- Being unable to read non-verbal communication cues (Bellini, 2018);

- Being unable to read emotional expressions (IAN community, 2007), see figure 57;

- Unaware of social conventions, which can lead to inappropriateness (Carter et al., 2005), see figure 58.

These problems in social skills can lead to social exclusion and not having many friends (figure 59). This in itself can then lead to frustration, anger and a feeling of loneliness in some individuals on the spectrum (IAN Community, 2008; Thompson et al. 2018).

Some individuals might not even worry about this exclusion, but several tutors i have interviewed, stress the importance of stimulating this social interaction (PT1, 2018; PT2, 2018).

fig. 60: space seems larger

3.1.3. Spatial

Layout

In her study, Gaines explains that vastness of space is an important factor for people with autism. Their disorder causes them to perceive space often larger than it actually is (figure 60), resulting in experiencing discomfort in large spaces (2016).

On the contrary, several typological projects showed that the layout of a space could also be too small (figure 61). Residents only had a small bedroom with bed and desk, which meant that for other activities, they were forced to go to the common room. This lead most of the time to overstimulation and irritated behaviour (Zoeterwoude, 2018; Ermelo, 2018). Several residents questioned also pressed their annoyance of the lack of size in their current house (R1, 2018; R2, 2018).

Also, one interview displayed how an extensive layout creates unclarity in routine: with several seperate rooms for bathroom, bed, and perhaps dressing, residents can find it hard to remember the routine 'undress, shower, bedtime' in the evening - or the other way around in the morning (R3, 2013), see figure 62.

fig. 61: current room is small
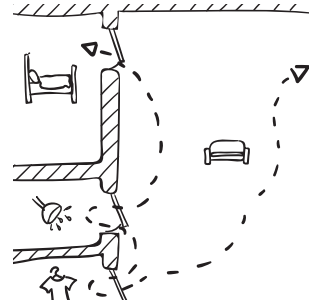
fig. 62: unlogical routine

fig. 63: too many hallways

Wayfinding

From several studies, it appeared that individuals with autism can have issues with the sense of priopoception, meaning the sense and knowledge of where your body is in a space (Gaines, 2016). This inability can lead to problems in orientation and,
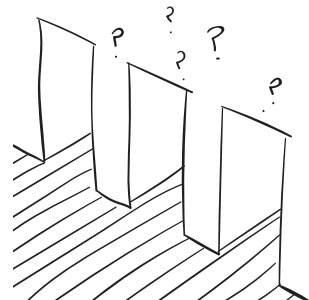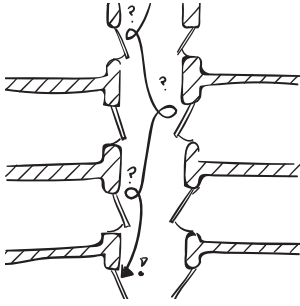
fig. 64: too many doors
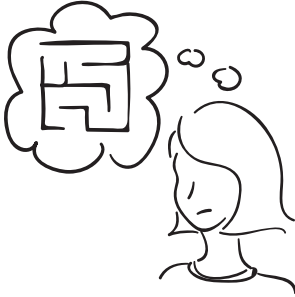
fig. 65: layout not memorable
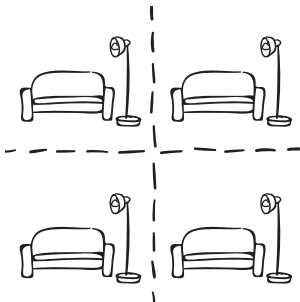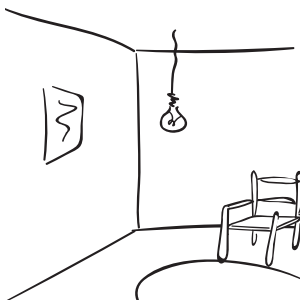
fig. 66: generic furnishings

fig. 67: scarce furnishings

therefore, wayfinding (Ultee, 2009).

Several residents stated in their questionnaires that in their buildings, there were too many hallways and too many doors (figures 63 and 64).

The terrain of Swetterhage (Zoeterwoude, 2018) consists of very organic shaped paths and greenery patches. When I got my tour, I was very quick to lose my sense of direction on the terrain. Also, all the residents I saw, where led by tutors in small groups. This was on the one hand because there were several severely disabled clients which needed constant monitoring. But on the other hand, clients would probably get lost they told me (figure 65).

I found this very peculiar: it does not really make sense to take away the independence of walking from home to the activity centers.

Furnishing
In several projects I have visited (Leiden, 2018; Zoeterwoude-Rijndijk, 2018), the furnishings were very generic (figure 66). Linoleum floors in all of the rooms, and often a mismatch of furniture. They tried to provide cosiness by adding artworks, but these were often basic "stock-photo's" of plants and flowers. The common rooms also were often a bit empty and scarcely furnished (figure 67).

Personalisation
Residents of the projects I have visited, had a tendency to extend their personal space and tried to personalise their front or room doors (Apeldoorn, 2018; Zoeterwoude, 2018; Zoeterwoude-Rijndijk, 2018). One resident was clearly a horse enthusiast: her door was full of posters of horses (Apeldoorn,

2018). Another person just had hung a lot of photo's of himself on the door, maybe so there wouldn't be any doubt of who lived there (Zoeterwoude, 2018). Some people put just several drawings or personalia on it (Zoeterwoude-Rijndijk, 2018). These collages resulted in quite a messy view and environment which caused a distraction for the individuals who have OCD-like symptoms (OCD = Obsessive Compulsive Disorder): they had the tendency to remove the pictures that didn't hang level.

From the questionnaires, it appeared that several residents lived in buildings with long, seemingly never-ending, corridors with a lot of doors. This added to the feeling they were living in an institution (R4 - R6, 2018), see figure 68.

Other residents added that they wanted to add more colour in their spaces, but that they weren't allowed to because of regulations (R3 - R6, 2018). They were only allowed to paint one wall in each room.

From the Apeldoorn project, I learned that too much freedom in choice of colours could cause confusion with several residents. For these residents, this resulted in eventually not knowing what to do and just leaving their room unpainted (2018).
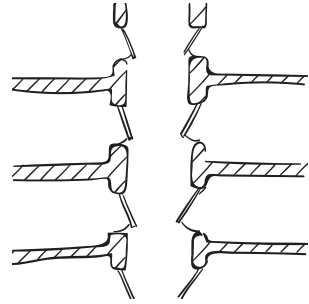
fig. 68: institution-like feeling

fig. 69: obliged regulations

"My name is Owen Suskind and I love animated films.
My friend Connor loves superheroes.
My friend Brian is an expert on the history of all actors and comedians who are Jewish.
There's a lot of them."
— Owen Suskind, 2016

"I started a Disney club so I could get to know more people and they could be around me. So I could be more popular … It worked!"
— Owen Suskind, 2016

3.2. Solutions

3.2.1. Sensory

Sound

A study revised the Sunfield school. In its design, ceilings were provided with a sound absorbing base on which slats with intermediate seams are applied. Also, the joints of the brickwork were deep (Whitehurst, 2006).

From literature, it appears that corner houses and free-standing houses are most appreciated because of less noise nuisance from neighbours (Huisman & Visser, 2008).

Several of the projects visited that had had renovations done, had made sure that there was a high amount of sound absorbing insulation added (Zoeterwoude, 2018; Apeldoorn, 2018; Ermelo, 2018).

While interviewing, resident 3 expressed the importance of soundproofing. "The first thing I can say is: make sure that soundproofing is above excellent! And use for example sliding doors instead of normal doors, because the sound of shrieking hinges is terrible" (2018). See figure 70.

In literature, locations near noisy traffic or train tracks were strongly discouraged (figure 71).
The nuisance caused by electrical appliances could be decreased by placing these systems in insulated cabins (figure 72).

Sight

Research implies that several windows and doors on every wall can be stressful, but
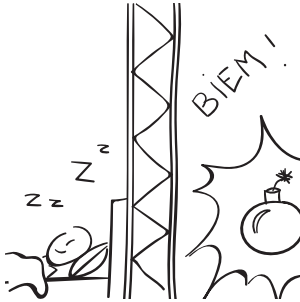
fig. 70: great insulation
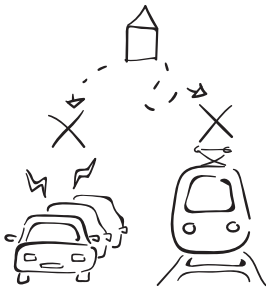
fig. 71: location consideration
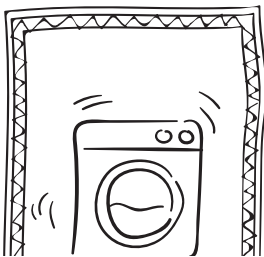
fig. 72: insulated cabins

several windows side by side on the same wall are experienced as positive and a good source of daylight. This is probably because with a variety of different views, too much information may be coming in (Gaines, 2016).

light (sight)

The most important aspect of lighting in design is control, Gaines writes (2016). This is confirmed by the questionnaires. Elements like sun-shading should not be automised, but allow for manual control (figure 73). This also applies to dimmers in light switches (R3, 2018).

Literature finds that horizontal surfaces like floors and window sills should be constructed out of matte and light absorbing materials to prevent disturbing sunlight reflection (van Dijk, 2013), see figure 74.

Additionally, daylight from above and the possibility to see the sky creates a tranquil and free atmosphere. For this, the same counts concerning sunlight. Solutions can involve applying shed-roofs with glass at the north side (van Dijk, 2013).

Literature also states that soft artificial light reportedly causes more relaxed behaviour and better academic focus. If possible, dimmer switches should be provided. A variety of light sources, such as overhead (general) lighting, natural light, task lighting, and softer lamp light, allows easier control of light (Gaines, 2016). Indirect or regressed lighting are favorable because the glare from the visible light source can also create an overly strong visual contrast, which can be a trigger (Tanabe, 2016).
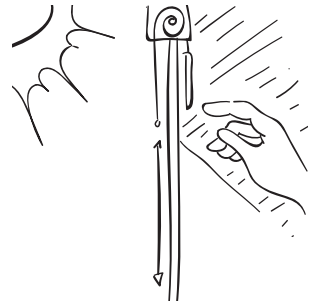
fig. 73: sunshading
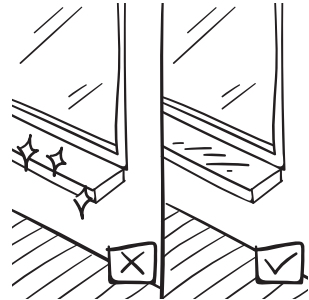
fig. 74: matte finishes
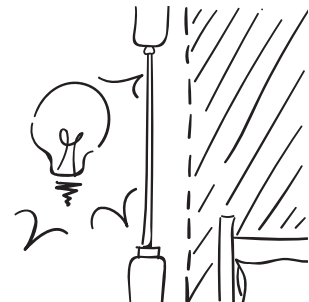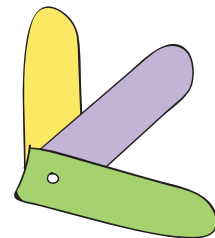
fig. 75: darkness
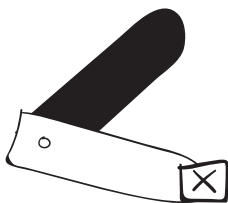
fig. 76: use soft pastels

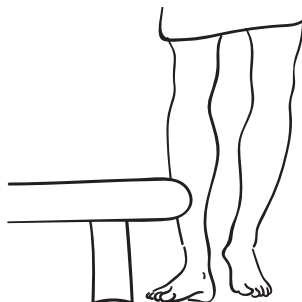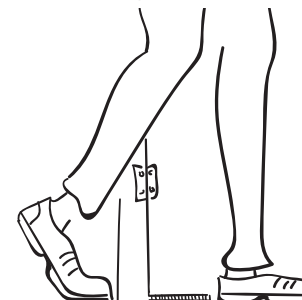fig. 77: avoid big contrasts

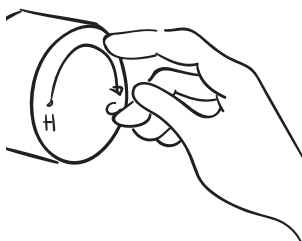fig. 78: round corners

fig. 79: no thresholds

fig. 80: temperature control

Instead of fluorescent light, soft non-flickering light is used in the design of the Sunfield school. Most light is natural light coming in from skylights (Whitehurst, 2003). The common area of Swetterhage has a pointed saw-shaped roof, of which one side of the "tooths" are skylights, while the other sides are opaque (2018).

In addition, resident 4 stresses the importance of absolute darkness that should be provided during nights, see figure 75 (2018).

colour (sight)
Concerning colours, peaceful colours are advised, but the Kannerhuis suggests that perception of colour is too individual: there are no colours which are peaceful and harmonious for every individual with autism (Schrameijer, 2013), see figure 76.

Colour expert Monique van Eeckhoud doesn't look at colours individually, but to the context in which colours are applied: the proportion to other colours, light, measurements, function of the room, windows and doors, walls, carpets and furnishing. Stark contrasts are discouraged (Schrameijer, 2013), see figure 77.

The colours throughout the common areas of Swetterhage are various, although applied on the whole wall per colour. The reoccurring colours are: dark grey, olive green, and light grey (Zoeterwoude, 2018).

Touch
Literature as well as interviews state that motoric or physical clumsiness occurs so often, that it's labelled as one of the autism characteristics. For this, furnishes can better have round corners or protrusions

(Schrameijer, 2013; R3, 2018).
Adding to this, it is best to use non-metal materials to prevent electroshocking (R1, 2018).
Resident 3 also adds in the interview that it is best to remove thresholds, so that the resident won't trip over it (2018), see figure 79 on page 57.

In the example (group) home I have seen in Swetterhage, the hallways are relatively broad: approximately 1.7 meters wide. I was told this was done to ensure the resident's personal space when they approach each other, as well as making sure they won't bump into the walls (Zoeterwoude, 2018).

The room temperature(s) should be controlled manually (figure 80, p. 57), says resident 3 (2018).

Smell
To prevent kitchen smells from spreading through other living areas, the kitchen should be separated (Gaines, 2016), see figure 82.

Additionally, purifying plants can be added to the living areas to filter the air. This might also add to the resident's development and self-esteem, since he or she also has to take care for these plants (Raanaas, 2011). Plants also have the quality to improve sleep and add to a sense of relaxation (Bringslimark, 2009), see figure 83.
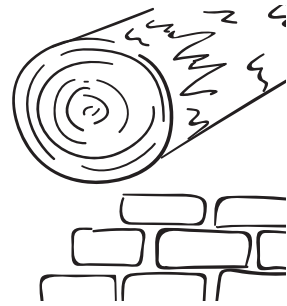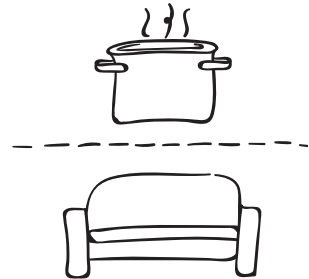

fig. 81: non-metal materials

fig. 82: seperate the kitchen

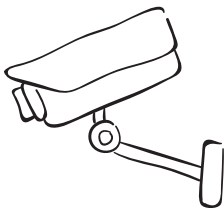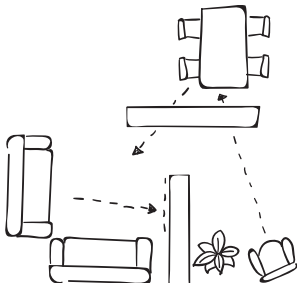fig. 83: air-purifying plants

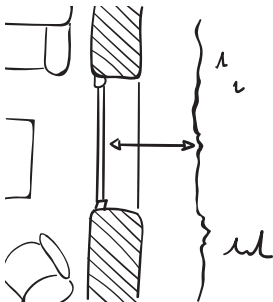fig. 84: add safety measures

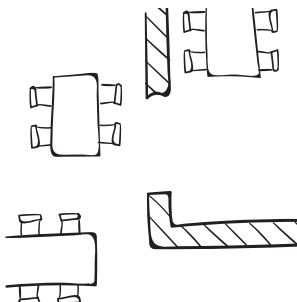fig. 85: space dividers

fig. 86: deep window niches

fig. 87: vary privacy levels

3.2.2. Social

Privacy

It is found in literature that people with autism tend to enter a room with caution, as they may experience a sensory overload. In response, they look for opportunities to attain privacy (Gaines, 2016). Acoustical/auditory and visual privacy have the biggest impact on well-being. Modular furniture units may serve to provide opportunities for personalisation and territorial marking (Mostafa, 2015).

This is also done in the large common spaces Swetterhage (Zoeterwoude, 2018) and De Villa (Apeldoorn, 2018). De spaces are divided into compartments by using cabinets which are partly see-through (such as the expedit range of IKEA). By filling several holes with accessories, and leaving others empty, some compartments provide transparency, while others block the view (figure 85).

In a study, many individuals on the spectrum reported feeling a sense of control and release when they had a designated place for relaxation (Waltz et al., 2017).

The characteristic of privacy of an own room or house is decided by the transition: the threshold, the door, a window.
A design option to ensure more privacy is to place the door in a deep niche, so the resident can exit the room or house without being immediately out in open space.
For windows, the same strategy can be applied: by creating deep niches, the resident can look outside, but still has the feeling of

protection (van Dijk, 2013, p.13), see figure 86.

After the renovations in Zoeterwoude and Ermelo, both facilities discovered that their clients were a lot less irritable. In Swetterhage, the residents got their own small studio apartment. And in Ermelo, the rooms vary from studio apartments to one-bedroom apartments. It appears that the freedom of deciding whether the residents mingle with fellow residents, have decreased feelings of stress and discomfort (Zoeterwoude, 2018; Ermelo, 2018), see figure 87 on page 59.

Sánchez et al. (2011) explain that layers of spaces can offer a sense of comfort, such as a tent within a room. Importantly, when occupants have control over the organization of space, they also experience greater comfort.

Interaction

A space can be designed in such a way that it invites to interact socially, like stated before. This can be achieved by applying various ceiling heights, see figure 88. Study showed that a higher ceiling stimulates social interaction, while lower ceilings stimulate tranquillity (Brand, 2017, p.3-4). Spaces where social interaction can occur spontaniously is often a good strategy (van Dijk, 2013, p.15).

According to Appleton's theory, "humans subconsciously desire the ability to be able to see into a room before entering and also desire areas in which to hide inside that room. The challenge in interacting with other people is the desire to maximise control of contact. This includes the desire to be with others as well as the desire to avoid others. Being able to see into a room before making a commitment to enter can satisfy this need for
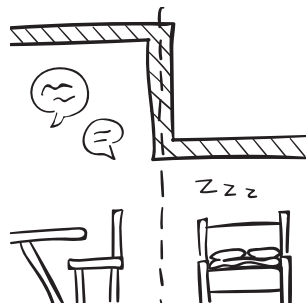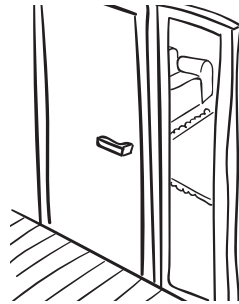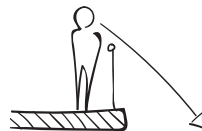

fig. 88: ceiling height

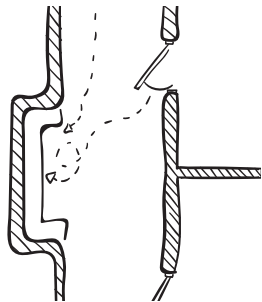fig. 89: previewing no. 1

fig. 90: previewing no. 2

fig. 91: add informal seating

control. This is labelled previewing "(Gaines, 2016)

This concept of previewing can be accomplished by sidelights, windows in doors, and subdividing spaces (figure 89). Additionally, this can be done by providing transparency through a space. A spatial design that is laid out as an open-concept space can achieve this, as it enables one to view from one space to another and scan the terrain without interruption (Gaines, 2016).

Previewing can also be achieved by planning multi-level spaces in a manner that allows a person to view from above (figure 90). This can mean incorporating architectural elements such as upper-level balconies with open-style railing, floor-to-ceiling windows with transparent window treatments, sidelights beside doors, windows in doors, and subdividing spaces. (Gaines, 2016)

In the study referencing the Sunfield School, it was stated that instead of a hallway in between residential and communal areas, a sort of indoor square as circulation space is applied, see figure 91. Here, the residents can develop all sorts of activities. This space seems to enhance social behaviour (Whitehurst, 2006).

In a housing facility where there is also a common room available, one resident suggests that it woud be beneficial to support eating together or maybe even make it an obligation one day per week, so that the residents are forced to commit to the group and social isolation is prevented (R4, 2018).

3.2.3. Spatial

Layout

Scholars press that a clear floor plan with functional circulation routes are a must (figure 92). For instance, the kitchen should connect to the dining room. For varying reasons, it is recommended to separate bathroom from toilet (Huisman & Visser, 2008), see figure 93.

The residents of several projects live in groups of 6 – 10 people, where they have their own bedroom with shower and toilet, combined with a common living room and kitchen (Zoeterwoude, 2018; Ermelo, 2018). The spaces are carefully designed, to prevent the design of too small or too vast spaces (figure 94).

Out of the typological projects where small bedrooms have been remodelled into larger spaces and/or even studio spaces, it has resulted in an improvement in behaviour and development of the residents (Zoeterwoude, 2018; Ermelo, 2018; Apeldoorn, 2018).

Humphreys states that for people with autism, "Simple and clear natural forms are understandable. It is helpful that there is distinction between types of spaces for people with autism so that they understand expectations placed upon them" (2016).

Wayfinding

"In wayfinding, symbols and coordinated colors or distinctive landmarks can improve navigation (figure 95). This improves navigability, especially when the signals
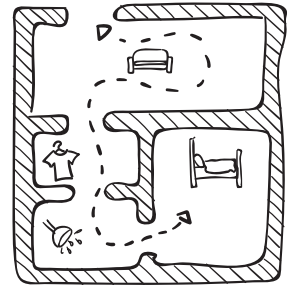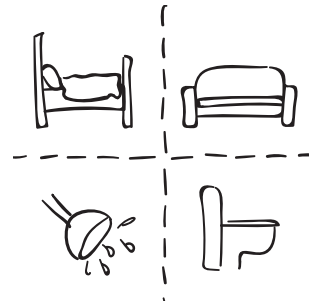

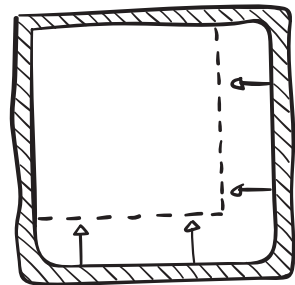fig. 92: routine expextations

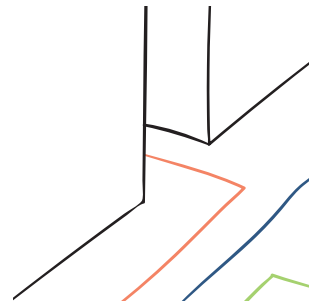fig. 93: seperate functions

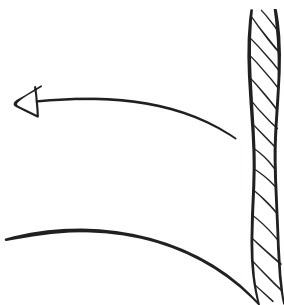fig. 94: avoid too vast spaces

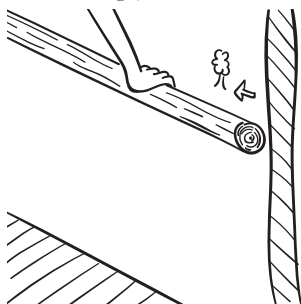fig. 95: coloured flooring

fig. 96: curvilinear walls
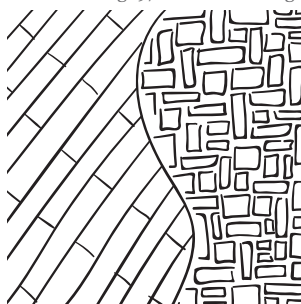
fig. 97: textured railings

fig. 98: functions vs. textures

fig. 99: homey furnishings

are culturally relevant and related to the intended use of the space" (Shell, 2017)

In the Sunfield school, the use of curvilinear design applies for many walls, see figure 95. It helps with orientation problems because residents can follow the hallways with their hands (Whitehurst, 2006).
I encountered this design strategy in Zoeterwoude as well: the niches leading to the exists from the hallway have curved corners which enhance orientation. The goal was to add more curvilinear design, but the budget would not allow that (2018).

Van Dijk writes that another tactile support for orientation can be the use of textured hand rails (figure 97), of which the texture refers to the function it is leading to (2013). For example a ceramic-like texture which leads to a dining area.

In the foyer area in Swetterhage, different floor textures are used. The large area exists of the reception and a more café-like area. The floor of the reception and circulation area are paved with dark grey organic stones. The seating area is dressed with light wood flooring in a herringbone layout. The bordering between these two floorings is curved and laid in an organic way (figure 98).

Furnishing
Shell writes that "finishes and furniture represent a small portion of most construction budgets, but have an enormous impact on indoor environmental quality" (2017).

Instead of applying general furnishings, real thought has to be put into the furnishings of the common areas (figure 99). One can apply comforting furnishings, questionnaires add,

like the Cacoon: a sort of hanging tent in which an individual can sit and have some privacy (R2, 2018), see figure 100. Literature adds that inflatable furniture can also be used. An overstimulated individual with autism can sit or lie in this type of furniture while it is inflating. Through the pressure, the nerves will relax again and the individual can also get calm (Emanuel, 2017).
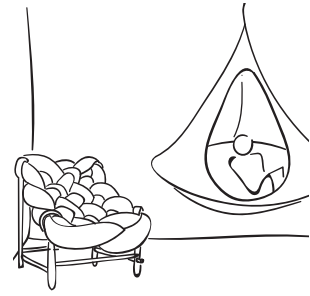
Furniture that can be multifunctional, is used more often by its occupants, says Resident 3 (2018).

Sánchez emphasises this by writing: "Because of the importance of these dimensions for people with ASD, movable furniture is better than built-in furniture. This is especially true when it can reinforce the social use of space by groups or individuals" (2011).

Personalisation

In several projects I encountered room doors on which the residents had added posters, pictures or other personal objects (Apeldoorn, 2018; Zoeterwoude, 2018). Architecturally, this can be allowed for by designing, for example, a set of picture frames in the doors (figure 101).

The colours for the common areas are set by the architects of the different projects, but in the rooms and studios, the residents can choose the colour(s) of at least one wall (figure 102). When moving away, this wall has to be painted white again.
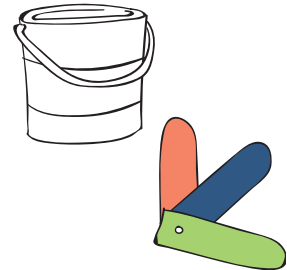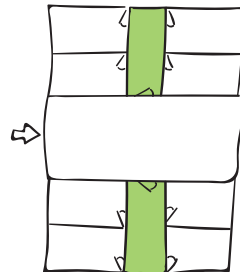
Also, in the group housing buildings of the facility in Ermelo, the common rooms are placed in the centre of the building. This way, the corridors could be kept short, which reduces the feeling of an institution (figure 103).
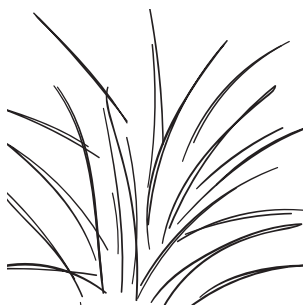

fig. 100: comforting furniture

fig. 101: front door decoration

fig. 102: colour picking

fig. 103: short hallways

fig. 104: long grasses rustle

fig. 105: bamboo knocks softly

3.2.2. The outdoors: sensory garden

"For any space to be harmonious it should facilitate not only need but also connect with the outside environment providing a smooth transition" - Simon Humphreys (2016).

Studies have suggested that contact with nature can reduce symptoms of ASD. A sensory garden can help autistic individuals to overcome the hyper-sensitivity to their surroundings and allows them to explore a space and find an area which makes them feel good (Shaikh, 2017).

A sensory garden is a garden environment that is designed with the purpose of stimulating the senses. This stimulation occurs courtesy of plants and the use of materials that engage one's senses of sight, smell, touch, taste, and sound. These types of gardens are beneficial to both children and adults who have sensory processing issues, including autism (Planet Natural, 2017). Sensory gardens which are well-designed can be both relaxing and stimulating and will serve functions such as teaching, socialising, and healing (IFAS). These gardens will help individuals with autism to explore their senses and find tranquillity without being overwhelmed (Shaikh, 2017).

Sound
Different grasses like Pampas grass and Pearl grass can simultaneously stimulate the senses and introduce tranquillity (Shaikh, 2017), see figure 104. These grasses are also soft to the touch and are on display all year round (Green Desk, 2011). By planting

bamboos and large-leafed plants, calming sounds can be produced by the wind blowing through the stems and leaves (Shaikh, 2017). Bamboo stems knock softly together (figure 105), grasses rustle, and palm fronds sway (Worden & Moore, 2018). A non-natural feature for producing calming sounds can be wind chimes (Shaikh, 2017), and other natural elements can include waterfalls, fountains, and water harps (Worden & Moore, 2018).

Sight

Literature finds that colour, visual texture, form, movement, light, and shadow stimulate the sense of sight. Different colours can promote activity or have a soothing effect. Warm colours like red, orange and yellow have this promoting effect, while cool colours like blue, purple, and white, have a tranquil effect (Shaikh, 2017), see figures 106 and 107. Roses are a great feature, but make sure they are placed away from the paths, prickly thorns might stimulate the touch a little too much (Planet Natural, 2017).

Another interesting feature can be caused by Lady's mantle, which traps dew drops that then sparkle in the light (Pollard, 2018). Forms of plants can also come into play, such as weeping, cascading, columnar or upright (Worden & Moore, 2018), like in figure 108. Movement can be added by plants or trees that will sway in the wind (which also provides sound), or maybe by water features with floating leaves or flowers (Worden & Moore, 2018).

Touch

Plants that contribute to the stimulation of touch, are for example: soft lamb's ear (figure 109), Jerusalem sage which is both soft and

fig. 106: warm colours activate
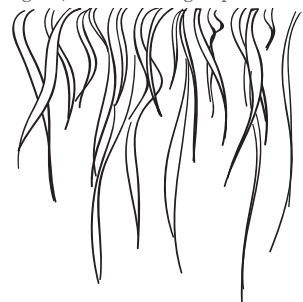
fig. 107: cool colours give peace

fig. 108: weeping or cascading
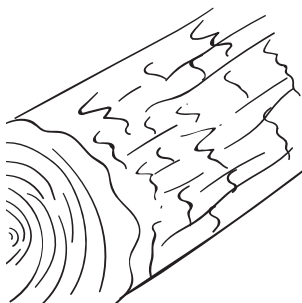
fig. 109: soft lamb's ear

64

fig. 110: rough bark
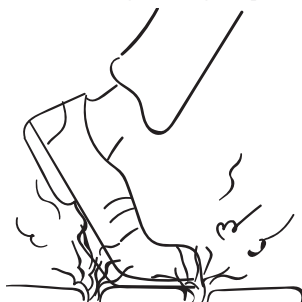

fig. 111: fragrant plants

fig. 112: fragrant herbs

colourful, Houseleek which has rigid leaves, or African Sundew which is sticky to touch (Shaikh, 2017). Other tactile delights can be found in rough bark (figure 110), succulent leaves, springy moss and prickly seed pods (Worden & Moore, 2018). Some plants even provide multiple textures in one, such as the silver buttonwood, which has rough bark and soft grey leaves, or southern magnolia, of which its leaves have a slick, shiny upside and a soft, felted underside (Worden & Moore, 2018).

Furthermore, textural paths are another way to stimulate the senses. Elements like stepping stones, pebbles, bricks or even mosaics can be used for this (Shaikh, 2017). Glass blocks or clay bricks can also be added in the pathways. Another important requirement for these paths is that they should be part of the larger pathway system and, obviously, should not dead end (Green Desk, 2011)

Smell
"The sense of smell is deeply emotional and associative. Scent in the garden can create a lasting sensory experience" (Worden & Moore, 2018).

Examples of shrubs that provide a nice fragrance are Rosemary or Provence Lavender (Green Desk, 2011). Gardenias or lilies, with their heady perfume, can be added (figure 111). Or maybe the resinous scent of pine needles. Some fragrances are activated by the heat of the sun, and others by night, like confederate jasmine. Other plants might only release their odours when crushed. Keeping this in mind, a fragrant creeping herb, like thyme, can be planted among pathways, so the leaves will get crushed while walking on

them (Worden & Moore, 2018), figure 112.

fig. 113: edible plants

Taste
"An objective in sensory garden design is to encourage users to interact with the plants, often directly, by breaking off leaves to smell or taste. Therefore, avoid plants that are poisonous, allergenic, or are likely to require pesticide applications" (Shaikh, 2017).

When you want to include some edible plants or flowers in your garden, it is advised to keep all of these plants in the same area to prevent confusion (figure 113). A raspberry bush is a very popular and easy to grow bush (Shaikh, 2017). To ensure that everyone can have their taste buds stimulated, include plants that can produce a large number of edible parts over time. Examples of these are mint leaves, strawberries or edible flowers (Worden & Moore, 2018).

Other
Signage can also be a key element of a sensory garden. It is possible to use colour labelling that makes clear which senses are stimulating which sense (Worden & Moore, 2018).

"A good bordering concerning the garden is advised, with a gate which activates an indoor bell when opened, so the resident can prepare him/herself for a meeting. For front doors, a camera, phone, or fish eye can help" (Schrameijer, 2013; R3, 2018).

The outdoor space should be maintained well, litter should be removed and should preferable consist of a lot of greenery (R6, 2018).
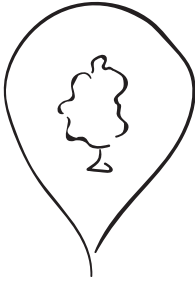
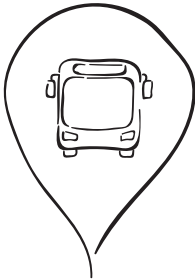fig. 114: easy access to supermarkets

fig. 115: having greenery nearby

fig. 116: public transport add to mobility

3.2.5. Surroundings

"Optimal design and neighbourhood selection at the outset can help avoid problems later on that may necessitate a subsequent move, which could prove debilitating for these residents who need stability and consistency in their lives" (Ahrentzen et al., 2009).

Several residents stated the wish having several facilities closeby. These services are: a supermarket, nature like a forest or park and a bus stop (R1 – R4, 2018), see figures 114 - 116.

The train station also should not be too far (R1 – R4, 2018), but make sure the building is not close to the train track: for sound reasons (R3, 2018).

Additionally, free parking spots should be available (R2, 2018). Trash containers with options to separate several trash categories were also named (R3, 2018; R6, 2018).

Several residents also said that they would want to live in a relatively small city, which is modern and urban but still has a little bit of a cosy feeling (R3, 2018; R4, 2018).

In this chapter, I want to bridge the gap between text and design by evaluating an additional analysis I have done. This analysis contained searching and overviewing several design elements which show several interventions that relate back to the guidelines I have set up.

While doing this analysis, I really had to force myself to stop, since this part just needed to contain several examples. In theory, I could go on for a long time - which I did during the design process, but this didn't have to be fully displayed in this thesis.

Sensory interventions
Relating to the themes in the previous chapters, several interventions will be discussed that can decrease the sensory load or add sensory stimulations concerning sound. sight, and touch.

x *figure 117: sound*
In this communal lobby area, acoustic suspended ceiling panels are added to create more sound absorption above the seating area;
x *figure 118: sound*
this sort of working space not only has suspended ceiling panels, but also acoustic wall paneling. This paneling adds to the design as well;
x *figure 119: sound*
this restaurant adds banners of fabric to absorb sound and simultaneously creates a meditarranean vibe;
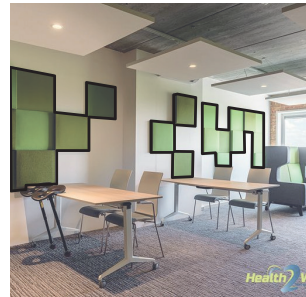

fig. 117: suspended acoustic ceiling [6]

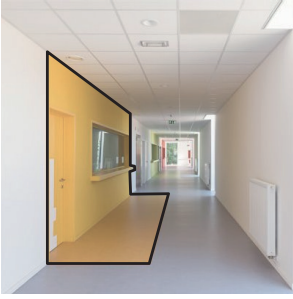fig. 118: acoustic wall panels [7]

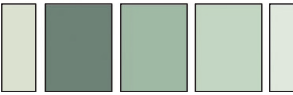fig. 119: acoustic drapery [8]

fig. 120: colour blocking [9]

fig. 124: lighting creates water effect [13]

fig. 121: colours derived from nature [10]

fig. 125: cobble stones texture [14]

fig. 122: dining table lighting [11]
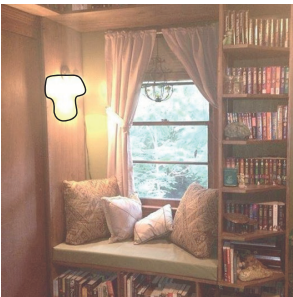
fig. 123: reading nook lighting [12]

x *figure 120: colour*
elements of colour can be beneficial to the atmosphere of the design. This element of 'colour-blocking' might add to a contemporary feel;

x *figure 121: colour*
colours derived from nature appear to be a valuable choice and can add to a coherent colour palette;

x *figure 122: light*
these types of lighting I find really special. The light creates an effect of water reflection on the walls, which adds to a transquil atmosphere in the space;

x *figure 123 and 124: light*
these references show how light can draw people to certain places. The dining table often is a family's spot to, besides having dinner, connect to each other, play board games, et cetera.

The right lighting can also create a very cosy reading nook, which adds to a sense of tranquility;

x *figure 125: touch*
   the cobble stones in this floor design invite to touch them. Additionally, human scale is still visible in this texture: the curves in which the stones are laid relate to the swing of the arm.

These examples show that sensory interventions don't have to be just that. These elements concerning sound, light, touch, and smell can add a design esthetic to the space.

Social interventions

Just as in the previous chapters, social interventions will embody social interaction as well as privacy.

Firstly, the analysis concerning privacy will be discussed, followed by interventions concerning social interaction.

x *figure 126: privacy*
   this cabin is part of a circulation space in the Sunfield School (UK) and offers a small private space for the children while not completely excluding them from the activities taking place there;

x *figure 127: privacy*
   this example shows how layers of privacy can be applied. In an already private bedroom, the kid can exclude itself even more by this cosy tent;

x *figure 128: privacy*
   this children's hospital lobby offers more privacy for visitors by the 1-person bunks in the wall;

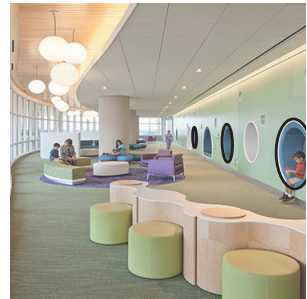fig. 126: private nook [15]

fig. 127: layering of privacy [16]

fig. 128: wall bunks give solitude [17]

fig. 129: privacy enhancing work spots [18]

fig. 130: privacy enhancing couches [19]

fig. 131: armchairs for visual privacy [20]

fig. 132: bench for social interaction [21]

fig. 133: seating space for connection [22]

x *figure 129: privacy*
in several flexible working spots, small cabins are applied in which workers can set up their stuff. These cabins are enclosed and have a lower ceiling than the common area, which adds to the feeling of (partial) privacy;

x *figures 130 and 131: privacy*
these seating objects are designed to give the user a feeling of privacy. The smaller benches ensure a sort of physical barrier from the bottom up. The armchairs give even more privacy, since the view from the outside is blocked by the exceptionally large 'ears';

x *figure 132: social interaction*
this is the same circulation space in the Sunfield School as discussed by figure 149, but now it shows how the same object can also offer a space that stimulates activity. In this case, this is established by the bench with connecting table;

x *figure 133: social interaction*
Also here, the same project shows how privacy as well as social interaction can be stimulated. These seating elements display how people can interact with each other from a small distance on the same side, or hang over the back of the seat;

x *figure 134: social interaction*
this stairway shows how a very specific, informal social interaction can be developed. By introducing a playful element such as climbing up, people can connect with each other;

x *figure 135: social interaction*
this hallway displays how a
circulation space can be elevated
to something more. Additionally,
the several seating spaces are more
or less divided in a formal and
informal arrangement, which is
even more emphasised by using
different textures;

Spatial interventions

The types of elements that concern
spatial interventions, include spatial
layout, wayfinding, and personalisation.
These themes often connect with sensory
stimulations such as light, colour, and
texture.

x *figure 136: spatial layout*
ceiling height can give different
atmospheres to certain functions.
Just as shown in this reference,
where extra daylight shines on the
dining area which underscores the
social element of this function. The
two functions (cooking, eating) are
connected which leaves no room
for misinterpretation;

x *figure 137: spatial layout*
this reference shows the possible
spatial flow between wardrobe and
bathroom. It is not unthinkable
that these functions are only
accessible by entering the other,
which creates a trigger for action;

x *figure 138: wayfinding*
Different functions or spaces in a
building can be found by creating
colour guides, such as shown in
this reference. This particular
design has added colour to the
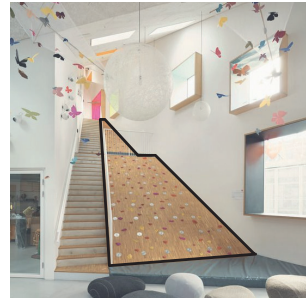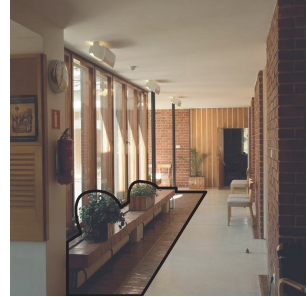wall, but it is also imagineable to

fig. 134: climbing element [23]

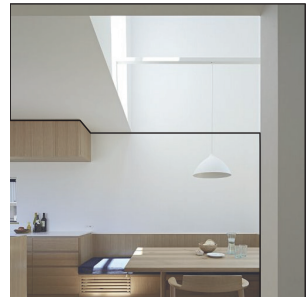fig. 135: different social elements [24]

fig. 136: different ceiling heights [25]
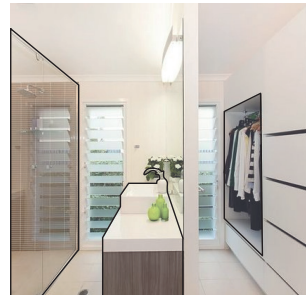
fig. 137: flow of functions [26]
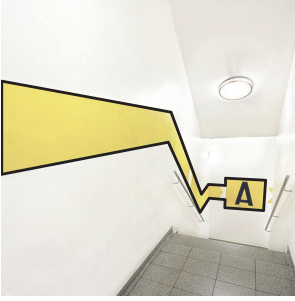
fig. 138: wayfinding by colour [27]

fig. 142: application of curved walls [31]

fig. 139: identity forming by texture [28]

fig. 143: front door personalisation [32]
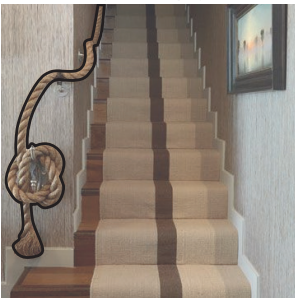
fig. 140: textured railings [29]
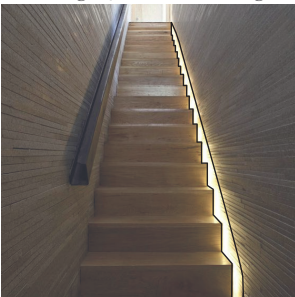
fig. 141: lighting forms guidance [30]

incorporate colour in flooring;

x *figure 139: wayfinding*
this reference shows how not only
texture, but living materials can be
a guidance. This '3' could even
mean that on this particular floor, a
natural facility is present;

x *figure 140: wayfinding*
textured railings can also be a way
of guidance. In this case though, it
would be nice to have another
(firm) railing resent since a rope is
a bit wobbly;

x *figure 141: wayfinding*
lighting can have a double
function. In this example, it
illuminates the stairs and can also
be continued through the hallways
to create a route;

x *figure 142: wayfinding*
in this project, curved walls are
applied to give notice to (probably)
important hallways;

x *figure 143: personalisation*
in this project, which I saw once in the tv-series '*extreme make-over home edition*', all the (adopted) children had Down Syndrome and/ or Autism. While remodeling their house, the idea was raised to keep all the children 'under the same roof', but give the room doors their own identity. They made it in such a way, that the main hall resembles a street;

x *figure 144 and 145: personalisation*
the seating/laying elements applied in these references aim to actively give comfort to the person using it. The first one resembles almost a comforting bird's nest, while the second one increases pressure which tends to comfort overstimulated individuals with autism;

Natural and outdoors interventions
Connecting the outdoor area, a garden for example, with the indoor spaces can give a sense of tranquility. It can already be beneficial to connect with nature by just referencing it.

x *figure 146: natural reference*
this wooden structure references with a tree-like abstraction to nature, just as the wood itself does. It is one of the examples that can prove beneficial in healing environments;

x *figure 147: connection*
this project shows a transparent connection to an inner garden through applying curtain walls;

fig. 144: comforting seating island [33]

fig. 145: pressure giving chair [34]

fig. 146: tree abstraction [35]

fig. 147: connection to garden [36]

fig. 148: nature intruding indoors [37]

fig. 149: wisteria arch [38]

fig. 150: overhanging lavender [39]

fig. 151: sensory pathway [40]

fig. 152: textural flooring [41]

x *figure 148: connection*
the sense of connection is taken even further in this project, where the inner spaces merge with the outdoor spaces. It almost seems like nature is entering the building;

x *figure 149: sensory garden*
the hanging wisteria ('blue rain') creates several sensations. The purple colour cascading down is a feast for the eyes, while the fragrance keeps adding to the experience when walking underneath it;

x *figure 150: sensory garden*
the lavender in this reference is planted in such a way that it overhangs the pathway a little bit. By walking past it, it releases it fragrance. Which also can lead to the desire to touch it so the person can carry the smell on its hands;

x *figure 151: sensory garden*
this pathway is guided by lighting and has a stair-like layout, which requires the attention of the user. Next to that, plants are overhanging which creates a more intrinsic connection to them;

x *figure 152: sensory garden* these stairs are covered in wood snippets, which can invite to take off your shoes and feeling the sensation of the soft wood while walking on it;

x *figure 153: sensory garden* this water stream creates a soft sound effect which can enhance the feeling of tranquility in the garden.

fig. 153: calming water sounds [42]

4. Conclusion

"The way people see those with autism, is that they don't want to be around other people. That's wrong.

The truth about autistic people is that we want what everyone else wants. But we are sometimes misguided and don't know how to connect with others.

I was bullied in high school. The future seemed so scary and uncertain. I didn't want to grow up. I just watched the world go by from my tower, like the Hunchback of the Notre Dame. The Hunchback doesn't end the way some movies do. Quasimodo doesn't get the girl, but he gets happily welcomed into society after a long, hard journey. Then he is no longer an outcast. That is also what happened to me.

Now, when I look in the mirror, I see a proud autistic man. Strong and brave and ready to meet a future that is bright and full of wonder."
– Owen Suskind, 2016

4.1. Hierarchy

This hierarchical scheme derives from all the results. The scheme should be read from the centre out (figure 154): corresponding importance.
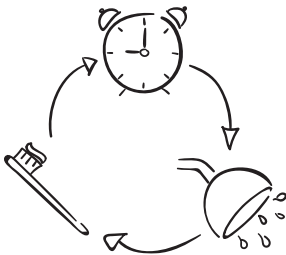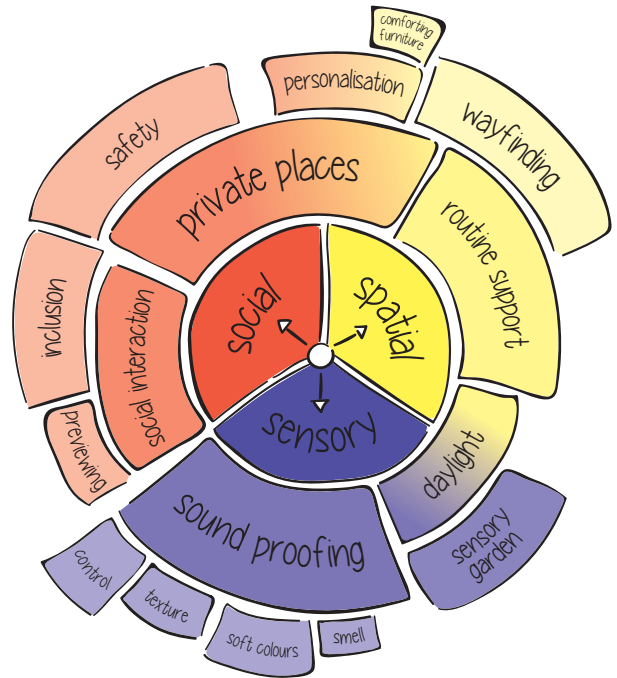

fig. 155: routine support

fig. 154: Hierarchical scheme of elements

Soundproofing should always be one of the bases of the design. In the results from literature, visited projects and questionnaires, sound-proofing or problems with sound were named almost everywhere.

From sound proofing, the architect should work its way around. Here, elements like **routine support** (figure 155) and **private places** are encountered. These support the independence and well-being of the individuals. Support of routine will decrease the need of tutors and personal guidance.

Private places ensure the individual to calm from all stimuli and encounters.

Following this, themes such as **social interaction** and **wayfinding** are found, directly followed by **daylight**, **previewing**, and **personalisation**.

In contrast to privacy, social interaction is also very important to keep the individual included in society, especially because people with autism have the tendency to exclude themselves. It seems evident to ensure a balance between the two factors.

Previewing can add to social interaction, since individuals can mentally prepare themselves for a social encounter, which enables them to go in stronger. This adds to a note stated consequently in the diagram: **inclusion**. This should also be considered on urban level.

Wayfinding and orientation add to the sense of confidence and familiarity (figure 156). This familiarity should be enhanced by enabling the individuals to add personal notes in and around their residencies; almost like 'marking their territory'.

Sensory gardens can add to the connection of the indoor area with the outdoors and also enables the resident to experience stimuli in a secure outdoor space.

Light and **temperature control** add to the feeling of comfort (figure 157), just like the use of **comforting furniture** and application of different **textures** and textural elements. Additionally, **smell** and **soft colour** use are named. Since colour preferences are highly personal, this isn't the most important, but care should be taken for applying colour in communal areas. Spreading of unpleasant smells should be prevented.
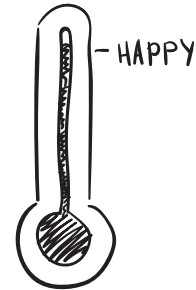

fig. 156: confidence

fig. 157: comfort

4.2. Conclusive guidelines for architects

The main research question to be answered through this thesis, was:

Which architectural elements can increase the well-being of people with autism within their home environment?
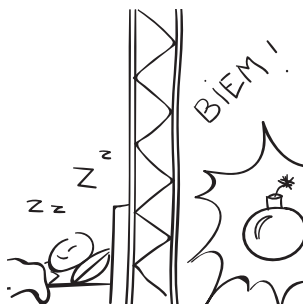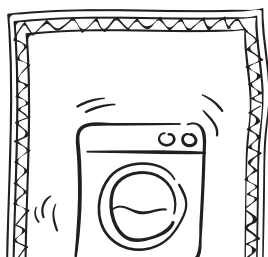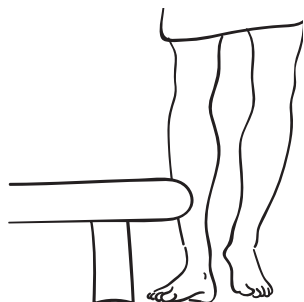
To enable myself and other architects striving towards fitting housing for the autistic, I set up a list of guidelines which should be followed. These guidelines will contain architectural elements and use of these guidelines can focus on enhancing the well-being of the intended residents: individuals with autism.

This list is derived from the several problems, solutions and the subsequently developed hierarchy scheme.

Reduce sensory load concerning sound, sight, touch and smell;
Throughout the research, it has become clear that both sensory decrease as well as sensory stimulation should be a reoccuring factor of thought. Sensory overstimulation has a far bigger impact on the well-being of people with autism and prevention should therefore be examined closely.

fig. 158: allow for outstanding insulation

fig. 159: consider soundload of appliances

fig. 160: use soft corners and edges

Design suggestions are:
- x provide outstanding insulation of separating walls and floors inbetween dwellings (figure 158);
- x be considerate of the soundload electrical appliances can produce (figure 159);

- x allow for a high level of daylight to enter, but prevent direct sunlight from coming in;
- x use matte finishes of smooth surfaces like floors and window sills to prevent glare;
- x ensure total darkness at night in private spaces;
- x provide guiding lights in circulation spaces;
- x use soft pastel colours and/or colours that refer to nature;
- x ensure an environment free of sharp edges or corners (figure 160 on page 83);
- x prevent kitchen smells from spreading by seperating functions;
- x allow for sufficient ventilation and clean air (figure 161);
- x addition of a sensory garden can stimulate and ease the senses in a secured outdoor area (figure 162);

Develop a spatial layout which creates expectations for action;

Individuals with autism are often dependent on routine - and feel very comfortable with it. In some cases, the routine does not come naturally but is provided by tutors. Several residents said that they had difficulties with remembering to shower in the morning, or even to eat.

A spatial layout which creates expectations for these actions can be beneficial for the development of these people: when ensuring that these routines will be followed, the level of tutoring can be decreased.

Design suggestions are:
- x create logical circulation routes within dwellings: related functions should connect in spatial

fig. 161: ensure clean air and ventilation

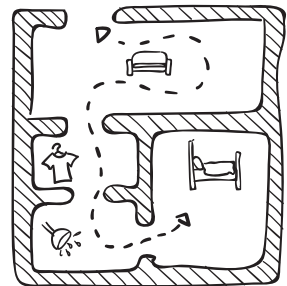
fig. 162: connect to a sensory garden

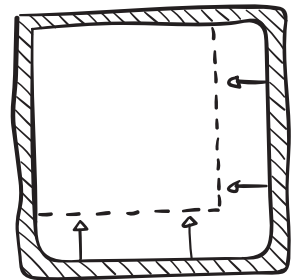fig. 163: create expectations by routing

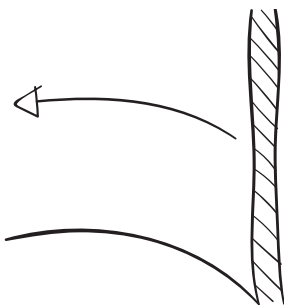fig. 164: avoid unnecessary large spaces
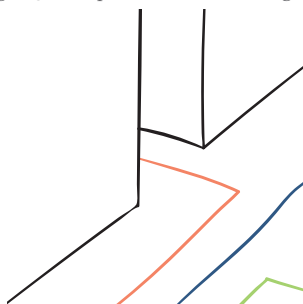
fig. 165: incorporate curvilinear design

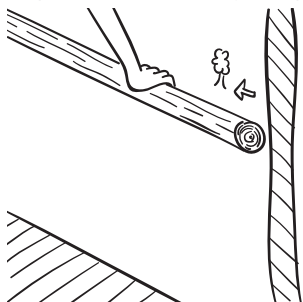fig. 166: use colour for wayfinding

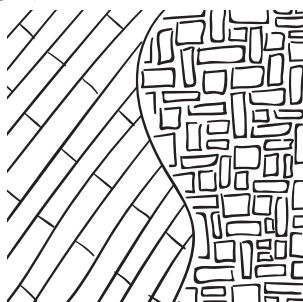fig. 167: texture for a sense of direction

fig. 168: textures for seperate functions

organisation as well;
- x create expectations by routing: by forcing the resident to enter the bedroom through the bathroom, he or she will remember the required actions (figure 163);
- x avoid unnecessarily large spaces (figure 164);
- x avoid too many dedundant rooms, for they will confuse the resident;

Maximise familiarity and clarity;

To enhance self-esteem and confidence, it is highly important to create a familiar environment. Routing should be easily understandable: we already feel insecure when looking for directions, therefore this is even more important for individuals with autism.

Design suggestions are:
- x spatial wayfinding strategies such as curvilinear walls can be applied (figure 165);
- x markers for wayfinding and orientation can be applied by means of colour, patterns and shapes (figure 166);
- x textures applied to railings, floorings or doorknobs can enhance the sense of place by associating with functions (figures 167 and 168);

Create "islands" of privacy throughout building, apartment, and outdoor area;

For everyone, it is important to have a personal, private space. This is even more evidently so for individuals with autism. When they have insufficient private space,

frustration and annoyance occurs which strongly decreases their well-being.

It should be very important to layer several levels of privacy in order for them to find relief.

Design suggestions are:

- x ensure feelings of safety by (visible) safety measures (figure 169);
- x ensure total privacy inside the dwelling;
- x prevent outsiders from looking in the dwelling;
- x in communal areas, add auditory privacy. This can for example be done by strategically placing furniture (figure 170);
- x even within the dwelling, layering of privacy should be considered;
- x make sure the dwellings have all the necessary functions, so the resident is not forced to reside in communal rooms;

Allow opportunities for social interaction – both accidental and planned;

In contrast to providing places for privacy, it is equally important to ensure social interaction. Many individuals with autism tend to retreat from social activities and tutors need to stimulate this constantly.

Thus, the designer(s) should be considerate of creating several levels of social interaction, varying from specially designed areas to spontaneous interaction through circulation routes.

Design suggestions are:

- x thought should be put in spatial design, such as ceiling heights;
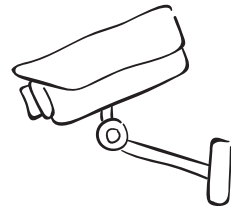- x provide different strategies in

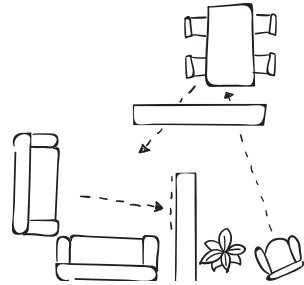fig. 169: visible safety measures

fig. 170: add auditory privacy

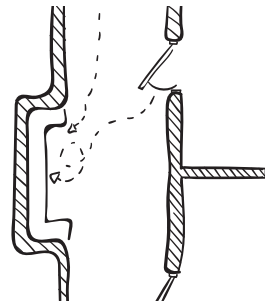fig. 171: allow for previewing

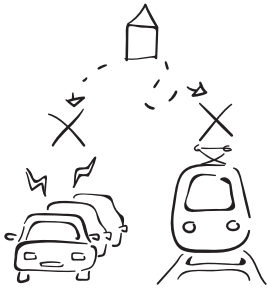
fig. 172: upgrade circulation spaces

fig. 173: location consideration
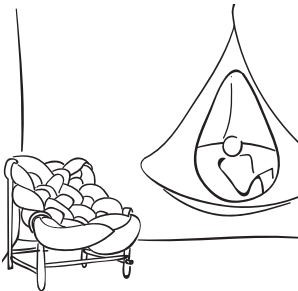
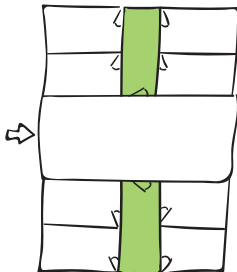fig. 174: home-like furnishings

fig. 175: comforting furniture

fig. 176: keep hallways short

"previewing", which can lower the stress that occurs upfront social interaction (figure 171);

x vary between circulation hallways and larger circulation areas where other activities can take place as well (figure 172);

x add communal rooms for eating, seating and other functions;

Ensure accessibility and inclusion in the surrounding neighbourhood;

Selecting the "perfect" area for your design is essential to the lives of the residents. A nice and fitting area can ensure that moving to another location can be delayed or even prevented.

Design suggestions are:

x consider locations where facilities like supermarkets, sport centres, general practicioners, etcetera, are accessible by walking or biking;

x ensure that public transport is well available in the area for travaling to places further away;

x stay void of "negative" area's where there can be a lot of negative stimuli. For example along a noisy road or train track (figure 173);

x consider adding communal services to your building to create meeting opportunities among residents of the neighbourhood.

Allow for a high level of personalisation to enhance identity;

Currently, housing facilities are under siege of restrictions and obligations regarding furniture. More than often, budgets for furnishings are scarce and tutors have to

make-do. Nevertheless, this should be regarded with great care. Personalisation and home-like furnishings (figure 174 on page 87) are very beneficial to to every person's well-being and the fact that individuals live in dwellings provided by an institution does not have to mean that it should feel like one.

Design suggestions are:

- x comforting furnishings can be applied in common areas which will support the emotional well-being of individuals with autism (figure 175 on page 87);
- x multifunctional furniture is used more often by its occupants and can therefore be a great addition to communal areas;
- x movable furniture in communal areas can reinforce the (social) use of that space;
- x By applying short corridors, the institution-like feeling will be minimised (figure 176 on page 87).
- x allow for personalisation of connecting outdoor space. For example: personalising front doors with photo's or placing personal objects outside (figure 177);
- x allow for choices in wall-colours, tiling, flooring, etcetera (figure 178);

Provide control of services;
Since people with autism often experience sensory overload, it is very important that they are able to control varying services in their home.

Design suggestions are:

- x add sunshading and/or blinds that

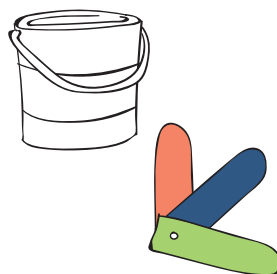fig. 177: personalisation opportunities

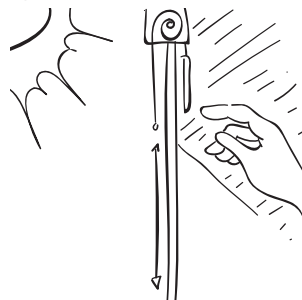

fig. 178: colour of own choice
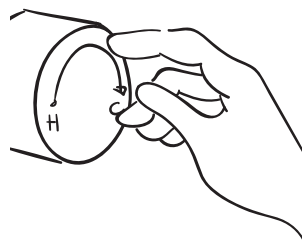

fig. 179: controlable blinds
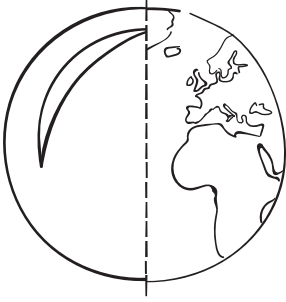

fig. 180: temperature control

fig. 181: own world v.s. real world

can be controlled manually (figure 179);

x make sure the lights are dimmable;

x central heating and/or cooling should be able to be adjusted manually (figure 180);

Always be alert of the balance between their world and the outdoor world: also design the in-between;

This last guideline is a very important note which should be considered throughout the whole design process. See figure 181.

For example, if an architect creates an environment avoid of sensory load, the individual's senses will be shocked when getting out of that certain area. For that reason, it is very important to also design the in-between areas. It can be considered like a crowded plaza. When you are in a quiet building next to this plaza and leave the building through a door, the noise will hit you in the face. If you approach this plaza through an alley, the noise will gradually increase so you can prepare yourself for what is coming.

Design suggestions are:

x in-between levels of privacy can be attained by creating deep niches: the individual will still have a small semi-personal area while leaving its home;

x pay great attention to entrances and exits of the building, since these form the bridge to the outdoor world;

5. Discussion

"My mother took my hand. 'I know,' she said, 'but you have to. You're four now. All children go to school.' She had said this earlier several times, but it didn't sound logical to me. I wasn't 'all children'."
— Judith Visser, 2018

During this research, I have come to understand more of the several factors I have investigated and how they are involved in architectural design: sensory architecture, privacy, social interaction, spatial layout, wayfinding, furnishings and personalisation. This understanding did not only occur with regard to the scope of autism: I have come to the conclusion - for myself - that we should be more aware of these elements throughout all architecture.

In my opinion the firstly named themes, comfort, routine, and confidence, apply to every individual out there. The Built Environment should contribute to these pillars. Maybe not to the extent as I am doing in this research and will be applying in my design, but it should definitively be present.

Sensory architecture, for sound, light, touch, and smell, is not only beneficial to those with autism. We, as neurotypical people, can also benefit from a well-considered sensory home. Busy traffic across your house, a train passing by every half an hour: it can be something you get used to. Only when you are at a really tranquil place, you realise how quiet the world, your world, can be. Doesn't this mean that the noise you often hear, subconciously adds to stressful feelings? To be always aware of these sounds, somewhere in your mind, probably doesn't add to your well-being.

Additionally, we all know the feeling of not knowing where to go, searching for the right office where you have a meeting. And we all

know the frustration of not being able to find a certain place.

We as designers, architectural as well as urban, should look more into this.

And even though current technology such as Google Maps can help guide us through it, it will not completely erase these feelings of discomfort and uncertainty.

When form overrules function, is that worth the trouble people will experience by using the designed entity?

6. References

"I thought I would have to teach my child about the world. It turns out, I have to teach the world about my child."
– Michel, 2014

6.1. List of figures

Figures and images are created by the author, unless signed with an endnote. These endnotes refer to the following sources.

[1]	Hay, 2014
[2]	Henry, 2012
[3]	Barfield, 2012
[4]	NAS, 2016
[5]	Smeets, 2017
[6]	Architonic, 2012
[7]	Health2work, 2018
[8]	Erwine, 2016, p. 176
[9]	Styfhals, 2014
[10]	Arctic Stones, 2016
[11]	Erwine, 2016, p. 53
[12]	Viva, 2017
[13]	Architonic, 2011
[14]	Erwine, 2016, p. 84
[15]	Archinect Firms, 2009
[16]	Tag, 2015
[17]	Mood, 2017
[18]	Pryce & Gardner, 2010
[19]	Photo taken by author: at BK City, Faculty of Architecture, TU Delft, 2018
[20]	Photo taken by author: at BK City, Faculty of Architecture, TU Delft, 2018
[21]	Archinect Firms, 2009
[22]	Mood, 2017
[23]	Dorte Mandrup Arkitekter, 2014
[24]	Fiederer, 2016
[25]	Sasaki, 2015
[26]	Brighton Homes, 2018
[27]	Goffgough, 2012
[28]	Plaats, v.d., 2014
[29]	Sherry, 2015
[30]	Guerra, 2016
[31]	Graham, 2014
[32]	Endemol, 2010
[33]	Rosemberg, 2017
[34]	Jackson, 2018
[35]	Millman, 2015
[36]	Mucko, 2017
[37]	Tenniswood, 2018
[38]	Gardenerdy, 2018
[39]	Erwine, 2016, p. 201
[40]	Landscaping Expert, 2017
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[42]	Jeff, 2018

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6.3. Typological projects

1.

Organisation:	Gemiva-SVG
Project name:	Swetterhage
Location:	Zoeterwoude, NL
Number of residents:	± 320
Housing facilities:	41 group homes, 5 activity centres. personal studio apartments with space for living, cooking and sleeping, and a personal bathroom.
	communal meeting point in each group home.
Extra services:	

2.

Organisation:	Gemiva-SVG
Project name:	Oude Vest
Location:	Leiden, NL
Number of residents:	± 20
Housing facilities:	personal apartment with living room (with kitchen block), bedroom and bathroom
	communal meeting point: living room, dining room, kitchen and garden.
Extra services:	24-hour support is available during day-, evening-, and

nightshifts of tutors.
Daily activities such as
dinner (17:30) and
coffee/teatime (19:30).

3.

Organisation:	Gemiva-SVG
Project name:	Zwieten
Location:	Zoeterwoude-Rijndijk, NL
Number of residents:	± 16
Housing situation:	Four houses, divided in sets of two row-houses, within the distance of a couple of streets. Each house gives space to four residents, who have their own bedroom and share other facilities like living room, kitchen, bathrooms and dining area.
Extra services:	24-hour support is available during day-, evening-, and nightshifts of tutors.
	Communal eating with opportunities to cook for yourself and/or others one or more times a week.

4.

Organisation:	's Heeren Loo
Project name:	de Villa
Location:	Apeldoorn, NL
Number of residents:	± 20
Housing situation:	Each resident has its

Extra services:	own studio apartment with kitchen block and bath room. Communal areas give space for lounging, cooking and eating with the group whenever they want. 24-hour support is available during day-, evening-, and nightshifts of tutors.
	Within the building, an activitycentre for 44 people is stationed: a candle-making atelier.

5.

Organisation:	's Heeren Loo
Project name:	-
Location:	Ermelo, NL
Number of residents:	± 500
Housing situation:	On the very large terrain, multiple clusters of houses are found. Group homes of ± 10 - 15 people are arranged around courtyard-like spaces. Each resident has either a personal studio apartment or a two bedroom apartment in case of a couple. In each group home, there is a communal area with living room and kitchen available.
Extra services:	support varies from very basic to intrinsic support, based on

the severity of disabilites of the residents. Residents with similar levels of disability, live together.

Appendix

Dankjewel dat je mee wil doen aan mijn onderzoek! Ik doe dit onderzoek voor mijn studie Bouwkunde in Delft. Op dit moment ben ik bezig met woningbouw en wil ik graag kijken naar woningen voor bewoners met autisme. Mijn tweelingzusje heeft Autisme Spectrum Stoornis en woonde begeleid, maar wilde eigenlijk graag zelfstandig wonen met een 24-uurs steunpunt. Daardoor vond ik het erg interessant om hier onderzoek naar te doen.

Ik zal een aantal vragen stellen die gaan over de kamer en/of het huis waar je nu woont, maar ook over de wensen die jij hebt voor een eventueel toekomstig huis en de buurt waar je zou willen wonen. Hierbij mag je zo veel opschrijven en dingen bedenken als je wilt! Alles mag! Ik ben heel erg benieuwd wat jij nou heel fijn, stom, gezellig, mooi of lelijk vindt. Je mag, als je dat leuk vindt, ook tekeningetjes erbij maken. Maar dat hoeft natuurlijk niet! Je kan het ook gewoon beschrijven met woorden. Dus denk vooral: wat zou ik willen als ALLES mag en kan?

We gaan het nu eerst over je **kamer** hebben.

- *Hoe ziet je kamer er nu uit, kan je die beschrijven?*

- *Wat zijn je favoriete onderdelen/ plekjes in je kamer?*

- *Waarom vind je die dingen fijn?*

De volgende vragen gaan over een **huis** of

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appartement in totaal.

- *Welke dingen vind je minder fijn in dit huis?*

- *Wat voor soort dingen vind jij belangrijk om te hebben in een toekomstige woning?*

Zo'n appartement zit natuurlijk in een **gebouw** met meerdere woningen bij elkaar.

- *Welke dingen zou je in het hele gebouw belangrijk vinden?*

- *Wat voor dingen zou je in de buitenruimte van het gebouw belangrijk vinden?*

Net als waar je nu woont, staat het appartementengebouw later in een **wijk**.

- *Welke dingen vind je belangrijk in de wijk?*

- *Van welke dingen/voorzieningen zou je het fijn/handig vinden als ze (redelijk) dichtbij huis zijn?*

- *Van welke dingen/voorzieningen zou je juist overlast ervaren?*

En als laatste woon je nu en later natuurlijk in een **dorp** of **stad**.

- *Als je zelf mag kiezen waar je zou gaan wonen, wat voor een plek zou dat dan zijn? Kan je die beschrijven?*

Thank you for wanting to participate in my research! I'm doing this research for my study in Architecture at the Delft University of Technology. At the moment, I am focusing on housing and I would like to look into dwellings for residents with autism. My twin sister has Autism Spectrum Disorder and used to live with a lot of support, but actually wanted to live independently with a 24-hour support point. This made me very interested in doing more research about this.

I will ask several questions that concern the room and/or house you're currently living in, as well as the wishes you might have for a possible future home and its neighbourhood. You can think of and write as much you want! It can be anything! I am very curious about what you think is nice, stupid, annoying, fun, pretty or ugly. You can, if you like, make additional drawings of some sorts. But you don't have to of course! If you feel better just describing with words, feel free to do so!
Most importantly, think about: what would I want if ANYTHING is possible?

We will talk about your **room** first.

- *What does your room look like now? Can you describe it?*

- *What are your favourite parts/spots in your room?*

- *Why do you like these so much?*

The following questions will be about a

house or **apartment** in total.

- *What kind of thing don't you really like in your house right now?*

- *What kind of things do you find important to be present in your future residence?*

Such an apartment will of course be in a larger **building** with other apartments.

- *What kind of things do you find important in the building as a whole?*

- *What kind of thing would you find important in the outdoor space of the building?*

Just like where you're living now, this apartment building will be situated in a **neighbourhood**.

- *What kind of things do you find important in that future neighbourhood?*

- *What kind of things/services would you consider important/nice/ convenient to have (relatively) close to home?*

- *Of what kind of things/services would you experience nuisance?*

Lastly, you are living and will be living in a **village** or **city**.

- *If you could choose, what place would you want to live? Can you describe it?*

Swetterhage

Location	Zoeterwoude-dorp
Number of residents	300
Facilities	(group) housing
	activity centres
	leisure

INCLUSION

large seperated terrain with services
reverse integration
not included in the neighbourhood

BUILDING TYPE

large collection of building types
> apartment buildings 2 stories
> closed 'hofjes' typology
> free standing houses
> 'row' houses

PRIVATE OUTDOORS

> personal balconies
> communal garden within 'hofje'
> communal garden group home

SUPER MARKET

> present on terrain, and

Walk	10	min
Bicycle	3	min
Car	2	min

NOISY TRAFFIC

N206	300	m
Lden (= Level day – evening – night)	45 – 65	dB

NIGHT CLUB

Not within range of night clubs

CAFÉ

Not within range of cafés

CITY CENTRE

Walk	25	min
Bicycle	20	min
Car	35	min
Public Transport		

GREENERY/PARK

> present on terrain, and

Walk	4.5	min
Bicycle	5	min
Car	11	min
Public Transport	50	min

TRAIN STATION

Walk	1h 20	min
Bicycle	27	min
Public Transport	30	min

BUS STOP

Walk	11	min
Bicycle	3	min

SIGHT > COLOUR	SIGHT > LIGHT	SOUND/ACOUSTICS	TOUCH/TEXTURE	SMELL/FRAGRANCE
Walk 27 min Bicycle 8 min Car 7 min	Not within range of night clubs	Not within range of night clubs	Not within range of cafés	

PRIVACY	WAYFINDING	SPATIAL LAYOUT	PERSONALISATION	AUTISM SPECIFICS
Walk 27 min Bicycle 8 min Car 7 min	Wayfinding on the terrain is very difficult (even for me) Few signs are present and the path layout is complex	Not within range of night clubs	Not within range of night clubs	Use of curvilinear design - niches towards exits have curved corners

4. Reflection

Since I grew up with a twin sister having autism, I developed a fascination for the current (available) housing situation for this focus group. It appears that a lot of group housing is on offer, but not many individuals are looking for such a housing situation. They rather live independently with or without support. My fascination developed to the point where I became interested in designing individual apartments where the architecture can support the resident.

The relationship between the theme of Explore Lab and residential architecture for people with autism.
Although my subject focusses on residential architecture, I could not have executed my research within the Architecture & Dwellings studio, since I would not have gotten the tools to investigate this focus group (people with autism) thoroughly.

I wanted to really dive into this research and explore several research methods. Also, I wanted to choose my own location, preferably in Leiden. The studio of Explore Lab made this possible.

The research question I constructed for this thesis was as follows:
>	*Which architectural elements can increase the well-being of people with autism within their home environment?*

For my research, I focussed on sensory architecture, as well as spatial considerations to support routine and implementing

elements for privacy as well as social interaction.

Relationship between the methodical line of approach of Explore Lab and the chosen methods.
The studio of Explore Lab has given me the opportunity to elaborate several research methods which enabled me to understand as fully as possible the challenges and opportunities for this project.
The methods I used to investigate this subject, were threefold. Also, my research focussed on finding problems as well as solutions to the problems. These problems and solutions can be divided under several themes I set up:

- sensory
    - x   sound
    - x   sight (light and colour)
    - x   touch
    - x   smell
- spatial
    - x   layout
    - x   wayfinding
    - x   personalisation
    - x   furnishings
- social
    - x   privacy
    - x   social interaction

Firstly, I did extensive literary research. Most studies done by scholars were focussed on school design instead of dwellings, so I needed to filter the found aspects on relevance for residential application.

Additionally, I visited several typological projects where I got personal tours by the location manager, or otherwise. Here, I could observe for myself how several design strategies were implemented. Also, in several projects, the residency had undergone

renovations which lead to more detailed information about the behaviour of residents before and after these changes. This was also very useful for me.

Lastly, I set up questionnaires which were filled out by residents living in either a group home (waiting for an individual apartment) in Leiden, or in an individual student's home in Delft. Through these questionnaires, I could ask for the wishes of these people for a future home.

The results were combined in a set of guidelines considering the earlier mentioned themes. With this, future architects, as well of myself, might get a bit more of a grip on designing for this focus group.

The relationship between research and design.
For the design of the little courtyard ('het hofje') I kept the design guidelines I set up as a result of my thesis as a reference. Through all the different scales of my design, I have taken several points in this list by heart.
On a typological level, the choice for designing a hofje resulted from the need for a tranquil environment. Since the location is in the heart of Leiden, which is beneficial for the independence of the residents, it was of big importance that the apartments offered acoustic relief.

Other implementations are design considerations throughout the building construction. By applying two seperate load bearing walls in between dwellings, the nuisance of contact noise is minimal.

For several subjects I decided upfront that I wanted to implement them in the design,

so I could take these with me in the research thesis. An example of this is the sensory garden. So the relationship between research and design worked, for me, in both ways.

The relationship considering the wider social, professional and scientific framework.
Through the experience with my sister, I understand the importance of stimulation of this focus group. If stimulation and support is insufficient, this has a great influence on their well-being and development.
Since approximately 1 in 100 people is diagnosed somewhere on the spectrum (including Asperger's Syndrome and PDD-NOS), this focus group has become a big part of contemporary society.

Therefore I think that it is not only time to take this group into account, but to maintain a certain standard in residential design. In my opinion, several design strategies can also be applied in residential design for non-autistic people.

In my opinion the firstly named themes, comfort, routine, and confidence, apply to every individual out there. The Built Environment should contribute to these pillars. Maybe not to the extent as I am doing in this research and will be applying in my design, but it should definitively be present.

Sensory architecture, for sound, light, touch, and smell, is not only beneficial to those with autism. We, as neurotypical people, can also benefit from a well-considered sensory home. Busy traffic across your house, a train passing by every half an hour: it can be something you get used to. Only when you are at a really tranquil place, you realise how quiet the world, your world, can be. Doesn't this mean

that the noise you often hear, subconciously adds to stressful feelings? To be always aware of these sounds, somewhere in your mind, probably doesn't add to your well-being.

Additionally, we all know the feeling of not knowing where to go, searching for the right office where you have a meeting. And we all know the frustration of not being able to find a certain place.
We as designers, architectural as well as urban, should look more into this.
And even though current technology such as Google Maps can help guide us through it, it will not completely erase these feelings of discomfort and uncertainty.
When form overrules function, is that worth the trouble people will experience by using the designed entity?