A touch of home

creating a feeling of home in elderly housing through materials

Broers, I.

Award date:
2017

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TU/e - December 2017

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December 11th, 2017

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Stimulating and Healthy home Environments (SHE)

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Preface

In front of you lies my thesis ‘A touch of home - Creating a feeling of home in elderly housing through materials’.

For several years now, I have had an interest in care architecture. This stems from several jobs within the elderly care sector, where I noticed how many times buildings that are meant for elderly are not designed with their needs in mind.

When the opportunity arose to graduate with an evidence based design project that focusses on stimulating environments for elderly, the choice was easily made.

I would like to use this opportunity to thank my tutors Masi, Irene and Renato, and the PDEngers Leonie, Joyce and Marije, for their guidance.
I would also like to thank my fellow SHE-students Lex, Tim, Bart and Koen for their support.

Also a thank you to my friends and family for their support through my whole studies. And especially my parents and my boyfriend Maarten. I couldn’t have done this without you.

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Introduction

This thesis is part of the graduation studio ‘Stimulating Healthy Home Environments’. The scope of this studio was to find out what the ‘feeling of home’ means for elderly, with every student focusing on one specific topic.

A research into the feeling of home and autonomy showed me how often elderly people do not have the chance to choose materials for their home. Most of the time these materials are chosen by ‘experts’ such as architects and care-givers. But these choices are often made from their perspectives, not those of the elderly. The experience of materials and atmospheres, and the ability to have influence on this, is researched amongst elderly and older adults to show the influence of materials on the feeling of home.

The results of this research come together in an evidence based design, which is then again tested in this thesis.

First the topics of the feeling of home, autonomy and the choice for materials will be explored, and a state of the art will be given of the current situation. Then, a research into the experience of elderly and older adults is presented. The third part focusses on a design based on the research and literature. Next, the design will be tested to find evidence on how it is perceived. Finally, a conclusion will be presented with future recommendations.

Chapter 1: Background

Introduction

The feeling of home among elderly people can be described through multiple definitions. Within these definitions, two main features of the feeling of home can be found; a sense of security - which entails a place safe from outside threats, that is familiar and protects one's privacy - and a sense of autonomy (Lundgren, 2000; Van Hoof et al., 2016; Evans et al., 2002; Marsden, 2001). Autonomy ensures the independency of a person, self-control and the ability to make your own choices. Autonomy is the base of multiple factors that influence the feeling of home. It ensures the ability to make choices regarding lifestyle and activities, but also to make a reflection of the personal identity (Pastalan & Schwarz, 1993).

Although autonomy is of vital importance for the feeling of home amongst elderly people, when moving to a care home or an assisted living facility their ability to make home-related choices is reduced rapidly. Although elderly people can bring personal items (such as furniture, photo frames, paintings and hobby equipment), they have little to no influence on the appearance of the space itself (Lundgren, 2000).

This lack of control of the appearance addresses a critical point. The concept of the feeling of home has become a combination of the "expert's" (care givers, architects, managers and politicians) tastes and prejudices, instead of being based upon experiences of lived-in homes (Lundgren, 2000). As also stated by Wastiels et al. (2012): "While selecting materials, architects often rely on their personal experiences and previous encounters with materials to judge the perceived attributes." This means that the materials chosen for the homes of elderly people, are not based on the perception of the elderly, but on the perception of the architect.

The assumption can be made that the perception of the (younger) architect is not similar to that of the elderly. Perceptual and sensory functions continue to change throughout the lifespan (Coren et al., 2004). Later changes, beginning around age 40, lead to decreased functioning of the senses (Werner et al., 1990). Color vision is one aspect that dramatically changes in old age (Adams et al., 1994), but touch sensitivity also reduces more and more after 65 years of age (Gescheider et al., 1994; Wells et al., 2003).

All of the incoming sensory information has influence on the experience of materials (Schifferstein & Wastiels, 2014). Vision and touch are the primary sources of information about materials, with vision as most dominating (Fenko et al., 2010; Rozendaal & Schifferstein, 2010; Suzuki et al., 2006; Wastiels et al., 2012). Stimuli such as warmth, color and surface geometry can therefore evoke different experiences with younger people and elderly.

There has been some research into the use of materials in the environment of elderly. Research on the use of colors has shown a large difference between the preferences of elderly and architects (Karatza, 1995). The research of Van Hoof et al. (2016) also showed how people were debating the choice of colors in their homes as an influential factor on the homelike atmosphere.

This chapter will present the background for the next chapter; research. The background entails the research question and case studies, as well as the aforementioned topics of the feeling of home, elderly's senses and material experience.

Research question

In this thesis, a research is conducted among older adults (55-75) and elderly people (75+) to find out how the choice of materials has influence on the feeling of home. The goal of this research is to get insight in the perception of materials by older adults and elderly people, and how this relates to the feeling of home.
The main research question is:

How do materials influence the feeling of home for older adults and elderly people?

To answer this broad question, more specific sub-questions are formed:

- How do older adults and elderly people perceive certain materials?
- How do materials link to autonomy for older adults and elderly people?
- Which materials do older adults and elderly link to the feeling of home?

It is hypothesized that materials are of influence on the feeling of home. And since the sense of autonomy is most important in the feeling of home; autonomy in choosing materials is also important.

Next to that, the perception of materials differs between elderly and younger generations, which leads to a different material experience. And a different material experience is of influence on the atmosphere experience.

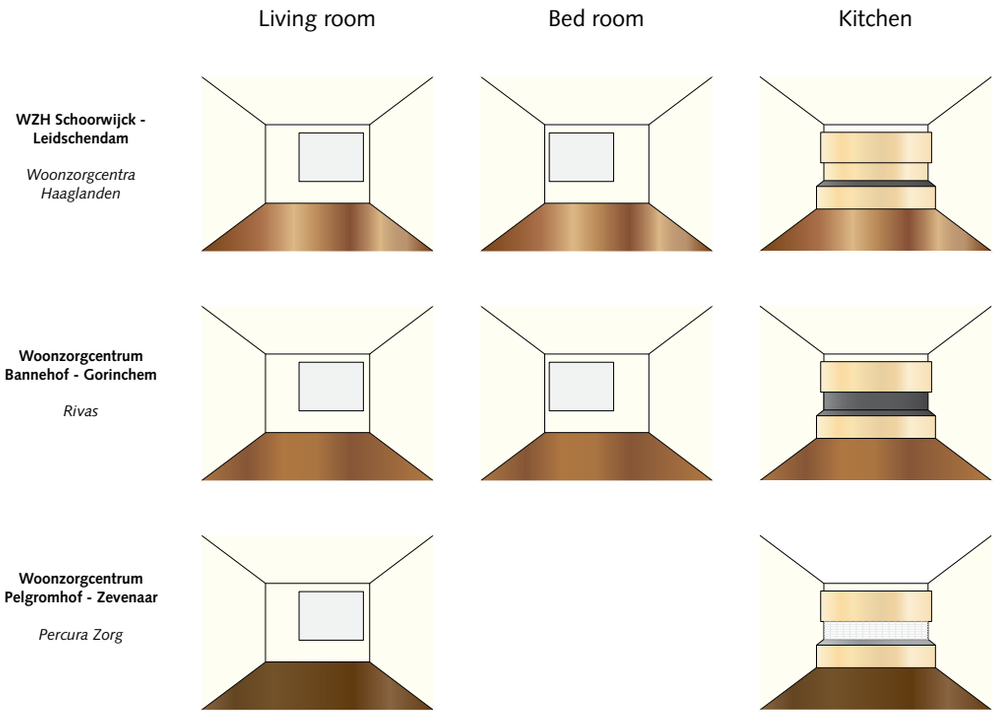


Image 1. Three case studies standardized upholstering

Case studies

As seen in the introduction, Lundgren (2000) states how elderly have little to no influence on the appearance of their living space. This is known for nursing homes, but there is no record in literature for care apartments in assisted living facilities. These apartments are residences that are connected to a care provider, where care can be bought in when necessary. These residences are becoming the new norm in The Netherlands due to the separation of care and living (Aedes-Actiz, n.d.), and therefore chosen as the focus of this research.

A case study into care apartments was conducted amongst several residences in The Netherlands. It became apparent that also in these apartments, standardized upholstering was used. This always entails white walls (paint or wallpaper) and a laminate floor in a dark orange or brown color wood. Some examples from the case study can be seen in *Image 1*.

It is highly likely these materials are generally chosen for their practicality and versatility. They can be easily cleaned and are a neutral base for furniture and personal items. There is however no record that these materials are the most preferred by elderly. Or that elderly prefer this standardized upholstering over being able to choose autonomous.

To see the impact of these materials, separate and as a combination, they will be used in the following research.

Feeling of home

Autonomy is not always a guarantee for people when they age, especially when moving into an institutionalized facility. Next to the loss of control due to physical decline, they also suffer the loss of control of their home. This can harm the sense of identity and the (psychological) well-being of elderly people (Van Hoof et al, 2016; Barnes, 2006; Parmelee & Lawton, 1990; van Boxel et al., 2007). The home is the reflection of the identity. It's a place of choice, an expression of the social status and a territory one controls through personalization and architectural appearance (Pastalan & Schwarz 1993). As said by Heynen et al (2004): "Identification is: to own. If you cannot identify yourself [with the house], then you do not dwell, then you lodge."

Here lays the problem with a lot of elderly housing options. In assisted living facilities in the Netherlands, such as *woonzorgcentra* and *aanleunwoningen*, elderly do not always have the opportunity to change the appearance of their house. Van Hoof et al. (2016): "Many nursing homes in the Netherlands offer standardized carpeting, upholstery and curtains, as well as wall paints." Such home environments are not enforcing autonomy for elderly.

Elderly's senses

As mentioned in the introduction, perceptual and sensory functions keep on changing throughout a person's lifespan. Changes in the aging brain lead to changes in perception (Mendelson & Wells, 2002), but the change in perception is also influenced by changes in the senses themselves. After the age of 40, sensory receptors age and neural efficiency drops (Werner et al., 1990).

The reduction of visual sensitivity is clear in aging individuals. This can be appointed to multiple factors. Firstly, the aged eye has a smaller pupil size, which causes less light to enter the eye. This explains the need for more light for elderly people to perform the same tasks as younger adults (Coren et al., 2004). Also, with increasing age the crystalline lens becomes yellower and darker, as well as the cornea which yellows slightly (Artal et al., 2002). The dramatic change of color vision in old age can be attributed to this change. Lastly, the loss of cone pigment may account for changes in color vision (Kilbride et al., 1986; Coren et al., 2004). The combination of these aspects also assure a faster deterioration of blue vision (Shefrin & Werner, 1990).

Touch sensitivity also reduces with age, even greater after 65 years of age. Research with vibrating stimuli to the hand (Gescheider et al., 1994) and foot (Wells et al., 2003) show that the detection thresholds increase with age.

The aforementioned changes are hypothesized to be of influence on the material experience, which could lead to a different atmosphere experience compared to people of lesser age.

Geometrical	Physical-chemical	Emotional	Associative
Smooth-rough Fine-coarse Plain-bumpy Regular-irregular Linear-non-linear	Warm-cold Hard-soft Shiny-mat Moist-dry Sticky-dry Heavy-light	Pretty-ugly Liverly-dull Comfortable-uncomfortable Modern-traditional	Ice-like Rubberlike Skin-like
etc.	etc.	etc.	etc.

Table 1. Four dimensions of material perception

Material experience

All the senses contribute to the material experience. Various studies show that the more senses stimulated at one time, the richer the experience will be (Bahrick & Lickliter, 2000; Stein & Meredith, 1993). Vision and touch however prove to be the most successful in providing detailed information about a product, while audition and olfaction prove to be less useful (Schifferstein & Cleiren, 2005). This research therefore focusses on vision and touch.

Zuo et al. (2014), researchers in product design and materials, created a framework to describe a person's perception of materials and textures. The framework makes the distinction between four dimensions; geometrical, physical-chemical, emotional and associative. The geometrical dimension describes the response to the geometrical aspects of the material surface, such as smooth-rough and fine-coarse, while the physical-chemical dimension describes the response to the material surface based on the interaction between skin and surface, such as warm-cold, hard-soft and shiny-mat. The emotional dimension describes the feelings that are evoked by the material, such as pretty-ugly, lively-dull. And the associative dimension describes anything associated with the material, such as mat like and ice like.
Zuo et al. state that the relationships between perception responses within the four dimensions are most important. Even more than the individual responses to a material. Correlation among the four dimensions has not only been found in the case of isolated material samples, but also in the case of multiple materials in relation with one another.

The information from both senses together is of influence on the material experience. Certain characteristics can even be perceived through both the sense of vision and the sense of touch. The research of Schifferstein & Wastiels (2014) showed that three characteristics are perceived the most through the two senses: warmth, color and surface geometry.

Warmth

Warmth is an important characteristic of the home interior (Schifferstein & Wastiels, 2014). But warmth does not only refer to physical warmth (physical-chemical dimension), it also refers to the feelings evoked by the material (emotional dimension). Both of these dimensions of warmth will be mentioned in the next sub-chapters *color* and *surface geometry*, while this chapter focusses only on the physical warmth.

Materials have different thermal properties, which means they are perceived differently even if both materials are at the same room temperature (Schifferstein & Wastiels, 2014). For instance, wood is perceived warmer then metal. This is caused by the thermal conductivity of a material. Metal for example has a higher conductivity, which ensures a faster cooling rate. When touching metal at room temperature, the heat of the skin is conducted by the metal. This leads to the perception of metal as a 'cold' material. Wood has a higher resistance, thus this is perceived as a 'warm' material.

Wastiels et al. (2012) researched the perception of warmth for different sensory modalities, and found no correlation between the results of vision and touch. Since physical warmth is one of the few characteristics that cannot be perceived visually, it is only perceived by touch. The results suggest that the visual perception of material warmth is influenced by the observer's knowledge of the material.

Image 2. Color circle divided in cool and warm colors

Color

The perception of warmth in color is linked to both the physical-chemical dimension, as certain colors absorb more warmth then others, and to the emotional dimension. Most research is done into the emotional dimension, and focusses on the feelings obtained through material experience.

Generally, research on the experience of color shows that warm colors range between yellow and red-violet on the color circle, and cold colors range between blue-violet and yellow-green (Schifferstein & Wastiels, 2014). These results have led to the general color theory, used for most color experiences. (See *Image 2*) Fenko et al. (2010) however found that this general color theory does not comply with all products. This implies that the color experience depends on the context. Chosen colors should therefore be verified within the particular context, to validate the predictions from the general color theory.

Surface geometry

Surface geometry has a connection to most of the dimensions. The physical-chemical dimension comes in place with surface geometry when talking about the geometrical dimension. When the surface of a material is rough (geometrical dimension), the contact surface between the material and skin is smaller than with a smooth surface. This could lead to a different perception of warmth (physical-chemical dimension) through touch (Schifferstein & Wastiels, 2014).
Through vision, Wastiels et al. (2012) have found that roughness has influence on the perception of warmth, with rougher surfaces being perceived as warmer. These results where irrespective of the material's color.

Glossy paint or glazed tiles have another influence on material perception. In the research of Thiis-Evensen (1987), it was found that glossy surfaces were perceived as hard, where finely grained surfaces were thought to be softer. These kind of experiences are related to the emotional dimension.

Chapter 2: Research

	Research I Preliminary	Research II Materials	Research II Atmospheres
Purpose	To identify users' preferences about materials	To study material experiences	To study atmosphere experiences
Subjects	Older adults: 3 Elderly: 5	Older adults: 4 Elderly: 4	Older adults: 4 Elderly: 4

Table 2. Parts of research

Methodology

This research focuses on two target groups, older adults (55-75) and elderly (75+). The choice for two different age groups was made to find differences in the sensory perception between both groups, which would indicate the decline of the senses. This is assumed to be of influence on the material experience. The two target groups will also show similarities and differences on the subject of atmosphere and the feeling of home.
The participants all lived independently in a house or an apartment in a *woonzorgcentrum*, and did not have dementia.

The research was divided into two parts, as seen in *Table 2*, starting with a preliminary research. The interview method was used for the preliminary research. In this research, samples of wall and flooring materials were shown in groups (*Appendix 1*), and participants were asked to choose their favorite in each group. The favorites from all groups were later shown together to make a final choice. The final chosen materials were put in a model to show it as a whole (See *Appendix 2*).
The samples consisted of multiple groups for both floor and wall materials. With common materials such as carpet, paint and wallpaper, but also with more uncommon materials such as polystyrene and laminate in wood and stone look. In each group there were both warm and cold colors.
The preliminary research resulted in data which in itself does not give enough information to answer the research questions, but did give direction for the second research.

In the preliminary research, it was found that personal preferences are important to the older adults and elderly. Within their preferences, it was found that they all leaned in the direction of calm and neutral atmospheres. To obtain this, they typically used neutral materials, such as white or light grey wallpaper, but incorporated a material to give the room an accent on one of the walls.

To obtain data on the material and atmosphere experience, and the feeling of home, the second research was done with the use of a semantic differential. This is a self-report method which is widely used in Kansei engineering to address relationships between emotions and products, but also to obtain information on sensorial perception (Huang et al., 2012). A semantic differential questionnaire presents two bivalent adjectives to be rated on a scale. Usually five, seven or nine point scales are used due to limited short term memory of participants (Chen et al. 2009). Since this research deals with elderly, with a very limited short term memory, it was chosen to use a five point scale.

To avoid having one side of the questionnaire completely with negative adjectives and the other side with positive, the words were randomly polarized. This was done to ensure that word pairs were placed in a way that participants were not influenced by the notion of a positive or negative side. The word pairs were also presented in a randomly order.
The questionnaire can be foun in *Appendix 3*.

Geometrical/Physical-chemical		Emotional
Tactile	Visual	
Cold-warm	Cold-warm	Pleasant-unpleasant
Smooth-rough	Mat-shiny	Pretty-ugly
Soft-hard	Light-dark	Boring-interesting
Sticky-dry		Natural-artificial
Bumpy-flat		
Flexible-stiff		

Table 3. Twelve adjectives material experience

Image 3. Materials for research material experience

For the material experience twelve adjectives were used that are common in literature on tactile and visual perception (Hollins et al., 2000; Barnes et al., 2004; Childs & Henson, 2007). These adjectives fall in the geometrical, physical-chemical and emotional dimension. Since both the geometrical and physical-chemical dimension are present in the tactile and visual adjectives, these adjectives are grouped by the latter. *(See Table 3)*
Next to that, the color could be chosen from the six main colors in the color wheel, as well as white, black, grey, brown, beige, colorless.
Not only the individual adjectives will be analyzed but also combinations in each dimension, as well as combinations between the dimensions. Since combining a number of pleasant stimuli does not guarantee a pleasant experience (Schifferstein et al., 2010).

The materials used for the material experience research were mostly chosen from the materials of the preliminary research. A few materials were added to provoke and/or stimulate the participants, and see how they react to these materials. *(See Image 3)*
Each material that has the tactile property of a fast cooling rate was chosen with the visual property of a warm color, according to the general color theory, and vice versa. The materials were alternated based on their cooling rate. Both choices were made to stimulate the tactile and visual perception.

Geom./Phys.-chem.		Emotional/Associative	
Sensorial	Homelike	Activity	Preference&Presumption
Cold-warm	Homely-lonely	Restful-active	Modern-old-fachioned
Light-dark	Cozy-bleak	Calm-busy	Familiar-unfamiliar
	Accessible-Warding off	Lazy-energetic	Dependent-autonomous
	Safe-Dangerous	Stimulating-demotivating	Pretty-ugly
	Unpleasant-pleasant		Chaos-harmony
	Comfortable-uncomfortable		Luxury-simple
			Natural-artificial
			Boring-interesting
			Extravagant-demure
			Expensive-cheap

Table 4. Twenty-two adjectives atmosphere experience

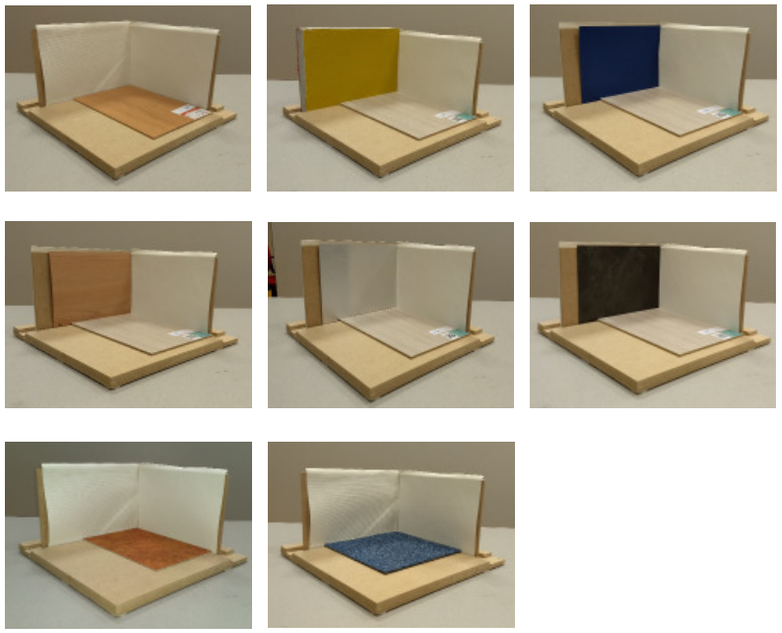


Image 4. Stages for research atmosphere experience

For the atmosphere experience 22 adjectives were used based on the literature study into the feeling of home. The word pairs can be found in *Table 4*. The questionnaires were in Dutch, and contained one word that is not easily translated into English. The word *gezellig* can refer to many things, but is used in this setting as homely or cozy. It will be referred to in this paper as homely.
The sensorial group is based on the geometrical and physical-chemical dimension. The emotional and associative dimension however have so many different adjectives, these are grouped into three specific groups (homelike, activity and preference&presumption) based on the literature study.

The atmosphere experience was conducted by setting up eight stages. A model was used to put in wall and floor materials. *(See Image 4)*
The materials for the first stage were based on the case studies, which showed a typical upholstering with white walls and a dark wood floor. The other stages were based on the preliminary research, where calm and neutral atmospheres with one accent were generally chosen. The stages therefore contain the neutral materials that were chosen most often by the participants, which were white wallpaper and light grey wood laminate. Five stages contained an accent wall and two stages contained an accent floor. By using almost generally the same materials for every stage, the results will show the impact of the accent material on the atmosphere.

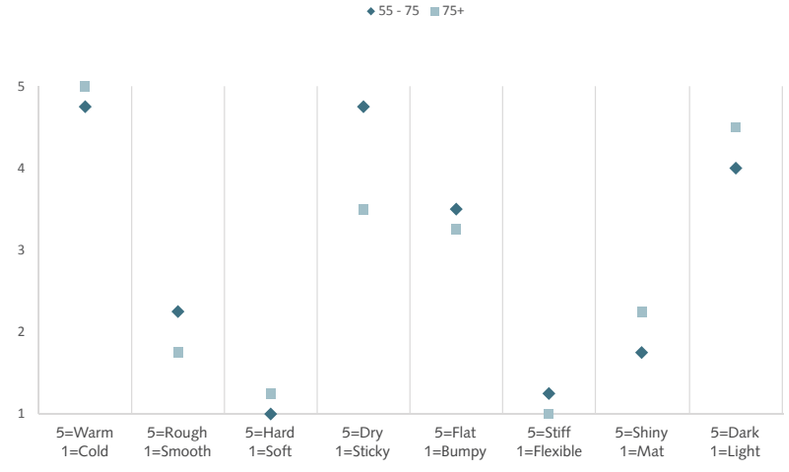


Image 5. Example material sample; age groups agree on visual and tactile topics

Results material experience

From the visual and tactile topics, older adults and elderly agree most on the topics of cold-warm, smooth-rough and mat-shiny. On the topics of soft-hard, sticky-dry and light-dark, they also agree on multiple occasions. *(See image 5)*
It was also found that for every material, the older adults and elderly appointed it the same color, or a color in the same range (such as brown and orange).

Next to that, it was found that most word pairs do not connect to other pairs. Smooth-rough was however found connected to flat-bumpy. Elderly, as well as older adults, gave similar responses to flat and smooth as to rough and bumpy within their respective target groups. However, where older adults found a material neither smooth nor rough, or flat nor bumpy, the elderly generally found them smooth, or flat.

As explained in the method, each material that has the tactile property of a fast cooling rate was chosen with the visual property of a warm color, according to the general color theory, and vice versa. Through the topic of cold-warm, which relates to both the tactile and visual property, it was found that all participants only chose based on the tactile property.

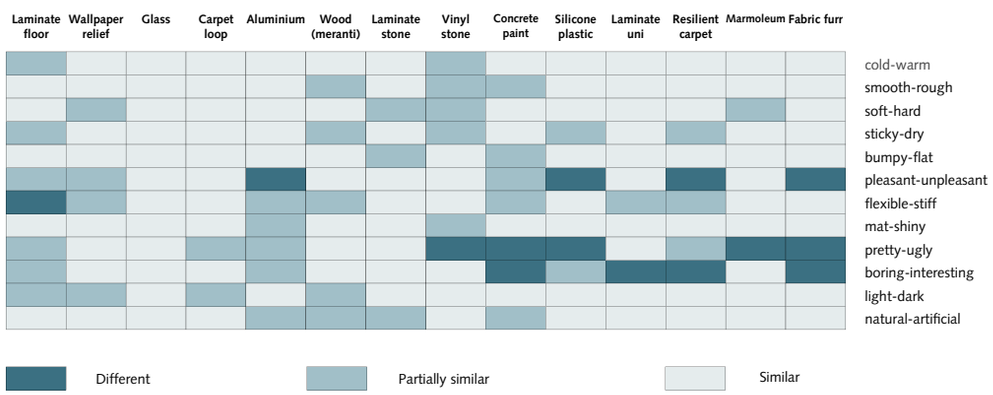


Table 5. Differences and similarities between age groups

Within the preference topics, older adults and elderly disagree most on the topics of unpleasant-pleasant, ugly-pretty and boring-interesting.

The three preference topics are generally always found connected, with on the one hand the dislikes (unpleasant, ugly and boring) and on the other hand the likes (pleasant, pretty and interesting). Elderly judged almost all materials pleasant, pretty and interesting, while older adults also disliked some materials. Concrete with yellow paint, silicon plastic, resilient carpet and fabric fur were all completely disliked by older adults, while wall paper relief, glass and laminate stone were liked by the older adults. There is no pattern to be find between the tactile and visual topics and the likes and dislikes of the older adults.

Between the likes and dislikes of the older adults individually there is also a lot of variation. This is also the case with the individual elderly, but less than with the older adults.

All similarities and disagreements in the material experience of older adults and elderly can be found in *Table 5.*

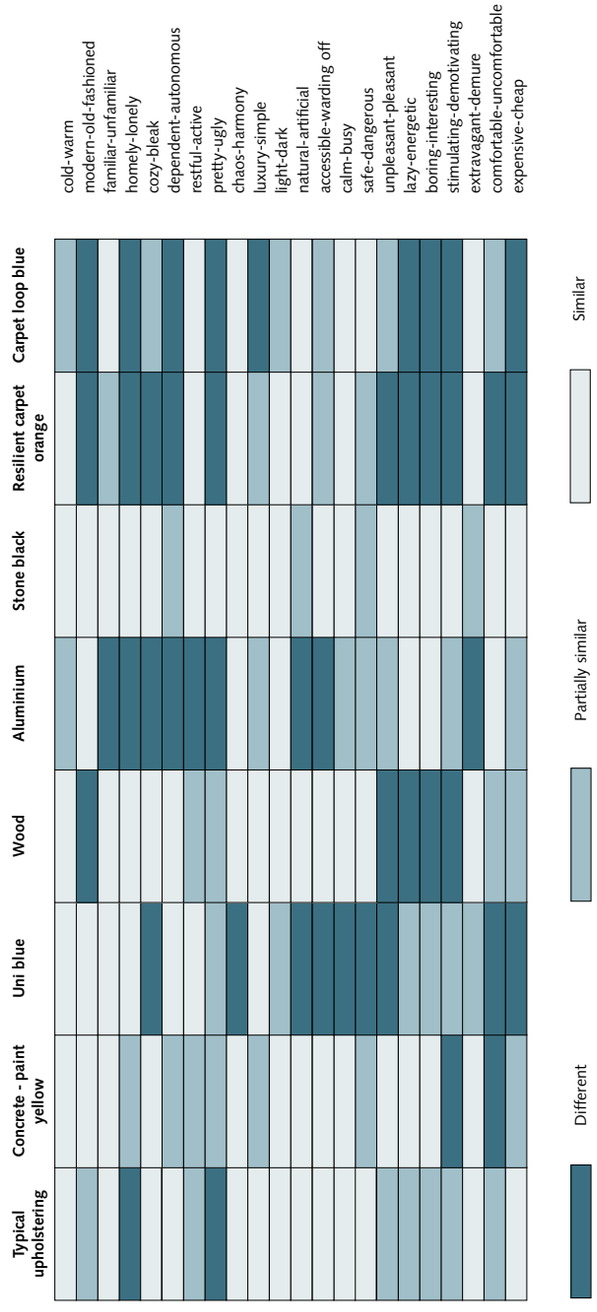


Table 6. Differences and similarities between age groups

Results atmosphere experience

The only stage where both groups generally agreed on was stage six, neutral with one black laminate stone wall. Some topics worth mentioning here are that both groups found the staging warm and cozy, even though black as a color is placed in the cold group based on the general color theory.
This stage was also the only stage that the older adults thought to be pretty. While the elderly found all stages (partially) pretty.

The only topics both groups agreed on in this part of the research were the topics of cold-warm, light-dark and chaos-harmony. The first two topics are the only tactile and visual topics in this questionnaire, so it is interesting to see that both groups agree on these topics, similar to the first part of the research. The topic of chaos-harmony is interesting as for almost all the stages both groups agreed; they all found the stages harmonious.

It was also found that older adults and elderly disagree most on the topic stimulating-demotivating. While elderly found every stage (somewhat) stimulating, the older adults only found two of the eight stages stimulating. These stages were the ones with the laminate silver wall and the laminate stone black wall, both materials not often used as wall covering.

Worth mentioning is the first stage, which was based on the study cases. This stage was very disliked by the older adults, yet the elderly rated it homely, pleasant and comfortable. The elderly did however agree partially with the older adults and also rated it partially bleak, boring and demotivating.

Also in favor of the hypothesis is the combination between the word pairs dependent-autonomous and stimulating-demotivating. The results show that when participants, especially the older adults, rate the stage autonomous they also rate it stimulating.

The topic groups are also present in the results. The word pairs of the homelike group have a connection between the words homely, cozy, accessible, safe, pleasant and comfortable, and also between their counterparts. This however can only be derived from the results of the older adults, since they expressed different ratings over the stages while the elderly were generally only on the positive side with all stages.
The activity group and the perceptions & presumptions group however show there is no definite link between the words of the word pairs in their respective groups. This might be that way since most of the words don't necessarily contradict each other. For instance, a stage that is thought to be calm, does not automatically mean it is boring or demotivating.

The eight stages again showed many disagreements between older adults and elderly. For instance, when looking into the individual answers of the participants, it is noticeable that within each group there is lots of variation.

Analysis results

Material experience

Older adults and elderly agree on most tactile and visual topics, which leads to the conclusion that their touch and visual receptors are not as different as hypothesized.

Both age groups appointed the same colors to a material. This would mean that the yellowing of the lens and cornea does not have a big impact on the color perception. This might be the case because the eye yellows gradually over time, during which the elderly gets acquainted with it.

The materials older adults found neither smooth nor rough, or flat nor bumpy, the elderly generally found them smooth, or flat. This could be an indicator that the elderly are less able to feel a small difference in surface texture, while older adults still do. This could be the result of lesser working receptors in the fingers of the elderly. Although noticeable, it is only a small difference.

An explanation for the found results in the topic of cold-warm, where the participants only choose based on the tactile property, could be the way the samples were presented. Since the materials were only small samples which were placed right in front of the participant instead of used as a full wall cover, and it was the first question on the questionnaire, more focus was paid to the tactile property than the visual.

Older adults and elderly disagree on all of the preference topics. Since they however agree on most of the tactile and visual topics, it can be assumed that older adults and elderly have different preferences based on personal taste rather than on sensorial perception.
There is also no pattern found between the tactile and visual topics and the likes and dislikes of the older adults, which leads to the assumptions that their preferences are also based on personal taste. Next to that, there is a lot of variation between the individual participants. It can therefore not be assumed that all people from one generation have a preference for one or another material, but that their preferences are based on personal taste.

Atmosphere experience

Both groups rated all of the stages harmonious. This could be so due to the fact that all stages were fairly neutral with only one stimulating element, which was based on the preferences from the preliminary research.

Older adults only found two stages stimulating; with the laminate silver wall and with the laminate stone black wall. It can be assumed that older adults have a higher satisfaction level when it comes to being stimulated, since they still experience more in their daily life. Whereas elderly find themselves being stimulated easily since they have a more uneventful daily life.

The first stage was disliked by the older adults, and the elderly even agree that it was (partially) bleak, boring and demotivating. This result is in favor with the hypothesis that the typical upholstering is not the best atmosphere for all elderly, and they should be allowed to have more autonomy in choosing materialization.

The results showed that when participants rate the stage autonomous they also rate it stimulating. Therefore the assumption can be made that people want to be autonomous, so they can create stimulating atmospheres.

The activity group and the perceptions & presumptions group however show there is no definite link. This might be so, as most of the words do not necessarily contradict each other. For instance, a stage that is thought to be calm, does not automatically mean it is boring or demotivating.

The variation between the individual participants is also seen in the results of the atmosphere experience. This leads to the conclusion that their preferences are again based on personal taste, and are not generation wide.

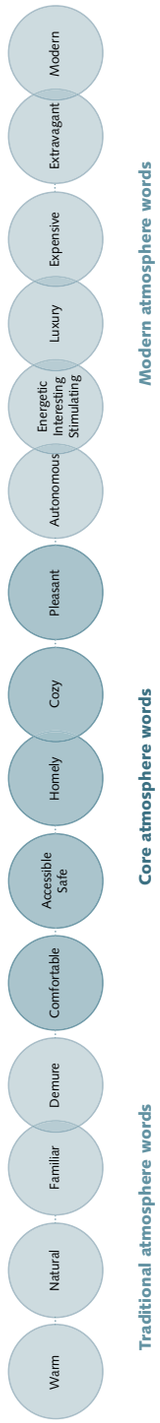


Image 6. Word scheme atmosphere words

It was found in the results of the older adults that, when looking at the positive word in a word pair, there is a gradual change. Every word was used in a few particular stages. When placing the words in order, a scheme can be made. This scheme can be seen in *Image 6*. Some circles overlap, these words are used in all the same stages as the word they overlap with. When there is a step between two circles, the two words differ with one stage.
The scheme shows how there are core atmosphere words which everybody wants for their home, such as safe, homely and cozy, but also two sides. One side consists of traditional atmosphere words and one side of modern atmosphere words.

Connection between results

As described in the method, multiple materials from the first part of the research II were put into second part to see if the preferences were still the same. Since the elderly were generally on the positive side, this could only be seen amongst the results of the older adults. And as suspected, there were many similarities between their preferences during both parts.

Also noticeable; during the first part of the interview, the elderly were intrigued with all the samples of materials. While using these materials in the atmosphere part of the research, they however were a bit more reserved. This could be due to the fact that a whole wall of a certain material somewhere in the distance does not intrigue as much as a small piece right in front of them that they can easily discover.

Discussion

A strong point of this research is the use of the semantic differential. The preliminary research produced much information, but no concrete data to answer the research questions. It became apparent that the use of open questions did not reach the emotions and feelings of the participants. With the semantic differential however, concrete questions about sensorial perception and material and atmosphere experience could be asked. As expected, all participants did have an opinion on these topics, they merely did not know how to express them in the preliminary research.
Noticeable about the semantic differential however was that while the scale in the questionnaire only had five points, taking into account a weaker short-term memory, during the interviews it became apparent that the elderly still only used the most outer ranges and the middle point. Since the older adults did use all five points regularly, there is a possibility this has been of influence on the averages that were calculated.

During the interviews it was noticeable that most participants examined if they could recognize the materials. For materials such as wood, aluminum, glass and carpet, this was guessed by almost all participants. It might be the case that when recognizing a material, the presumptions about the material have influenced the way of the participants rating the tactile and visual topics.

As mentioned in the method, there is a possibility that not all participants interpret every word the same as each other, or as the researcher (Huang et al., 2012). Besides that, in this research there might be another layer to this since some of the elderly needed an explanation of some words. These words were then explained by the researcher, therefore placing the researcher's interpretation of the words in the results of the participants.
While conducting the interviews, there were some warm days followed by much colder ones. While the temperatures in the homes did not differ that much, there was a possibility that the temperature would influence the sensorial perception. Did cannot be derived from the results, but should be kept in mind.

Due to the time span and there were only eight participants, four in each group. Their results therefore have a considerable weight on the average of each group.

The small number of participants is most likely the reason why there is no pattern to be found in the results. This makes it impossible to completely answer the research question, and make an overall conclusion. It is however possible to make sub conclusions.

Conclusion research

In this research, the goal was to get insight in the perception of materials by older adults and elderly people, and how this relates to the feeling of home. Unfortunately it is not possible to make an overall conclusion, as explained in the discussion, but it is possible to make sub-conclusions.

Although it was expected that the sensorial perception of elderly would have made a noticeable change, this did not come forward in the results. The older adults and elderly generally agree on the tactile and visual topics, which concludes that the perception does not change as much as hypothesized. It can be concluded that the sensorial perception is not the main influence on the preference of materials.

Even though there was no difference between the sensorial perception of both groups, there was difference in the emotional response. It is clear that different materials evoke different experiences.

The likes and dislikes differed a lot between the participants, and this was not found linked to their generation. All preferences can be concluded to be based on personal taste. This was both found in the research into material experience as well as the atmosphere experience. It is therefore not possible to conclude which materials are best used to obtain a feeling of home. It confirms the hypothesis that autonomy is of major importance on the atmosphere experience, and thus the feeling of home. When designing for the elderly, it is therefore advised to leave possibilities for autonomy.

It is advised when continuing with this research, to use a higher number of participants to get a more balanced overview and average result. This could then lead to a pattern in the results, from which more conclusions about material preferences can be made.

Chapter 3: Design

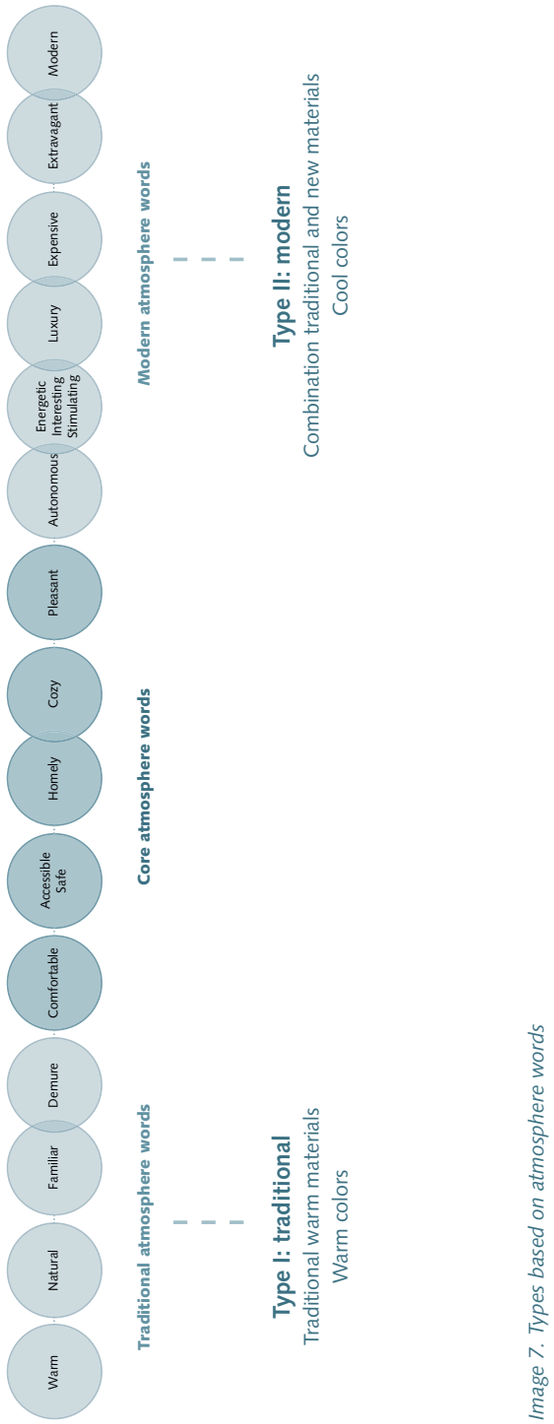


Image 7. Types based on atmosphere words

Controlled autonomy

The research has shown how influential autonomy is on the atmosphere experience, and thus the feeling of home. The possibility to choose materials when making a house a home, was found to be of high importance.

However, people do not always choose a stimulating balance of colors and materials. The tendency and advice has historically been to stick with safe, neutral tones (Reed, 2010). This was also noticeable in the preliminary research, where people generally chose neutral materials such as white or light grey wallpaper.

Reed (2010) stated that "if color is not planned, whether the color of the materials or the applied color, the resulting space may lack character and visual significance." This statement shows that the input of the architect is still important, as their choices guide the resident in making decisions about the materials they want to implement.

Keeping this in mind, I have chosen to make a combination of all these factors. Houses will be developed where certain materials are already chosen, based on a material balance. But there will be some areas left open to give the resident the ability to choose autonomous. On these areas it will be possible to implement materials that can be chosen from a catalogue. Multiple materials will be possible to choose, but all of them have been previously selected to make a good balance with the materials that are already chosen for the house.

As the first step, two types are chosen based on the analysis of the atmosphere experience; a traditional type and a modern type. Both types will have materials and colors specific to them. The traditional type has traditional, warm materials with warm colors, and the modern type has a combination of traditional and new materials with cool colors.

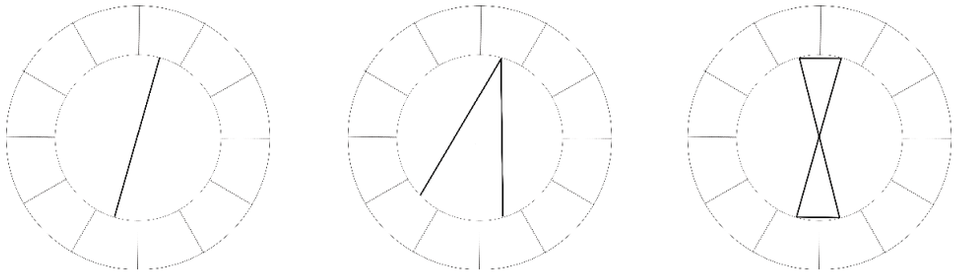


Image 8. Complementary, split-complementary and double-split complementary harmony

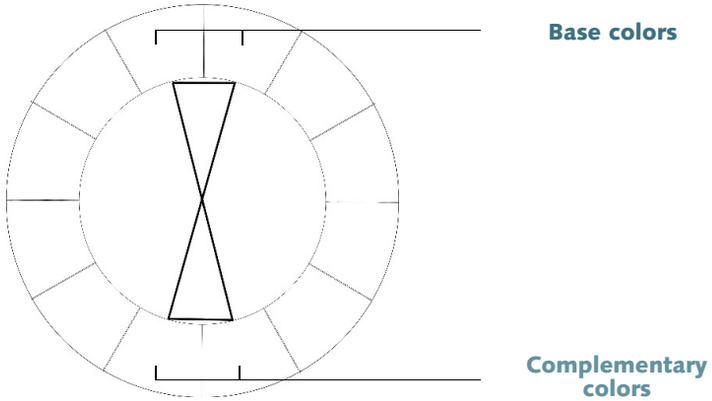


Image 9. Use of double-split complementary harmony

Material balance

Having a good material balance makes a house a comfortable place to live. To obtain a balanced material palette, the palette should be in harmony and in proportion.

Harmony is the result of a perfect balance between individual color relationships (Reed, 2010). Proportion is defined as the size relationships between elements and the visual composition or space.

Harmony

Harmony contributes highly to the making of a pleasant space. Harmony in colors ensures that our eyes do not get overworked when trying to view a space (Reed, 2010).

Harmony can also help in organizing elements in a space. Lauer & Pentak (2007) state: "Our brains look for elements, and when we recognize them, we see a cohesive design rather than unorganized chaos." Through similarity in color, shape and form, it is possible to achieve harmony. "Color produces an essentially emotional experience, whereas shape corresponds to the intellectual control" (Arnheim, 1974). Balancing emotional and visual stimuli will make it possible to find harmony in spaces.

There are seven types of color harmony; monochromatic, complementary, (double-)split complementary, analogous, triadic, tetrad and multi-hued schemes. A few of the harmonies can be seen in *Image 8*.

On the previous pages I have explained the choice for two types, where each has colors specific to that type. But also established the need for areas with autonomous chosen materials. To make a distinction between the type specific materials and the autonomous materials, it is chosen to use a complementary color scheme. Here the colors on the one hand are used for the type materials and the colors on the opposite side are used for the autonomous materials. This is elaborated to a double-split complementary, with two adjacent hues and their complements, to give some more possibilities in the choices. (See *Image 9*)

Image 10. Fibonacci in nature

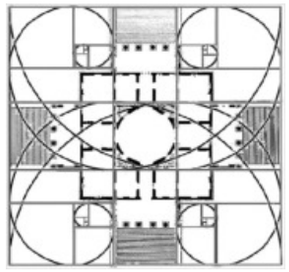


Image 11. Fibonacci in architecture, Villa Rotonda

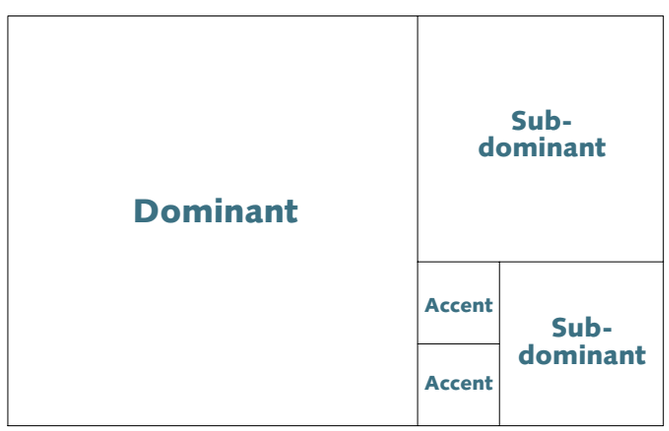


Image 12. Fibonacci sequence to plan proportions of materials

Proportion

Making a good material balance also depends on the right use of proportions (Reed, 2010). I have chosen the Fibonacci sequence to plan the proportions of the materials.

The Fibonacci sequence is a famous mathematical order, where each next number is the sum of the last two numbers. The sequence is as follows: 1-1-2-3-5-8-13-21-34-55-89-144-etc.

What is also interesting about the Fibonacci sequence is that a number divided by its predecessor, especially with the higher numbers, approximates the golden section (1.618).

I have chosen the Fibonacci sequence since its proportions feel natural to humans. An explanation for this is that the Fibonacci sequence is often found in nature. For instance in the number of pedals of a flower and their arrangement, or the composition of a sea shell. (See *Image 10*)

It is therefore also used in many instances where proportion is important, such as architecture. For instance in the floor plan of Villa Rotonda by Palladio. (See *Image 11*)

When using the numbers of the Fibonacci sequence as the ribs of a square, a pattern with exponentially growing squares forms. This pattern can be used to plan the proportions of materials in a room. *(See Image 12)*
The largest part of the pattern is the proportion of the dominant material. This is often the floor, as this is the largest part of most rooms. Then come the sub-dominant materials, who have considerable area in a room but do not have the overhand in a room. The accents are the smallest parts of the pattern, and thus in a room. Accents should complement the dominant material.

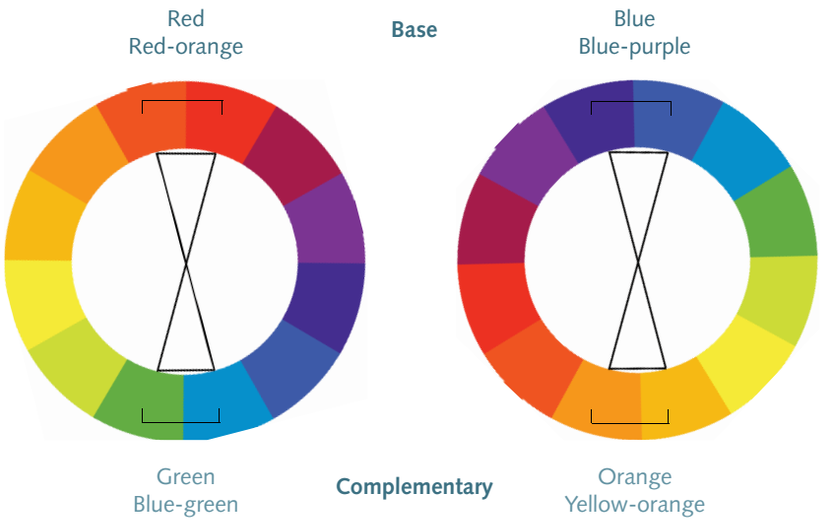


Image 13. Color harmony - Left: type I - Right: type II

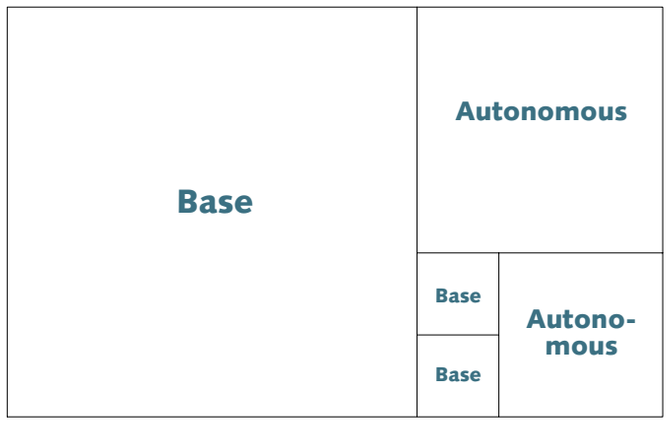


Image 14. Fibonacci sequence to plan proportions of materials

Types

As explained earlier, two types are chosen as the foundation. The two types are a traditional type and a modern type, with each type divided in base materials and autonomous materials.

The base materials have been chosen beforehand and will be the same in all houses of that type. The materials will be used for recurring elements, such as doors and window frames but also the area around light buttons. These recurring elements can help in creating harmony in a space by their similarity in color, shape and form (Lauer & Pentak, 2007). And create a clear overview in the house, which is very benificial for the elderly (Bureau Kroner, n.d.) Elements such as doors and the area around light buttons are also the places that people touch the most in their house. The touch aspect of the base materials is therefore taken into account. Having a similar touch experience for similar elements throughout the house creates a guide that can be a handhold for the elderly.

The autonomous materials can be chosen by the residents themselves. They can be implemented on certain areas that will be determined beforehand. Six options will be available for on the wall, and six for on the floor.

Type I has a base of materials with warm colors. Therefore, I have chosen for red and red-orange. Complementary to that, there are green and blue-green. These colors are those of the materials that can be chosen autonomous.

Type II has a base of materials with cool colors, thus blue and blue-purple are chosen. Orange and yellow-orange are the complementary colors, used for the autonomous materials.

Within the Fibonacci pattern to plan proportions, the base materials will take up the dominant and accent spots. The dominant spot will be the neutral material, while the accents will be the materials for the doors, window frames and around the light buttons. The autonomous materials will therefore be the sub-dominant materials. This way they don't dominate the whole room, but are large enough to have an impact on the atmosphere.

Image 15. Materials type I: traditional

Type I: traditional

Type I is based on atmosphere words such as warm, natural and familiar. I have therefore chosen to use materials that have a warm tactile experience for both the base and the autonomous materials. To have a visual experience of warmth, the base materials have warm colors. Keeping in mind the double complementary color harmony, the autonomous materials have cool colors.

The base materials hint to the "back to nature" movement of the 70's (Van Rotterdam, 2007). In this movement wood had a prominent place. Next to the off-white wallpaper that will be used as a neutral, all the base materials are wood. Different types of wood, with different colors in the range of red to red-orange, will be used for the doors, window frames, walls and the floor.

The complementary materials are also warm, naturel materials but with cool colors in the range of green to blue-green. For the wall, wallpaper and wood can be chosen. While for the floor it is possible to choose carpet, wood or linoleum.

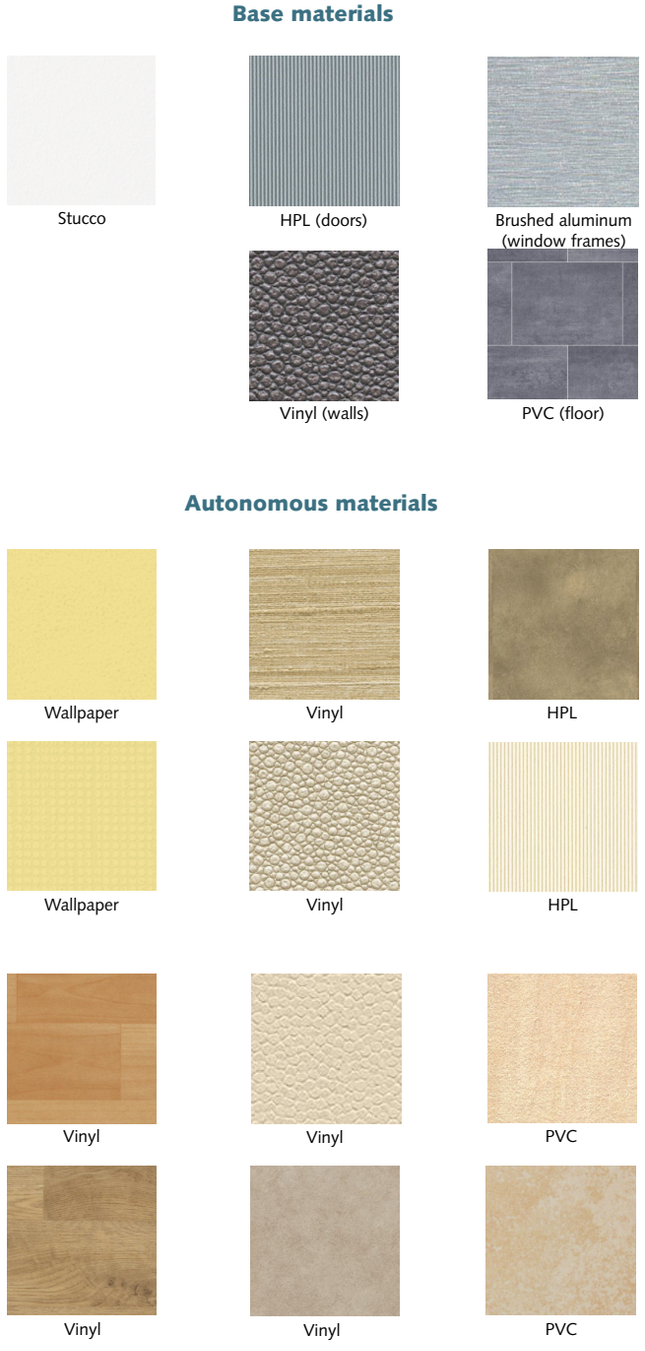


Image 16. Materials type II: modern

Type II: modern

Type II is based on atmosphere words such as modern, interesting and stimulating. I have therefore chosen to implement materials that are new and maybe even a bit unfamiliar to evoke new and stimulating tactile experiences. This is done for the base materials, but also for the autonomous materials. Although the autonomous materials also have options that are more familiar.

For type II, cool colors are chosen for the base materials. As a neutral, off-white stucco will be used. The doors will be made of ribbed High Pressure Laminate (HPL), the window frames of brushed aluminum, the floor of PVC tiles, and the walls (such as the areas around the light button) will be have vinyl with a bumpy leather feel.

The complementary materials are a combination of materials with a warm an cool tactile experience, but with warm colors in the range of orange to yellow-orange. For the wall, wallpaper, vinyl and HPL can be chosen. While for the floor it is possible to choose vinyl or PVC.

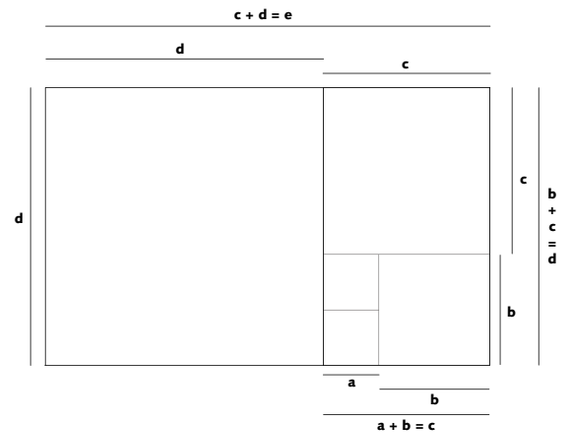


Image 17. Fibonacci rectangle

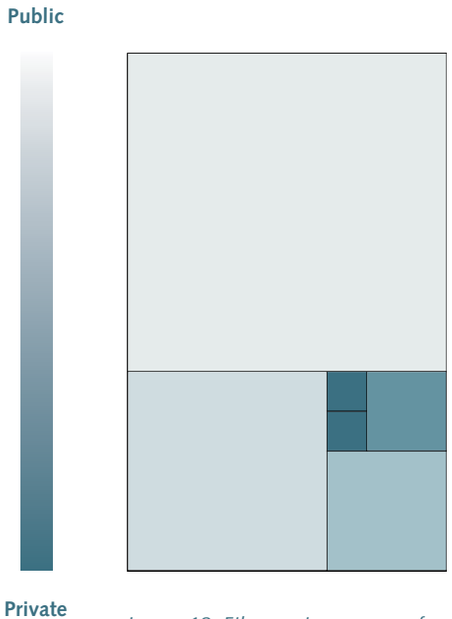


Image 18. Fibonacci sequence of spaces

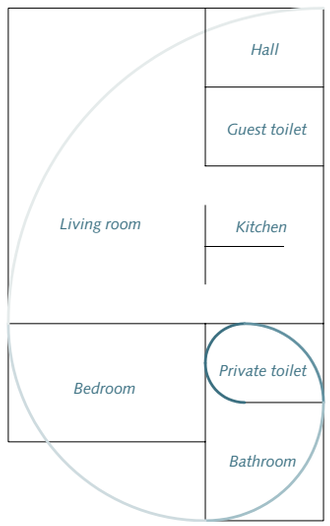


Image 19. Fibonacci sequence of rooms

Floorplan

It has been made clear how the Fibonacci sequence is a good way to plan the proportions of the materials in a room. But it was also shown to be used in architecture. To connect the material experience with the architecture, I have chosen to design a house completely based on the Fibonacci numbers.

First, the proportions of a Fibonacci rectangle need to be explained. A Fibonacci rectangle is built from two consecutive numbers in the sequence. Of which, as explained earlier, the latter number is built up from the first number and its predecessor. In *Image 17* this is explained. One Fibonacci rectangle is, for example, c x d, where d is built up from b + c. The next rectangle is built up from d x e, where e is built up from c + d. And so on.
This proportion was found as the most pleasing to people in several researches, dating as early as the late nineteenth century (Elam, 2001). Therefore it is chosen as a base for the floorplan, but it will further on also come back in the context and the walls.

The Fibonacci numbers are also used for the sequence of spaces. From small to large, the numbers evoke a sequence from private to public. This can be seen in *Image 18* with dark and light blue. The darker the color, the more private the space. As can be seen, the smaller spaces are more private and the larger the space gets, the more public it becomes.

This translates to the rooms, as seen in *Image 19.* As can be seen, the rooms are based on the Fibonacci pattern, but are also Fibonacci rectangles themselves.
The first two similar squares and the consecutive square form the first Fibonacci rectangle, which is the private toilet. This rectangle plus the next square form the next rectangle, which is the bathroom in its entirety. Within the next square, a Fibonacci rectangle is placed which forms the bedroom. The next square is divided in multiple Fibonacci rectangles. The largest rectangle forms the living room. Next to the living room are four small Fibonacci rectangles. The upper one is the hall and below that is the guest toilet. The last two rectangles form the kitchen. Although the kitchen is one space, due to the cooking island it will be generally split up.

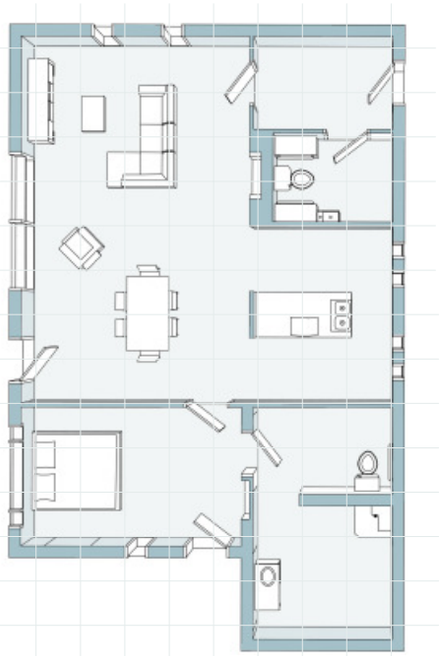


Image 20. Floorplan

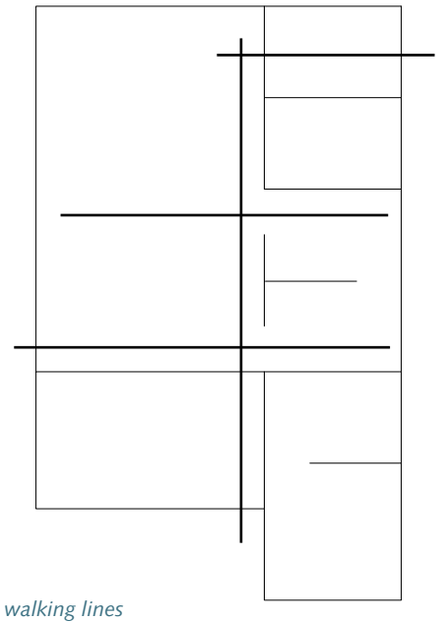


Image 21. Sight- and walking lines

To have a more practical grid, I have chosen for a grid of 1.2 m x 1.2 m. The first numbers of the Fibonacci sequence (1) will be replaced with 1.2. The sequence is then as follows: 1.2, 1.2, 2.4, 3.6, 6.0, 9.6, etc.

Sight- and walking lines

Since this house is designed for elderly, I wanted it to cause a minimum amount of confusion. So for the routing through the house, I wanted to have clear sight lines that are also the walking lines. I was inspired by Schloss Charlottenhof in Potsdam, Germany. In this villa, the doors are placed in line with each other. This ensures a sight line through all the rooms, which is also a walking line. As the rooms are all materialized differently, it is therefore possible to experience the difference in the rooms and their function. In *Appendix 4* more information can be found on Schloss Charlottenhof.

Having clear sight lines and walking lines is also stressed by Bureau Kroner architecten, an architecture firm familiar with designing for the elderly. They are the authors of the site *Ontwerpen voor dementie.* This mainly focusses on elderly with dementia, but much of their advice is also applicable in houses for other elderly.

Sightlines are created through multiple rooms and to the outside, by placing doors and windows in line with each other. These direct sightlines are also walking lines. Having unobstructed walking lines that are connected to the sightlines can be very stimulating for elderly (Bureau Kroner, n.d.). These lines stimulate people to stay active, and walk to a window or a door and look or go outside.

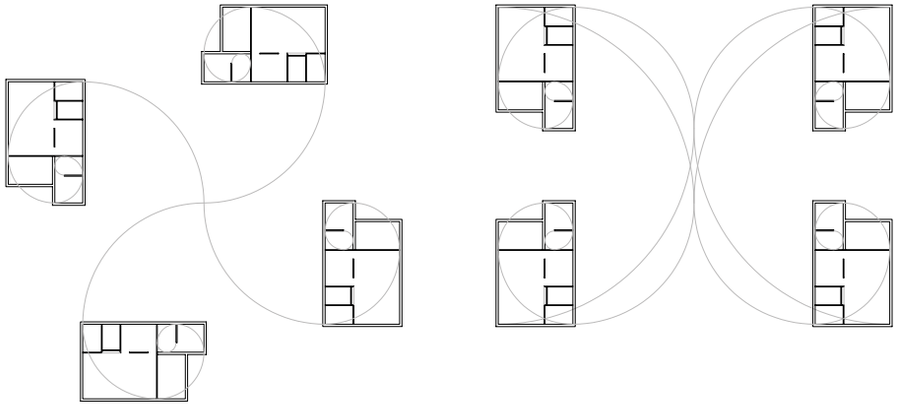


Image 21. Possibilities free-standing houses

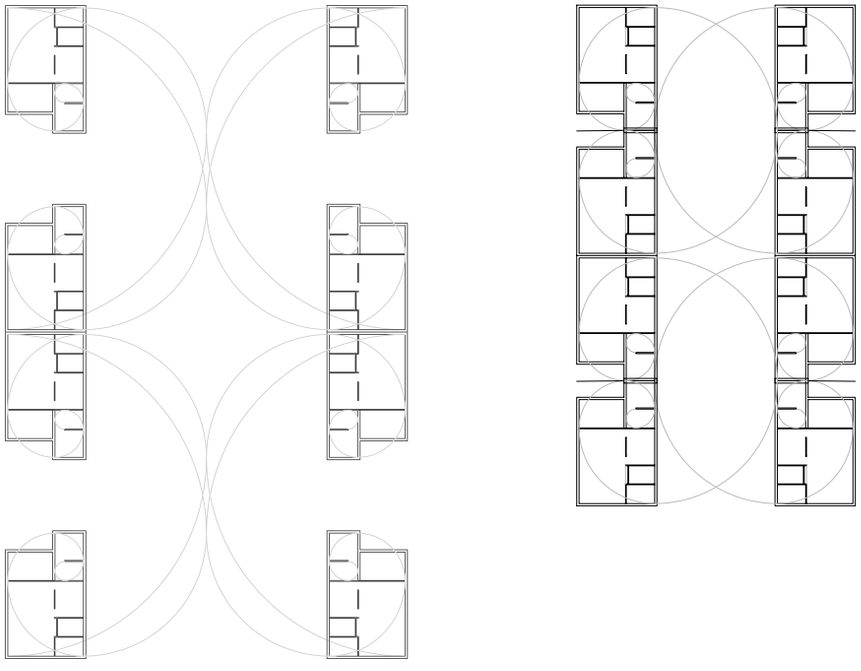


Image 22. Possibility semi-detached houses and row houses

Context

In the previous sub-chapter, it was explained how the Fibonacci rectangle was the foundation for the floorplan. When using the next numbers of the Fibonacci sequence, it is also possible to create different contexts. This is done by extending the Fibonacci curl. Inside the house, the curl begins in the private toilet and ends in the hall. When extending the curl, the houses can be connected.

Image 21 shows two possibilities of free-standing houses. In the left option, the curl is extended one step. The curls are connected in a center point, and the houses all turn 90 degrees relative to each other.
The right option shows how the curl of a house is extended two steps. The end of the curl connects to the outer corner of a house that is mirrored next to it. Another two houses connect at the ends of the first steps.

In *Image 22,* the first option shows the same layout as seen in the right option of the previous image. By connecting the ends of the curls, semi-detached houses are created.
In the right option, the extended curl of a house connects with a corner of a mirrored house across from it. Connecting multiple houses in this manner, row houses are created.
With these options, houses could even be connected to create an apartment building.

By connecting the houses with each other in such a manner, the spaces between them also get extra importance. The spaces are based on a connection between the houses and could therefore also be the foundation of a connection between the residents. Having a community can be very beneficial for elderly (Alter, 2013). A community can be a support system on which people can rely, but also help them stay active.




Image 23. JAL factory - Top: Main building - Bottom: Sewing complex

Location: JAL factory

A location is chosen to show how the houses could work in a context. I have chosen for the JAL factory terrain in Dongen, North-Brabant.

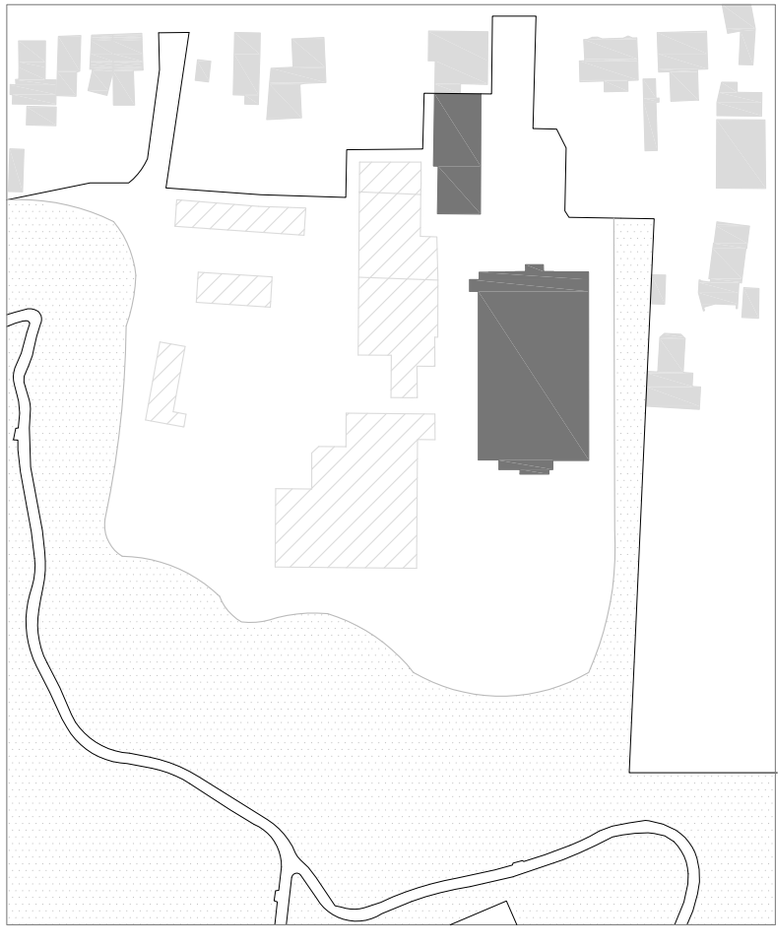
The choice for a location in Dongen was made, as this is in the same area as where the participants of the research live. The factory is an important part of history in this area. Founded in 1879, it used to be a leather shoe factory. The leather industry was the main industry in the area, and it has left its traces. Many people still feel a connection to this part of the history, especially elderly.

The factory was closed in 1981. Currently, anti-squatters are residing in the factory to keep an eye on the property.

The main building and the sewing complex of the old factory are still intact. (See *Image 23.*) However, both buildings are not very properly maintained, even though the main building is a State Monument. The other buildings were built later in time and don't match the old architecture.

The factory terrain is part of Old Dongen and close to the village center. However close to the center, there are no shops within 500 meter of the terrain.

The terrain is surrounded by houses and the park *De Bergen*. It is a unique spot in the middle of a fairly large village, that has a lot of potential.



Factory
Demolish
Surrounding houses
Trees

Image 24. Current situation

Image 24 shows the current situation of the terrain. As mentioned before, the terrain is surrounded by the park and multiple houses. Next to the main building and sewing complex, the terrain also has multiple other buildings that were built later in time. These buildings have no added value anymore and will therefore be demolished.

The main building and sewing complex however, are built in the common brickwork style of the late 19th century and early 20th century. This style can be found in houses of that period in time in the whole area. With their style, these buildings are very recognizable for elderly.

These buildings can still be of value. As mentioned before, there are no shops within 500 m of the terrain. The main building can be used for little shops such as a bakery or a butcher. This is very practical for the elderly, while it is also a boost for the rest of Old Dongen.

The sewing complex could be used for medical purposes. Such as a pharmacy, doctors office or physical therapy. It is also possible to place the office of the local home care organization here. This could be a boost for elderly to move to this location. Since care is close by but not directly connected to their home, as for instance in a nursing home.

The trees from the park are also on a large part of the factory terrain. Since these are a natural barrier, the current fences that are between the trees will be taken away. This natural barrier will also be taken into account when placing the houses.

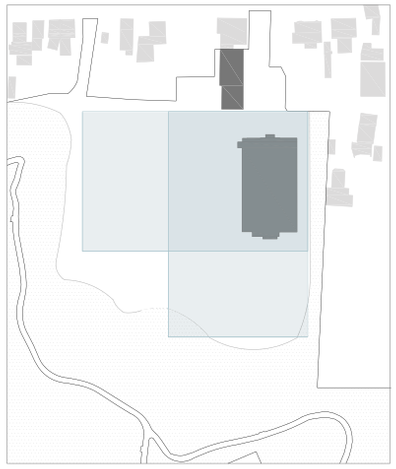


Image 25. Core with Fibonacci rectangles

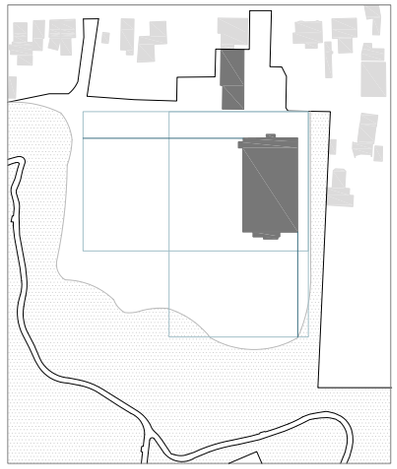


Image 26. Guidelines

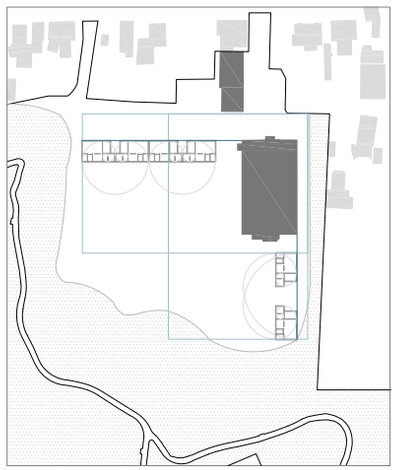


Image 27. Placement first houses

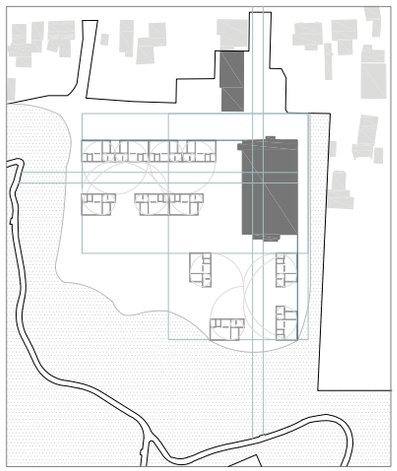


Image 28. Placement second houses

To determine the placement of the houses, the Fibonacci sequence is again being used. Two Fibonacci rectangles are placed over the main building (*Image 25*). These rectangles are based on the Fibonacci sequence of 1.2 that was explained in the sub-chapter of the Floorplan on page 77. Placing these rectangles ensures the building as the core of the terrain. Within the rectangles, the houses will be placed.

In *Image 26* guidelines can be seen. Two guidelines beginning from the main building will be used to place the houses in line with the building. This will also ensure that there is enough space behind the houses for a garden or a terrace.

In the beginning of this sub-chapter it was shown how houses could be placed in a context. On the terrain I wanted to show a gradiation from a more closed to a more open context, which reflects the gradiation from the street to the park. *Image 27* shows the placement of the first houses. In the horizontal rectangle four row houses are placed, and in the vertical rectangle two free standing houses from the semi-detached option are placed.

Image 28 shows the placement of the rest of the houses. In the horizontal rectangle three houses are placed from the semi-detached option. In the vertical rectangle, two free-standing houses are placed.
There are also lines that go through the main building. These start at the entrance and go through the building as a pathway that leads to the park. Within the building it is also possible to take the other pathway to the park through the horizontal rectangle.

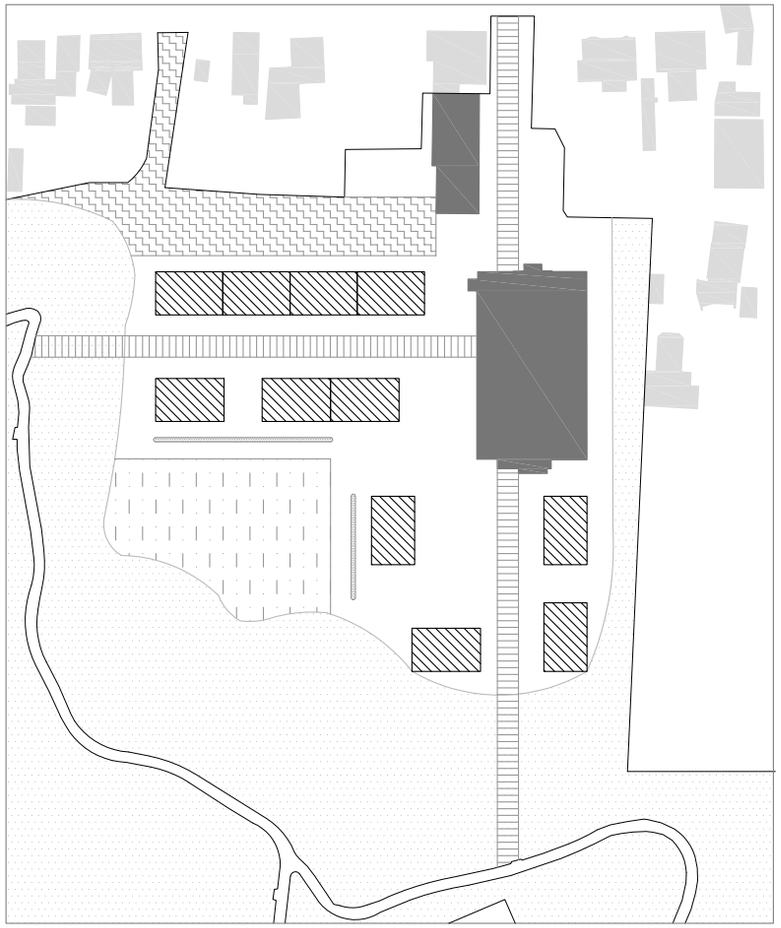


Image 29. New masterplan

The steps on the previous page lead to a new masterplan (*Image 29*). The main building is the core element of the terrain. In this building, a market place will provide a bakery, butcher, florist and so on, for the elderly and the surrounding neighborhood. A pathway leads visitors from the main entrance to the building. This pathway continues through the building as a core around which the little shops reside. On the other side of the building it continues and goes into the park. From within the building, another horizontal pathway emerges that goes into the park.
The pathways will be the only way into the park from the north side. The terrain will therefore always be visited by people passing-by, and thus included into the neighborhood.

Surrounding the pathways are the houses for the elderly. Some of these are jointed, others are free-standing. The space between the houses has a communal purpose. By placing objects in these spaces with different types of materials, people can explore new material experiences. This can involve benches and tables, but also art objects for which local artists can be asked. These objects are interesting for people of all ages and can stimulate the elderly living in the adjacent houses to go out and be active.

The space between the two groups of houses also has a communal purpose. This square can be used by the whole neighborhood for communal activities, but also for children to play. It can also be used by the shops in the factory for special occasions.

The second entrance of the terrain leads to a parking lot behind the row houses. This parking lot will also be available for residents of the surrounding houses.

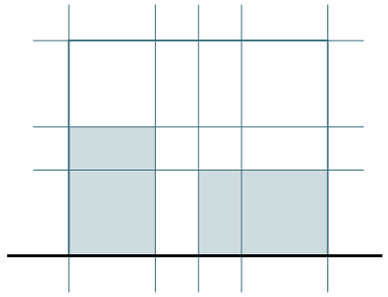


Image 30. Base grid with Fibonacci rectangles

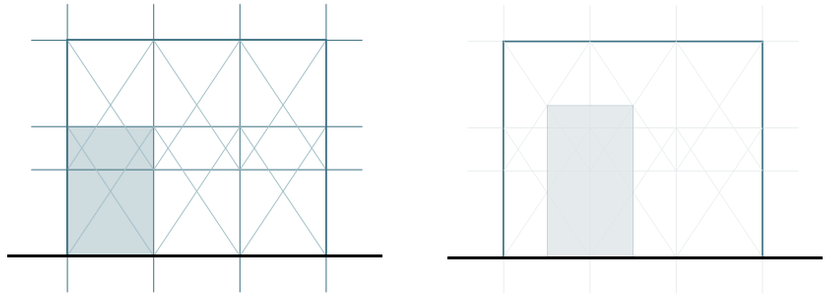


Image 31. Grid for doors

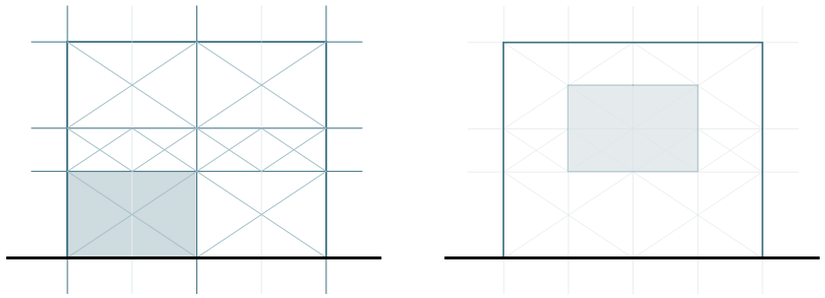


Image 32. Grid for windows

Walls

In the sub-chapter about the Floorplan, I have already discussed the placement of the doors for the direct sight- and walking lines. In this sub-chapter I will determine the exact location of the doors, but also of the windows. I choose one of the free-standing houses in the masterplan on the previous page as the context in which the house is placed. This will also give an indication where to put the windows and where they look out upon.

In the previous sub-chapters, it was made clear how the house is built up from the inside out through material balance and the Fibonacci sequence in the floorplan. When determining the placement of the doors and windows, this will also be from the inside outward.

On the grid of 1.2 m x 1.2 m, a pattern based on the Fibonacci rectangle for the walls is made. This can be seen in *Image 30*. The pattern includes the Fibonacci rectangle vertically and horizontally. The lines that result in vertical rectangles will be used for the doors, the lines that result in horizontal rectangles will be used for the windows.

Image 31 shows the pattern for the doors, based on the vertical rectangles. By connecting the corners of the rectangle, multiple intersections arise. The intersections form guidelines for positioning a door.

Image 32 shows the pattern for the windows, based on the horizontal rectangles. By connecting the corners of the rectangle, multiple intersections arise. The intersections form guidelines for positioning a window.

Another aspect of Fibonacci in architecture is the use of symmetry. When placing a door or window, symmetrical to that another element should be placed. This could be another door or window, but also an area where autonomous materials can be chosen for. This way, autonomous areas emerge that take up a portion of the materials of the room, in accordance with the determined proportions in the Fibonacci pattern shown in the sub-chapter Types on page 69.

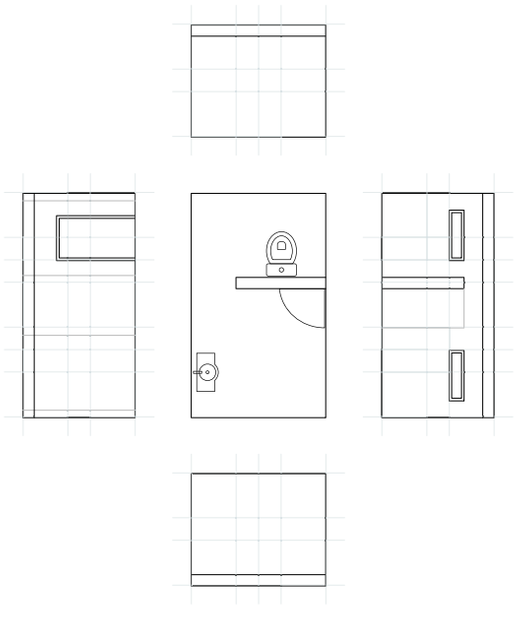


Image 33. Bathroom

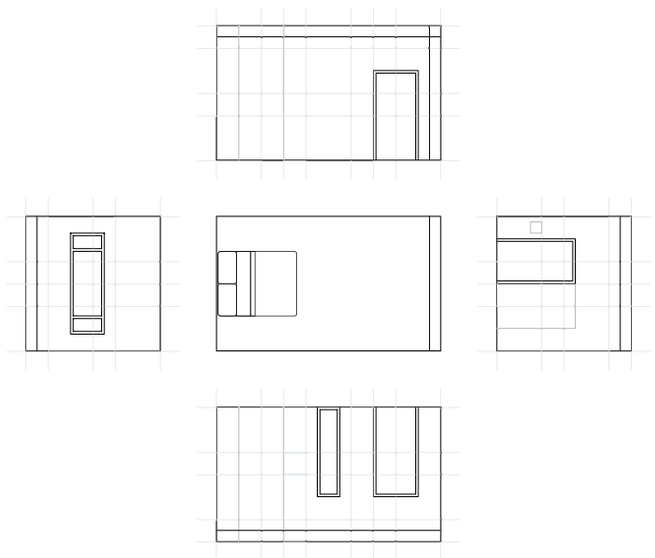


Image 34. Bedroom

First, to emphasize the difference in private and public, all rooms get higher when they get more public. The bathroom is therefore the lowest, the hall the highest.
The height goes up half a Fibonacci square each time (0.6 m). This is of influence on the pattern for the doors and windows. As the pattern changes slightly with each room, the placement of the windows and the height of doors also changes. The doors are lower in the private areas as they are in the public areas. This gives every room its own specific look.

In every room, the placement of the doors and windows has been determined from the inside out. This starts with the most private room; the bathroom (*Image 33.*). This room is 3 m high and has a door with a height of 2.1 m.
The bathroom has no options for autonomy, and is materialized with tiles on both the floor and the walls. The walls are mostly white, but tiles with a contrast color are placed in the area symmetrical to the door. This contrast helps elderly with seeing the white sink, as it is hard for them to recognize objects when they are the same color as the background (Bureau Kroner, n.d.). The partition wall between the toilet and the shower also has contrasting tiles on both sides.

The next room is the bedroom. As explained, this room is 0.6 m higher than the bathroom. The doors have a height of 2.4 m. Since the door to the bathroom is lower, as this door was determined from the wall pattern in the bathroom, a panel of the same material as the door is placed above the door to match the height of the other doors.
Symmetrical to the doors to the outside and the living room, there are areas where autonomous materials can be chosen. Symmetrical to the bathroom door, there is a built-in closet. The backside of this closet can also be chosen by the residents with the autonomous materials.

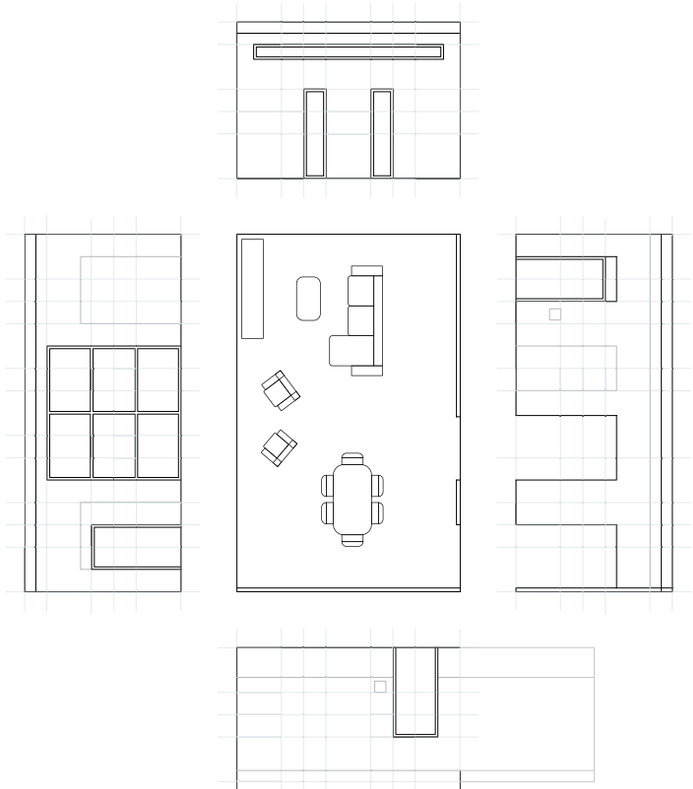


Image 35. Living room

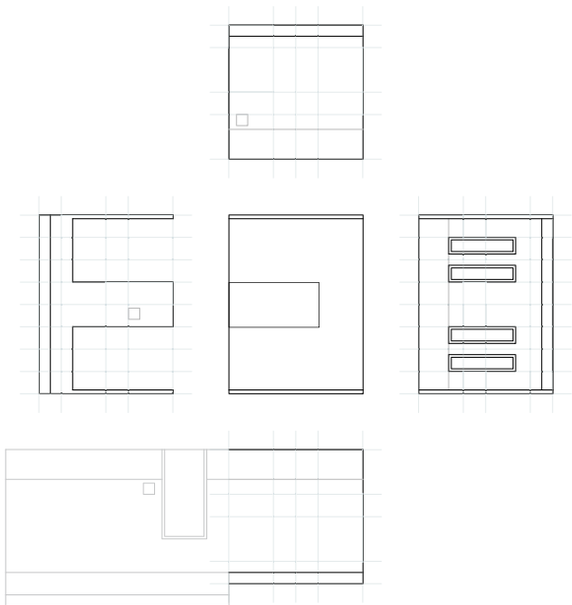


Image 36. Kitchen

Attached to the bedroom is the living room. The left wall has a large set of windows to look out over the trees of the park. This wall also has a door to the outside and symmetrical to that an area to implement an autonomous material.

Opposite to this wall is a wall with multiple functions. There is a door to the hallway, and symmetrical to that is a built-in closet. Next to that are two large cuts that make a semi-open connection with the kitchen.

The kitchen was built up from two Fibonacci rectangles, as seen in the sub-chapter of the Floorplan. This has impact on the patterns to determine the windows. In Image 36. it can be seen that the windows are two sets.
Below the window a band is chosen as the area for the autonomous material. This is extended to the adjacent two walls of the kitchen.

One of these walls extends into the living room, and so does the band. Another band is present on the top of the wall in the living room. This is the difference in height between the kitchen and the living room.

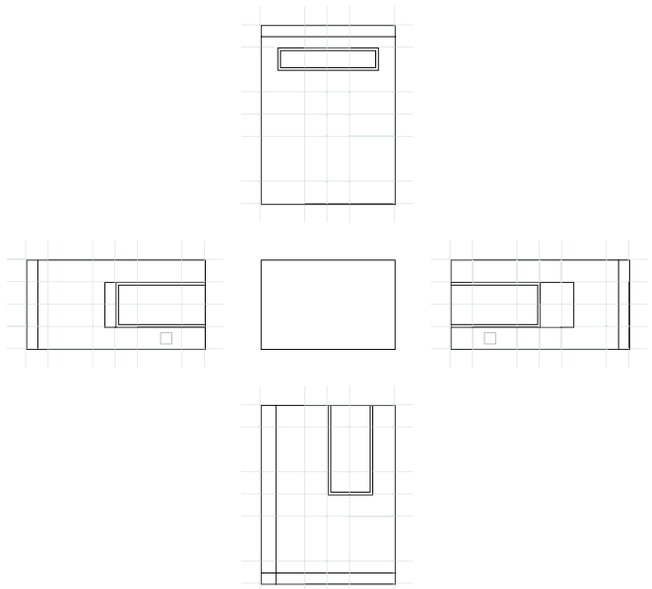


Image 37. Hall

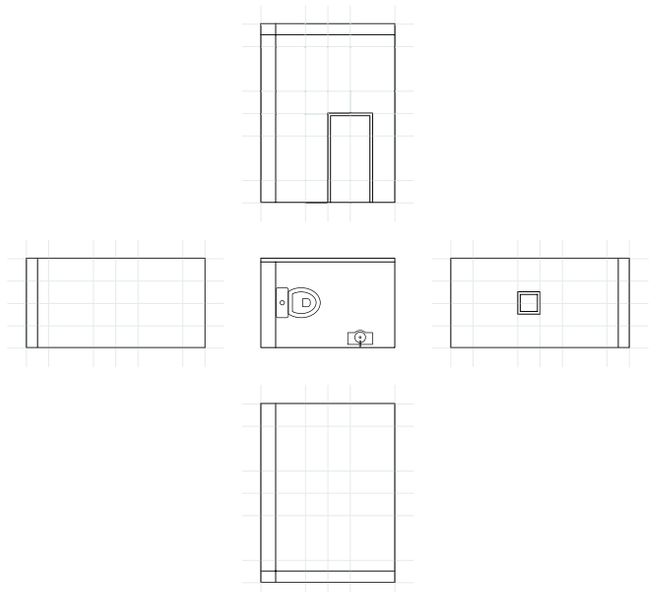


Image 38. Guest toilet

The hall and the guest toilet are the highest rooms of the house; they are both 4.8 m high. This evokes an interesting experience in these small room, as they are higher than in most other houses. Most of all, this evokes an experience of a house that becomes more and more cozy when entering each room, as the height becomes less and less through each room that is more private.

The guest toilet has no options for autonomy, and is materialized with tiles on both the floor and the walls. The walls are mostly white, but tiles with a contrast color are placed behind the toilet.

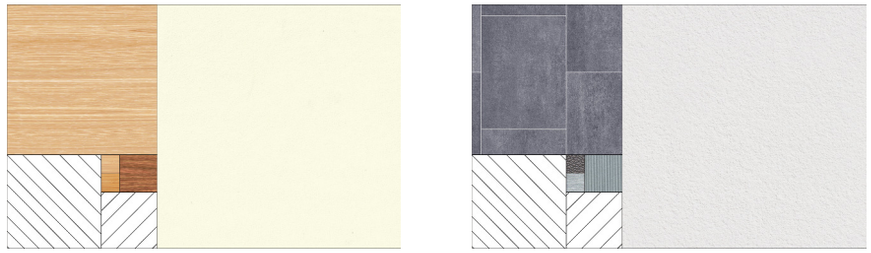


Image 39. Proportions materials living room- Left: Type I - Right: Type II

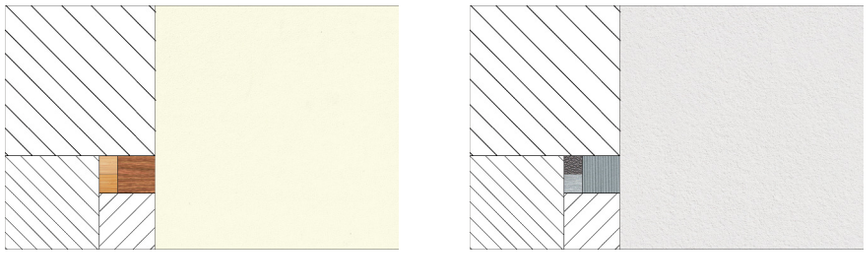


Image 40. Proportions materials bedroom - Left: Type I - Right: Type II

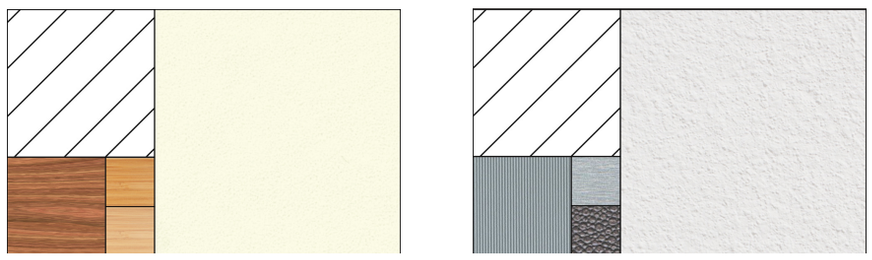


Image 41. Proportions materials hall - Left: Type I - Right: Type II

Autonomous areas

Each room has different autonomous areas, which are in accordance with the proportions determined by the Fibonacci sequence. As shown in the previous part about the Walls.

For the living room, this corresponds to the scheme seen in *Image 39*. The dominant material is the neutral material, which for type I is the wallpaper and for type II the stucco. One step smaller is the base material for the floor. After this are the autonomous materials, which are sub-dominant. In this scheme the autonomous materials are portrayed with lines, since different materials can be placed here. The smallest proportions are for the base materials for the doors, the window frames and the walls.

The proportions of the materials in the bedroom can be found in *Image 40*. These proportions are the same as for the living room. The difference is that residents can choose an autonomous material for the floor. The choice to have an autonomous material for the floor was to ensure more personalization. The bedroom is a private room, where an even more personal touch can be given.

The materials for the hall can be found in *Image 41*. In the hall there are no autonomous wall areas, but the floor can be chosen. Since the hall is the first thing visitors see, I wanted residents to have the option to show their personality here.

Every autonomous material provides a different atmosphere. Images of all the possible options can be found in *Appendix 6*.

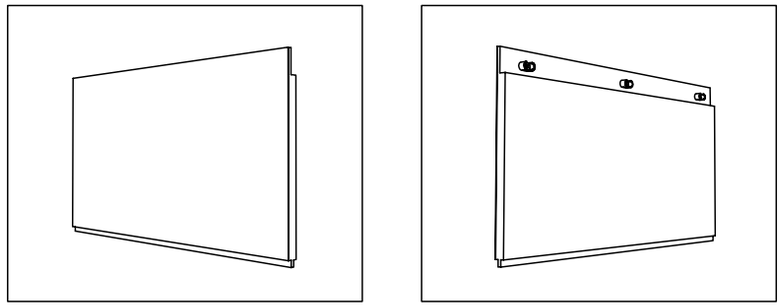


Image 42. Panels - Left: front - Right: back

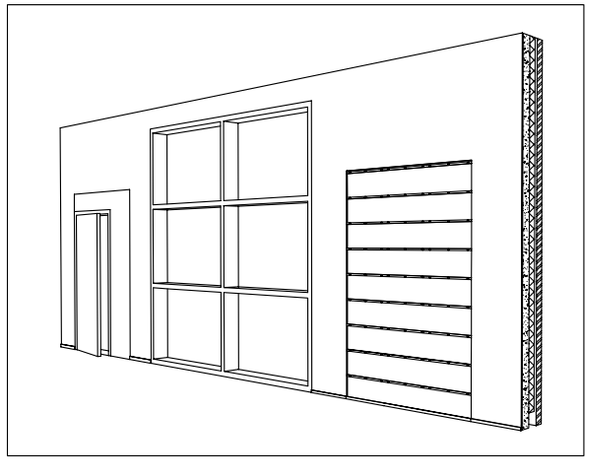


Image 43. Area for autonomous materials with ridges on the inner wall

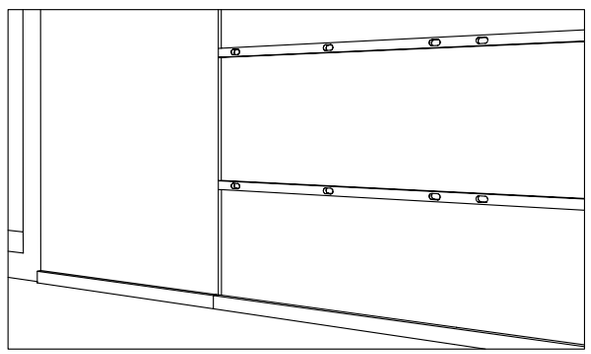


Image 44. Close-up of ridges with holes for the clips

Panels

To ensure the possibility for residents to choose the material on the wall that they want, and to change that when necessary, I have developed a panel system.

For each autonomous material, the panels are built up the same. But they have a different top layer.

One panel is 30 cm x 60 cm. This size is chosen so it is possible to use the same panels on all the autonomous areas, instead of having all different sized panels.

On the back of the panel are three clips. These clips attach the panel to the wall, by clicking into a ridge that is attached to the inner wall.

The bottom of the panel is cut in such a way that the panels overlap, but not connect to each other. When one panel is in place, the panel above it turns in behind the first panel and can be clicked into place.

By not connecting the panels, it is possible to remove one panel without having to remove a whole row. This could be beneficial if a panel needs to be replaced, or even if a different type of material is being tested in one spot.

A baseboard is placed over the bottom panels, to close of the cut of the bottom of the panels.

The drawings on the left and on the next pages show how the panels are built up, and how they can be placed and removed.

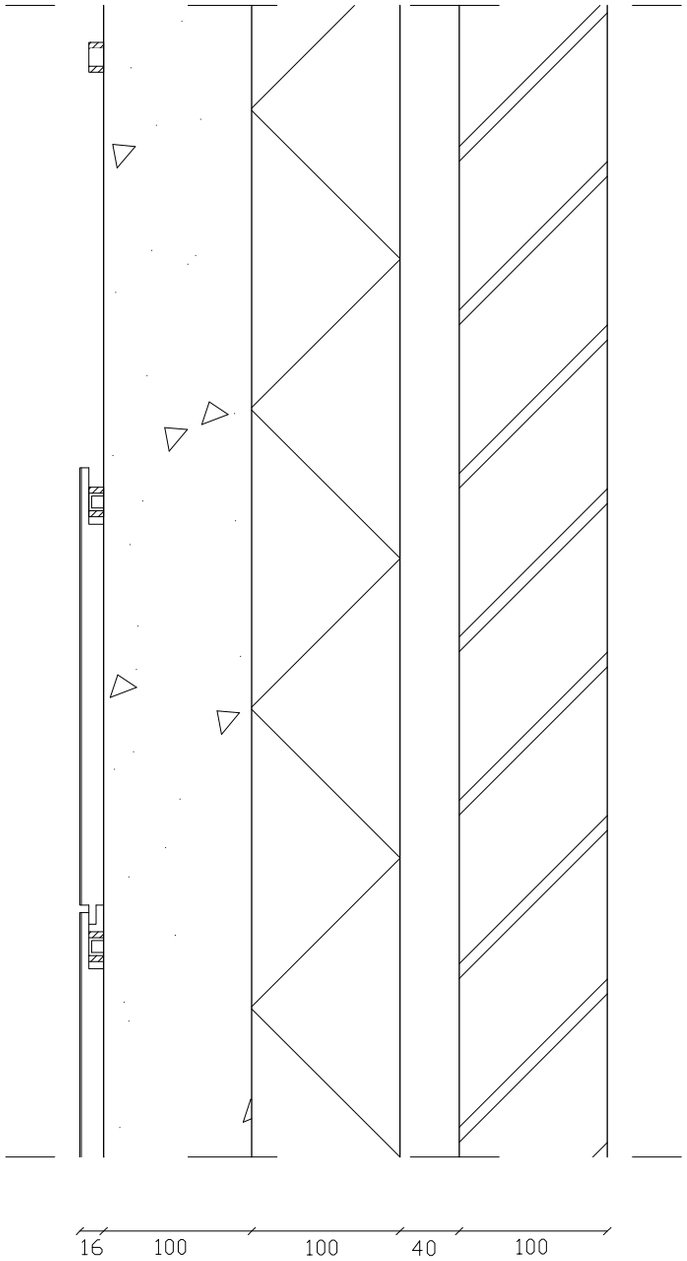


Image 45. Section 1:5

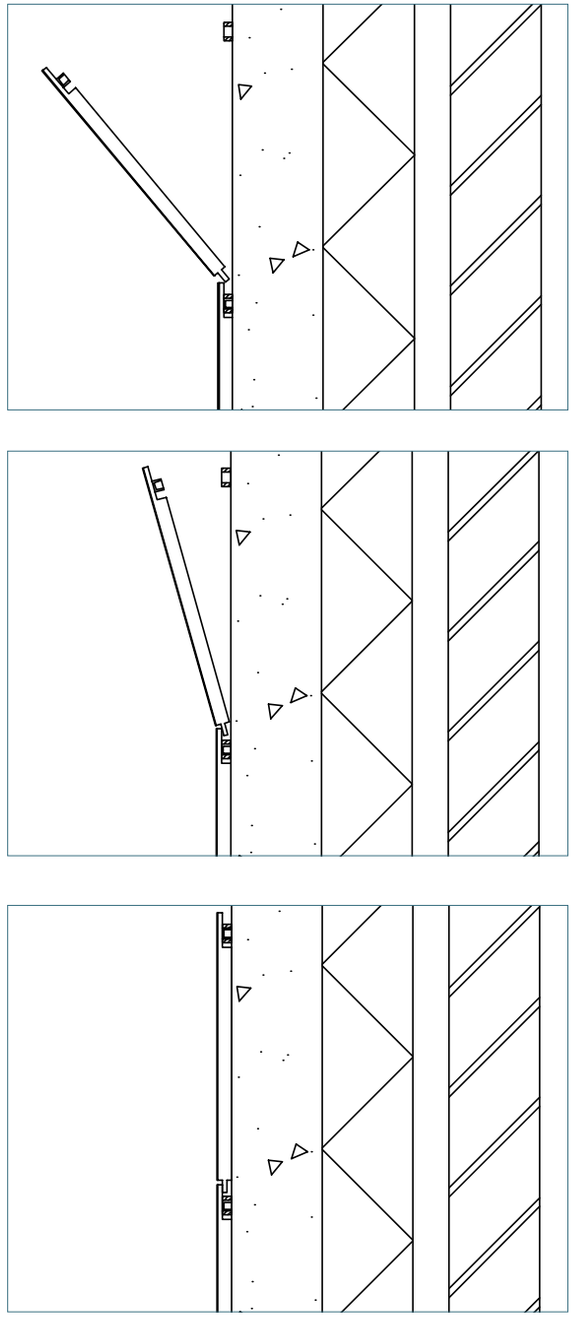


Image 46. Placement of panel

Image 47. In the hall - view on visitors

Experience

All of the previously taken steps were made with one goal in mind; a house in which the elderly experience the feeling of home.

To experience how the houses can feel like when inhabited, a walkthrough of both types is shown in this sub-chapter. For each type, autonomous materials were chosen at random from the options.

A walkthrough a house from type I can be found from *Image 47* to *Image 53*.

Image 48. View of doors to the toilet and to the living room

Image 49. Overview of the living room and part of the kitchen - view on doors to outside and to bedroom

Image 50. Closet in the living room with personal belongings

Image 51. Looking into the nature from the living room - view on door to the hall

Image 52. A look into the bedroom

Image 53. Closet in bedroom with personal belongings - view on door to bathroom and to the outside

Image 54. In the hall - view on visitors

A walkthrough in a house of type II can be seen from *Image 54* to *Image 60*.

Image 55. View of doors to the toilet and to the living room

Image 56. Overview of the living room and part of the kitchen - view on doors to outside and to bedroom

Image 57. Closet in the living room with personal belongings

Image 58. Looking into the nature from the living room - view on door to the hall

Image 59. A look into the bedroom

Image 60. Closet in bedroom with personal belongings - view on door to bathroom and to the outside

Chapter 4: Test

Finding evidence

In the previous chapter, a design for a senior house is proposed. In the design, the research and literature was taken into account to create the most optimal house for the elderly based on the material experience.

However, this thesis is about evidence based design, which means there should be evidence if the design also works as intended.

To find this evidence, another research is conducted. This research will look into the subject of the research question; the feeling of home. The relationships with materials and the autonomy in choosing those materials will be examined. It will also be explored if the choice for controlled autonomy still leaves enough options for people to get the feeling of home.

Type and materials
Which type would you choose, when you would get/take this senior house?
Which autonomous materials would you choose per area?
Satisfaction
Are you satisfied how the house looks with your choices?
Would you feel at home in this house?
Did you like the fact that you could choose certain materials yourself? Was there enough choice?
Did you like that there were two types? Would you rather have had more options, or would one type have been enough.
Furniture
Would you want to take your current furniture, or would you choose your furniture based on the materials?
The autonomous materials were now chosen beforehand, and then furniture is brought in the mix. If it would be possible to choose your materials based on your furniture, would you rather choose the materials first (as is now) or first choose the furniture?

Table 7. Questions research

Methodology

This research only focusses on the group of older adults (55-75). This was chosen because the two types were only based on the results of the older adults. Also, these are the people I am designing for in the future.

For the research, a catalogue was prepared where both types were explained with pictures of the materials and renders of their application in the design. The renders of the catalogue can be found in Appendix xxx. The complete catalogue can be requested with the researcher. There are also two models prepared; one with the materials of type I and one with the materials of type II.

Eight participants take part in the research. They first get a brief explanation how the design came to be; explaining the sequence of private to public and the height differences, the two types and how they have base materials and autonomous materials, and on which areas it is possible to implement these autonomous materials. Both the catalogue and the models are used for this.

The first part of the interview asks the participants to choose a type. After this choice, each area for autonomy will be looked at, with the renders for the chosen type. For each area, the six possible materials will be shown through renders, implemented in the type.

The second part of this research focusses on the experience of the aforementioned process of choosing type and materials. The proposed questions research the satisfaction levels and the feeling of home.

The final part focusses on the bringing along of furniture. Furniture can be brought from the old home, but it is also possible to get new furniture before moving into a new house. This part poses the questions if the materials are of influence on this, and what is more important; the materials or the furniture.

Table 7. shows the questions of the research.

Results

From the eight participants, two chose type I and six chose type II. Within the choices for the autonomous materials, there was a lot of variation between the individuals.

The second part of the research brought an interesting, unanimous result; all the participants declared that they would feel at home in the house. The majority of the participants were also pleased with how the house looks with the choices they made.

All the participants also agreed that they liked the fact that they had a choice in the materials. Multiple reacted that they felt it was necessary to have a choice. One participant even said that “if there would be no choice in materials in the next house, I would consider staying in my current house”.

Some participants did not like the look of the house with the materials they chose. This was always connected to a wish that there were more materials to choose from.

This also came forward in the question if there was enough choice in the autonomous materials. Most participants wanted to have more choice. Sometimes this was because of the colors, since there were only cool colors in type I and warm colors in type II to choose from, sometimes because they wanted other materials. Often they brought up the fact that when they go and choose something now, they want to see everything possible before choosing.

Two participants did not want more choice in the autonomous materials. They both stated that having too much choice would make the choice too hard. One of these two also stated that they were not very strong in visualizing, so having less choice was better. Also because it allowed them to focus on the materials that were there, and make a good decision.

Unanimous, the participants said that one type would not have been enough, as they want to have a choice.
Almost all of them also agreed that two types was enough to choose from. They found that it gave clarity, and because the types were so different it gave enough space to find something of their preference.

One participant clearly stated they wanted more choice in types, so there would be more variation. They also already wanted to have more choice in the autonomous materials.

Two others hesitated if two types was enough. For one, this was because they named the types “orange” and “blue” and wanted to have a “green” type. Another was hesitant because of the implications choosing a type brought with them, as you can only choose from a prefixed catalogue. They would not necessarily want to have more types, but again more possibilities in the autonomous.

The question about taking the current furniture or buying new ones was answered half and half. This depended mostly on the state of their current furniture. But many also answered that they had their furniture in the back of their mind when choosing the materials. Most that said they would bring their furniture, did say they would first check if it fit in the house. If not, they would than buy new furniture.

The participants also did not agree on the last question. One half would still choose their furniture based on the materials they chose. This was mainly because they wanted new furniture. But one participant also stated that they have a certain taste, that will be present in choosing materials for a new house but is also already present in their current home. They predicted that the furniture would therefore go with the chosen materials.

The other half however would have liked to base the materials on the furniture, mainly because they wanted to bring their furniture. They said they would have the furniture in the back of their mind when choosing materials. And that their furniture was already chosen with much care and they also wanted to implement those in a new house.

Discussion

This research was a good test to give an insight if the design works as intended. A good thing was to see that all participants felt at home in the house with their chosen materials.

One issue that came up with some of the participants was the amount of materials that could be chosen from, and the color range of them. After the interviews, I explained how the materials were chosen based on a color harmony. This changed multiple minds on the need for more colors.
I chose to not tell this beforehand, to see if the participants would react to the color of the material choices. It could be hypothesized that when telling this beforehand, participants are more content with the range of colors of the possible choices.
Adding to that, Reed (2010) also stated that color harmony is partly theory and partly personal preference. Meaning that it can be hard to please everyone with a theoretically good harmony, as personal preferences will always play a part in an atmosphere experience.

The participants were all older adults, so between 55 and 75 years old. Some of them stated they wanted more choice. They did however all later on agree that for an elderly it is better to have less choice. Since they could imagine having too much choice was not desirable for elderly people, as this could become confusing. Their statement of wanting more materials to choose from was based on their current mental capabilities.

Conclusion

This final research explored if the design made, created the feeling of home it intended to. Evidence has been found that the house designed gave participants the feeling of home. The ability to choose materials played a large part in this.

The participants were not bothered by the controlled autonomy, but rather embraced the two types. Some did however prefer more or different options for the autonomous materials. But all were content with the fact that they could choose materials.

The participants were divided about the subject of furniture, and whether or not to take the current furniture with. They did however express similar feelings about the fact that the furniture does play a big part in the atmosphere experience. And that the materials and the furniture enhance each other to create a feeling of home.

Chapter 5: Reflection

Conclusion thesis

This thesis started with the research question: ‘How do materials influence the feeling of home for older adults and elderly people?’ This question was divided in sub-questions about how older adults and elderly perceive materials, how they link materials to autonomy and which materials they link to the feeling of home.

Due to the small number of participants in the research, there was no pattern found amongst the groups which materials were preferred. As such, it was not possible to make an overall conclusion for the research question. It was however found that personal preference has more influence on the experience than the sensorial experience, and that autonomy in choosing materials is of high importance.

When analyzing the results, it was found that the atmosphere words form a scheme with on the one hand the traditional atmosphere words and on the other hand the modern atmosphere words. Since there was no guideline from the research about which materials were preferred, this scheme was used as the base of the design. The base was complemented by literature on material balance.

This accumulated into a design where controlled autonomy is present. Two types with different materials, based on the atmosphere word scheme, were designed. In which it is possible for the resident to choose materials for some areas. All these materials were previously selected with the material balance in mind.

To see if the house also works as intended, and thus stimulates autonomy and the feeling of home, it was tested amongst older adults. Unanimous, the participants agreed that having a choice in materials is of high importance. They embraced the two types, and many liked the amount of choice for the autonomous materials. They also all agreed that they could feel at home in the house with their chosen materials.
It can be concluded that the house, designed with autonomy and the feeling of home in mind, works as intended.

Future recommendations

More research into the topic of how elderly experience materials is highly recommended. Not a lot of information is present at this time, and it could help architects when designing buildings for elderly.

It is advised when continuing with this research, to use a higher number of participants. This should enforce a more balanced overview and average result. It could even lead to a pattern in the results, which could give more of a guideline on the material preferences of the elderly.

For the design, it would be interesting to research which amount of choice is the best for the autonomous materials. Also more research could be done into which specific materials should be included into the autonomous materials.
Interesting would also be to see which types could be developed in other parts of the country, or even the world. As the types and materials in this thesis are specified on the participants from the area of Dongen and Rijen.

Reflection

I can honestly say I have never done a project similar to this one. The chance to get deep into the subject through literature was very inspiring and gave so much insight. Also to have literature research as a backbone to a design was great. And should, in my opinion, be more stimulated during other projects in our study.

Because of the amount of information however, and the gaps I found on multiple occasions in the state-of-the-art, I kept searching for more and more information. Although this was very interesting, it also ensured less time to design. It would've been better if I managed my time a bit more, and started designing earlier.

It was also great to do 'physical' research with the interviews. It is a good way to connect to the focus group of the design, and to see and hear things you might not think about from your own perspective.

As mentioned in the previous sub-chapter, it would've been better to have had more participants for the research on material and atmosphere experience. Unfortunately, time limitations did play a large part in this. Maybe this could've led to a pattern in the results and showed preferences throughout a generation, which could've helped in designing.

I am however very pleased with the literature I found on material balance. And how I've connected this to the conclusions I could get from the research. I think the information from the experience research and the literature on material balance strengthen and complement each other.

All and all, the proces of this graduation project had its ups and downs, but I am pleased with the results. I look back on a hard but interesting project, that thought me a lot about the subject but also about what I would like my role to be as an architect in the future.

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Appendix

Appendix 1. Materials preliminary research

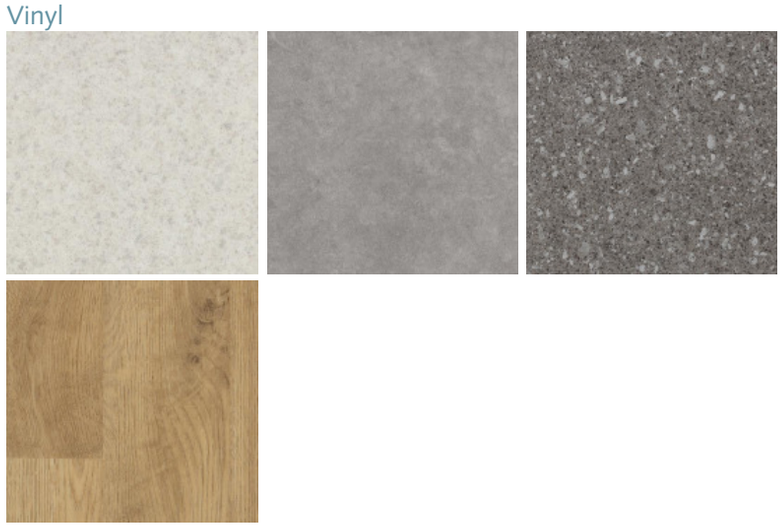
Carpet tiles

Carpet tiles

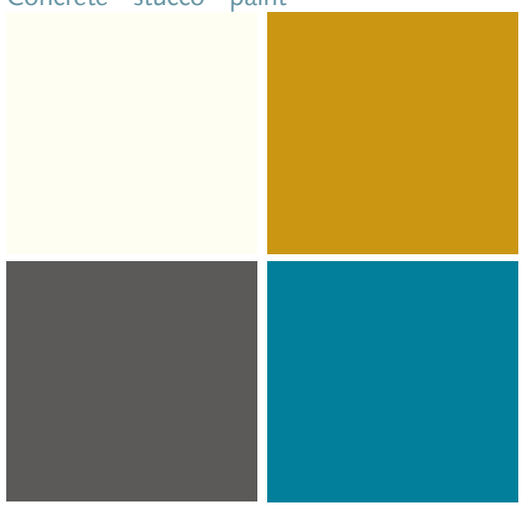
Laminate

Linoleum

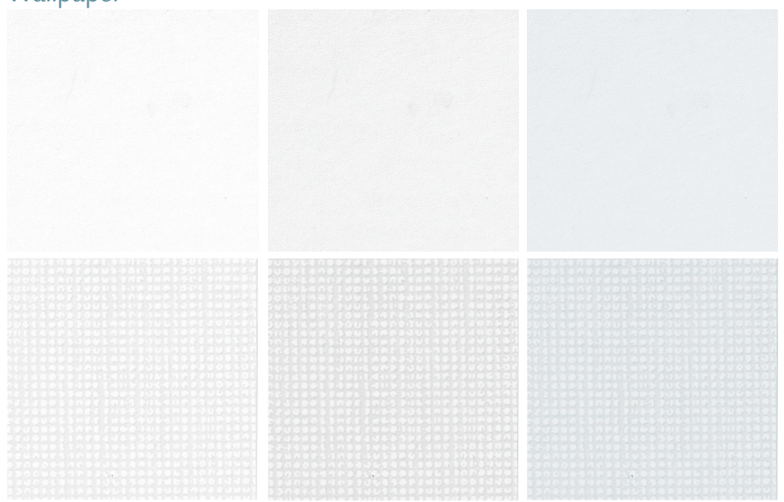
Vinyl

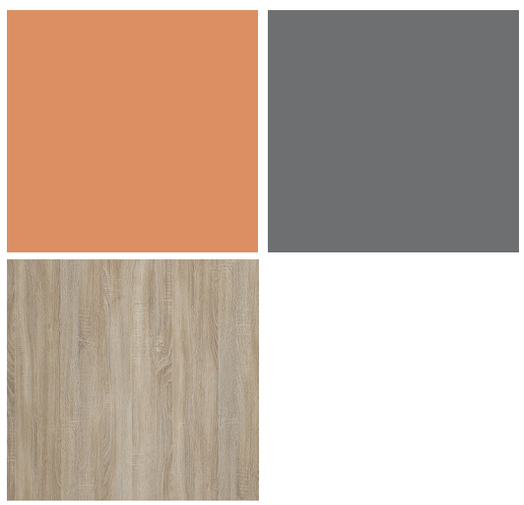


Concrete - stucco - paint



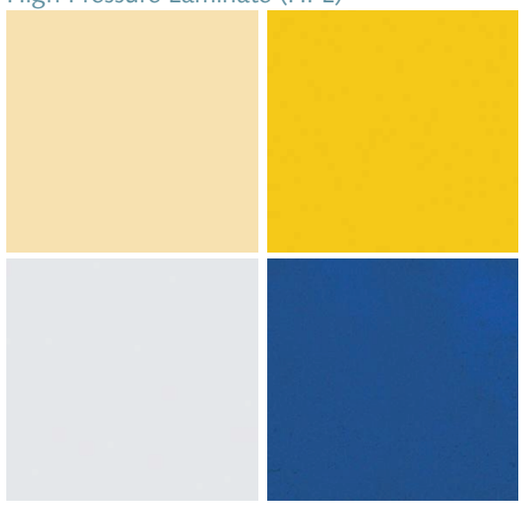
Wallpaper

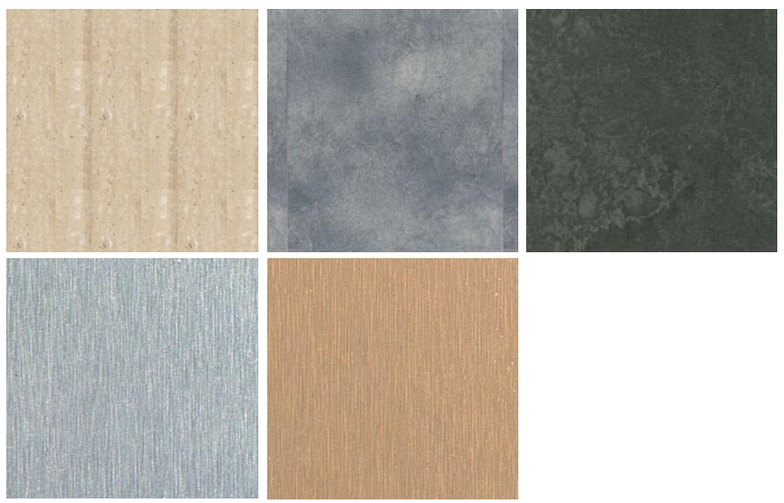




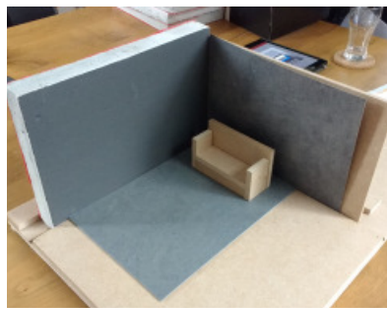
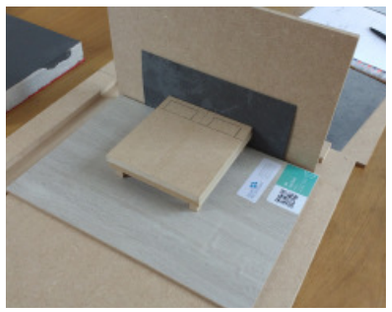
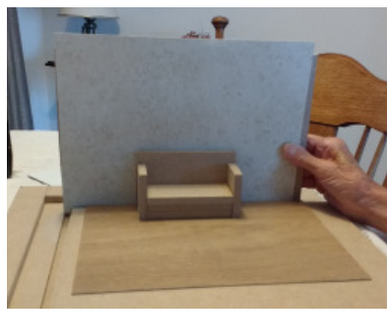
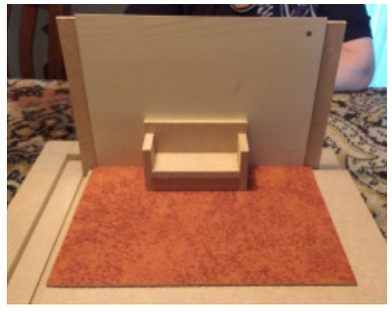
Polystyrene

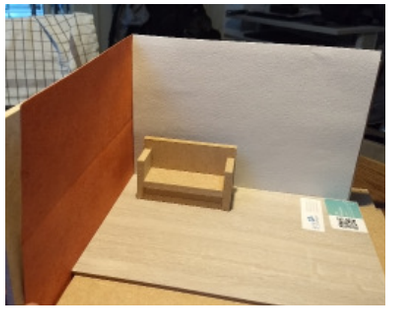
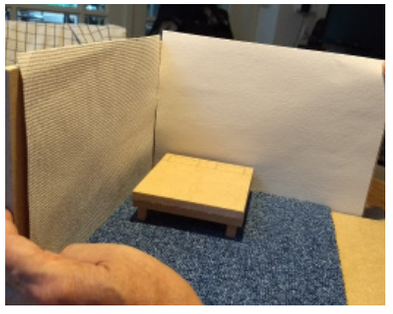
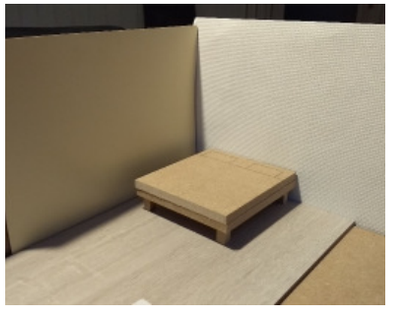
High Pressure Laminate (HPL)





Appendix 2. Results preliminary research

Participant	Living room	Bedroom
#1 Female (56)		
#2 Female (87)		
#3 Female (88)		
#4 Female (84)		

Participant	Living room	Bedroom
#5 Female (81)		
#6 Female (81)		
#7 Male (63)		
#8 Female (60)		

Appendix 3. Questionnaire research experience

Basisgegevens
Naam:
Leeftijd: *Geboortejaar:*
Geslacht:
Hoe lang in huidige woning?:
Temperatuur buiten:
Temperatuur ruimte:
Licht aan/licht uit:
Begintijd:

Materiaal 01 - Material 14

Koud	*0*	*0*	*0*	*0*	*0*	*Warm*
Glad	*0*	*0*	*0*	*0*	*0*	*Ruw*
Zacht	*0*	*0*	*0*	*0*	*0*	*Hard*
Klevend	*0*	*0*	*0*	*0*	*0*	*Droog*
Hobbelig	*0*	*0*	*0*	*0*	*0*	*Egaal*
Aangenaam	*0*	*0*	*0*	*0*	*0*	*Vervelend*
Flexibel	*0*	*0*	*0*	*0*	*0*	*Stijf*
Dof	*0*	*0*	*0*	*0*	*0*	*Glanzend*
Mooi	*0*	*0*	*0*	*0*	*0*	*Lelijk*
Saai	*0*	*0*	*0*	*0*	*0*	*Interessant*
Licht	*0*	*0*	*0*	*0*	*0*	*Donker*
Natuurlijk	*0*	*0*	*0*	*0*	*0*	*Kunstmatig*

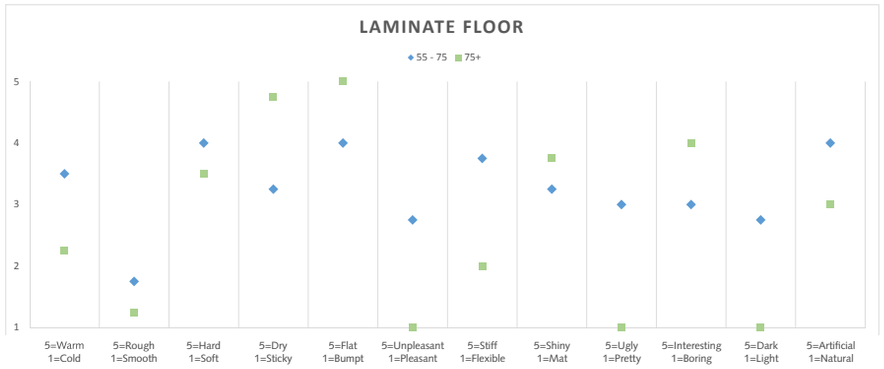
0	*0*	*0*	*0*	*0*	*0*
Rood	*Oranje*	*Geel*	*Groen*	*Blauw*	*Paars*

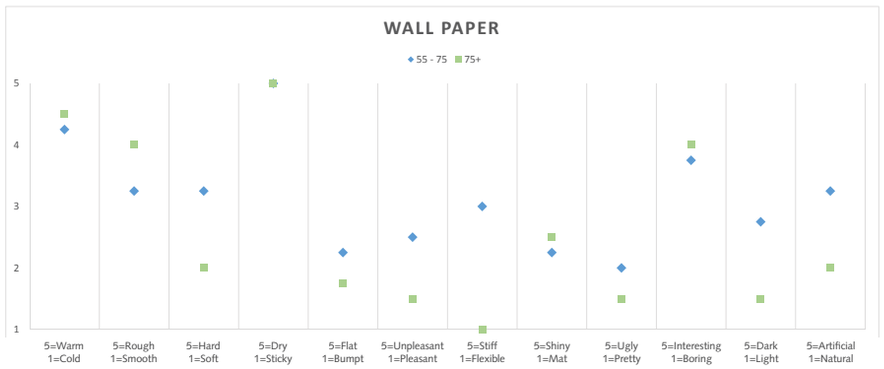
0	*0*	*0*	*0*	*0*	
Wit	*Grijs*	*Zwart*	*Kleurloos*	*Bruin*	

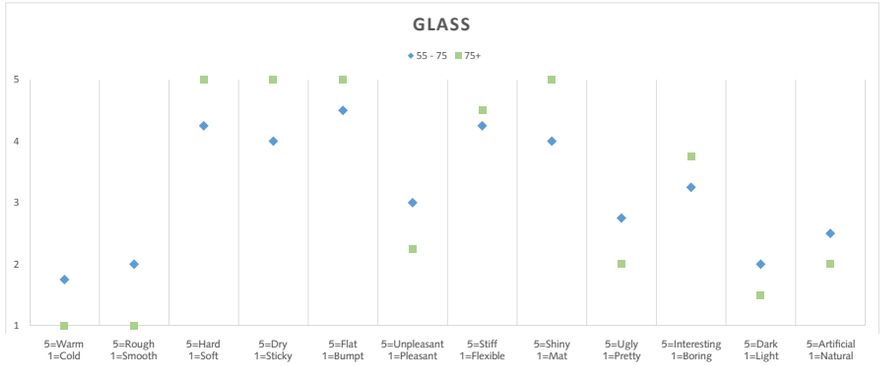
Opstelling 01 - Opstelling 08

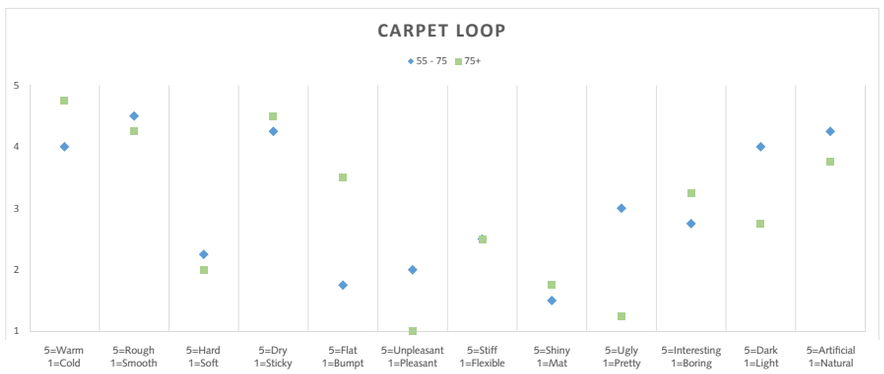
Koud	*0*	*0*	*0*	*0*	*0*	*Warm*
Modern	*0*	*0*	*0*	*0*	*0*	*Ouderwets*
Bekend	*0*	*0*	*0*	*0*	*0*	*Onbekend*
Gezellig	*0*	*0*	*0*	*0*	*0*	*Eenzaam*
Knus	*0*	*0*	*0*	*0*	*0*	*Kil*
Afhankelijk	*0*	*0*	*0*	*0*	*0*	*Zelfstandig*
Actief	*0*	*0*	*0*	*0*	*0*	*Rustig*
Mooi	*0*	*0*	*0*	*0*	*0*	*Lelijk*
Chaos	*0*	*0*	*0*	*0*	*0*	*Harmonieus*
Luxe	*0*	*0*	*0*	*0*	*0*	*Simpel*
Licht	*0*	*0*	*0*	*0*	*0*	*Donker*
Natuurlijk	*0*	*0*	*0*	*0*	*0*	*Kunstmatig*
Toegankelijk	*0*	*0*	*0*	*0*	*0*	*Afwerend*
Kalm	*0*	*0*	*0*	*0*	*0*	*Druk*
Veilig	*0*	*0*	*0*	*0*	*0*	*Gevaarlijk*
Vervelend	*0*	*0*	*0*	*0*	*0*	*Aangenaam*
Energiek	*0*	*0*	*0*	*0*	*0*	*Lui*
Saai	*0*	*0*	*0*	*0*	*0*	*Interessant*
Stimulerend	*0*	*0*	*0*	*0*	*0*	*Demotiverend*
Extravagant	*0*	*0*	*0*	*0*	*0*	*Ingetogen*
Comfortabel	*0*	*0*	*0*	*0*	*0*	*Oncomfortabel*
Duur	*0*	*0*	*0*	*0*	*0*	*Goedkoop*

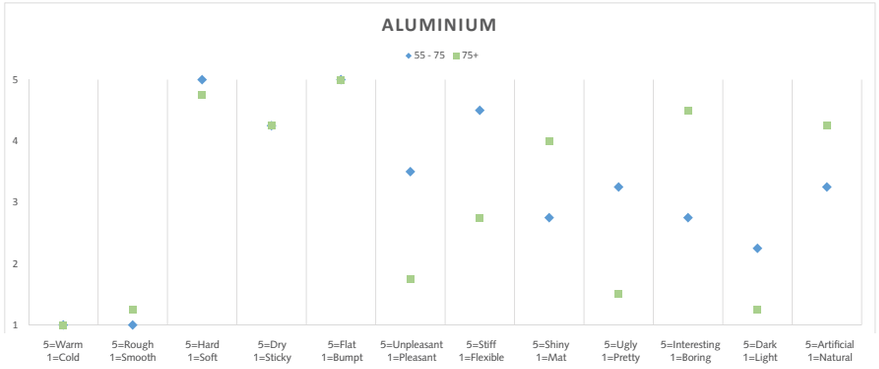
Appendix 4. Results material experience

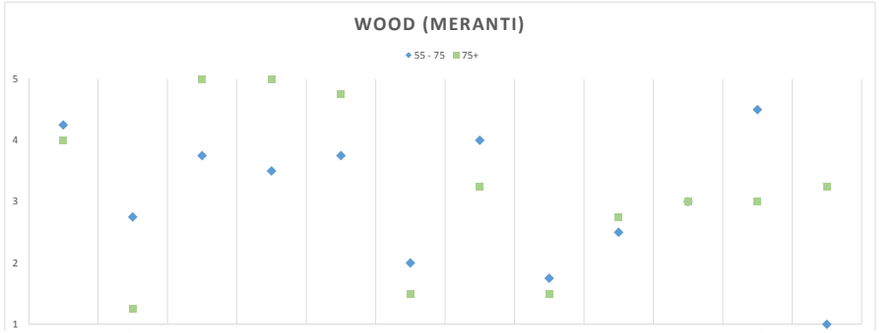


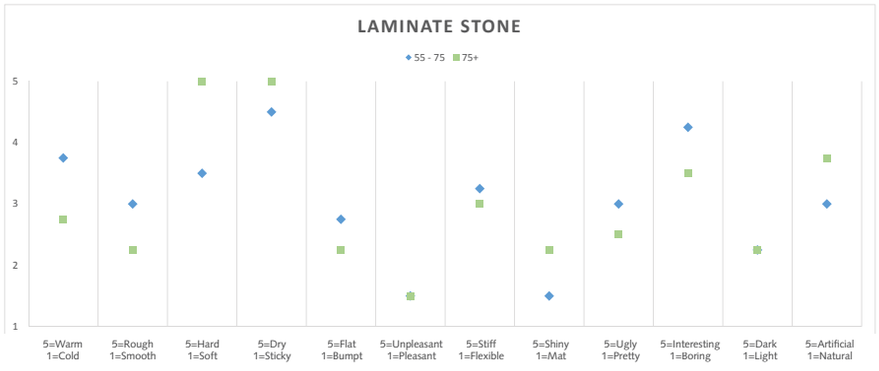


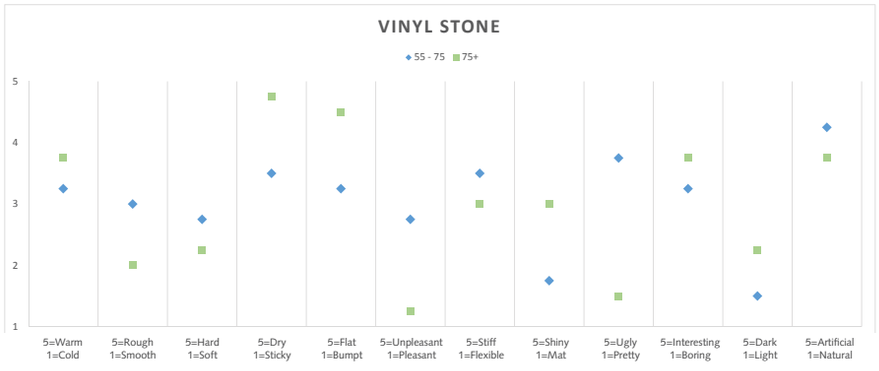


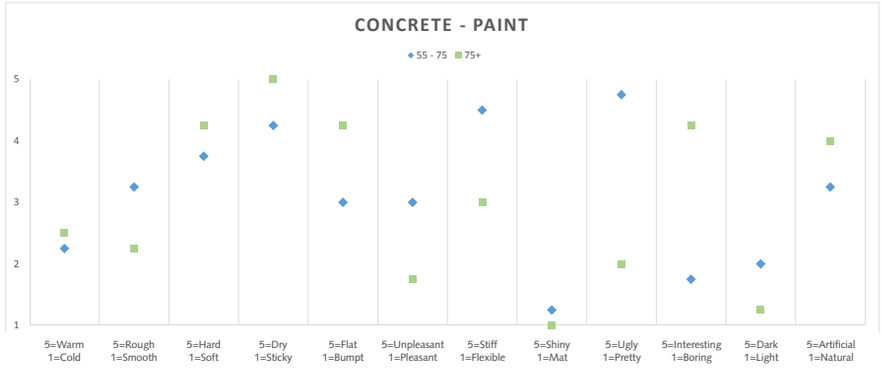


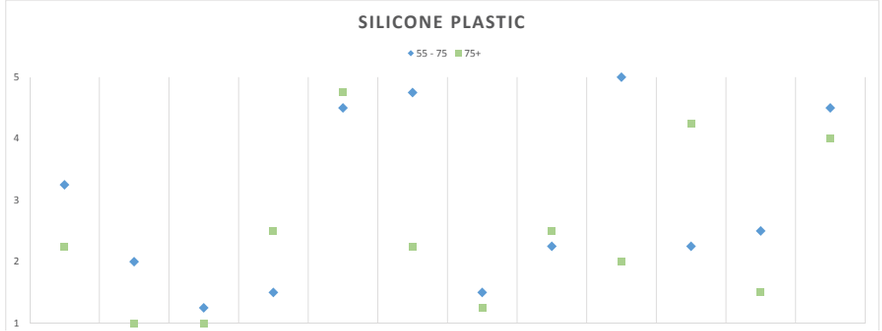

ALUMINIUM
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural

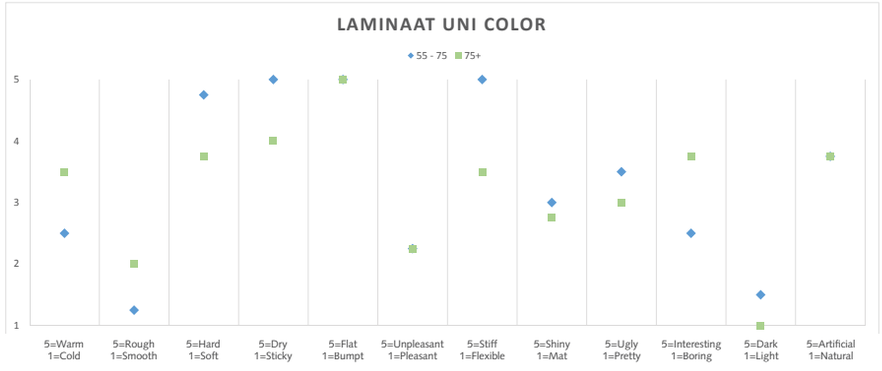

WOOD (MERANTI)
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural

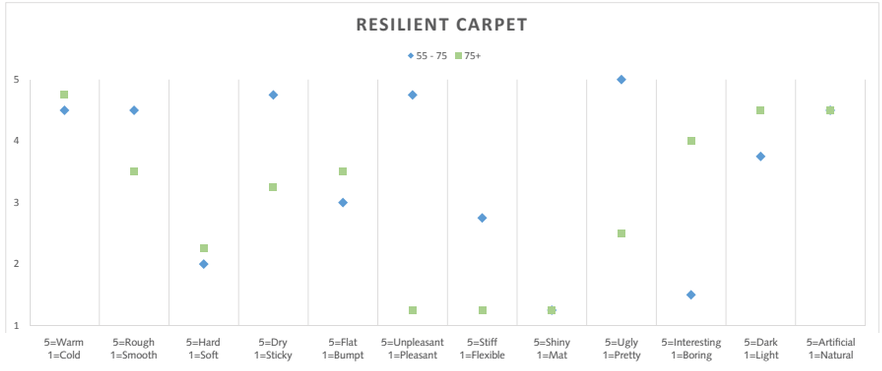

LAMINATE STONE
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural

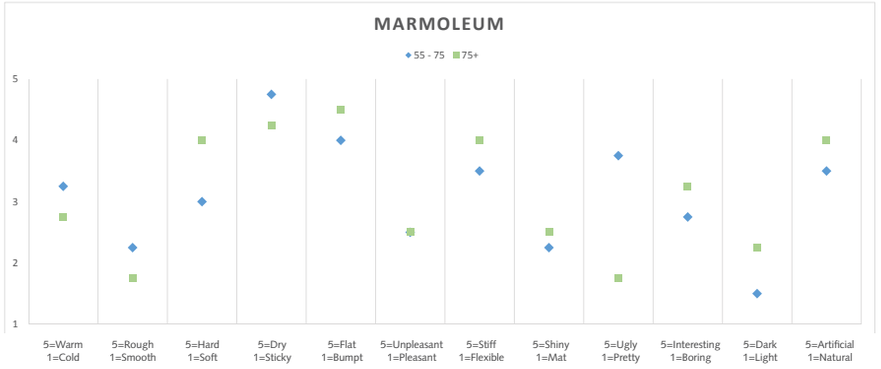

VINYL STONE
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural

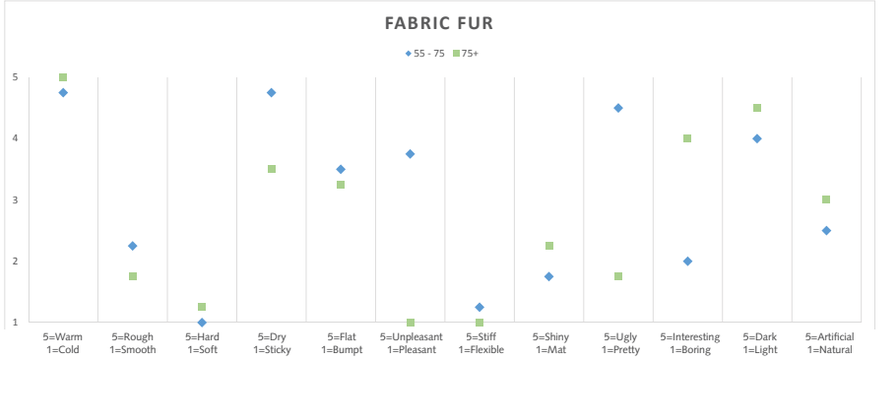

CONCRETE - PAINT
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural


SILICONE PLASTIC
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural

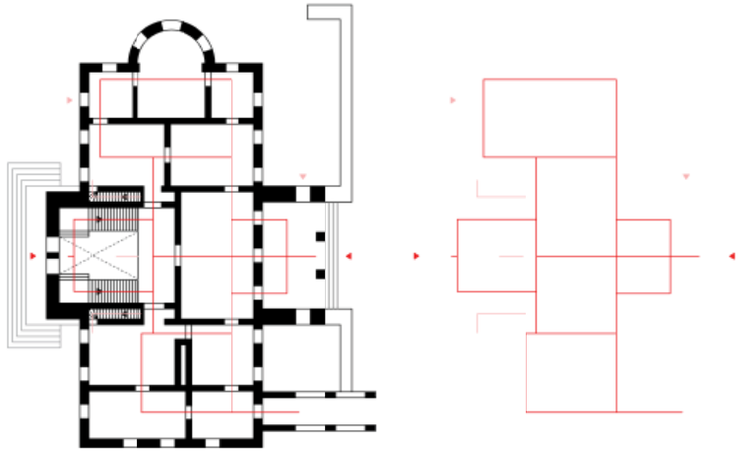

LAMINAAT UNI COLOR
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural


RESILIENT CARPET
55 - 75
75+
5
4
3
2
1
5=Warm 1=Cold
5=Rough 1=Smooth
5=Hard 1=Soft
5=Dry 1=Sticky
5=Flat 1=Bumpt
5=Unpleasant 1=Pleasant
5=Stiff 1=Flexible
5=Shiny 1=Mat
5=Ugly 1=Pretty
5=Interesting 1=Boring
5=Dark 1=Light
5=Artificial 1=Natural

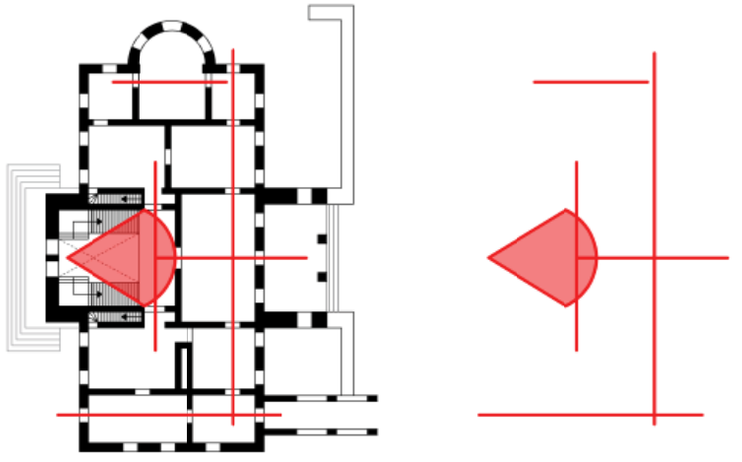




Appendix 5. Schloss Charlottenhof



Routing



Sight lines

Appendix 6. Catalogue materials

Type I - Living room

Wallpaper

Blue
Smooth

Behang

Blue
Bumpy

Wallpaper

Green
Smooth

Wallpaper

Green
Bumpy

Wood - paint

Grey-blue
Grains

Wood - paint

Grey-green
Grains

Type I - Living room closet

Wallpaper

Blue
Smooth

Behang

Blue
Bumpy

Wood - paint

Grey-blue
Grains

Wallpaper

Green
Smooth

Wallpaper

Green
Bumpy

Wood - paint

Grey-green
Grains

Type I - Bedroom (wall)

Wallpaper

Blue
Smooth

Behang

Blue
Bumpy

Wood - paint

Grey-blue
Grains

Wallpaper

Green
Smooth

Wallpaper

Green
Bumpy

Wood - paint

Grey-green
Grains

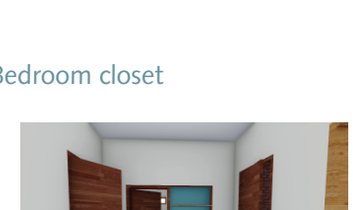
Type I - Bedroom closet

Wallpaper

Blue
Smooth

Behang

Blue
Bumpy



Wood - paint

Grey-blue
Grains

Wallpaper

Green
Smooth

Wallpaper

Green
Bumpy

Wood - paint

Grey-green
Grains

Type I - Bedroom (floor)

Carpet

Blue
Rough

Carpet

Green
Rough

Carpet

Grey-blue
Rough

Wood

Greywashed
Grains

Linoleum

Grey-blue
Smooth

Linoleum

Light-green
Smooth

Type I - Hall

Carpet

Blue
Rough

Carpet

Green
Rough

Carpet

Grey-blue
Rough

Wood

Greywashed
Grains

Linoleum

Grey-blue
Smooth

Linoleum

Light-green
Smooth

Type II - Living room

Wallpaper

Yellow-orange
Smooth

Wallpaper

Yellow-orange
Bumpy

Vinyl

Wood
Smooth

Vinyl

Beige
Bumpy

HPL

Grey-orange
Smooth

HPL

Beige
Ribbed

Type II - Living room (closet)

Wallpaper

Yellow-orange
Smooth

Wallpaper

Yellow-orange
Bumpy

Vinyl

Wood
Smooth

Vinyl

Beige
Bumpy

HPL

Grey-orange
Smooth

HPL

Beige
Ribbed

Type II - Bedroom

Wallpaper

Yellow-orange
Smooth

Wallpaper

Yellow-orange
Bumpy

Vinyl

Wood
Smooth

Vinyl

Beige
Bumpy

HPL

Grey-orange
Smooth

HPL

Beige
Ribbed

Type II - Bedroom (closet)

Wallpaper

Yellow-orange
Smooth

Wallpaper

Yellow-orange
Bumpy

Vinyl

Wood
Smooth

Vinyl

Beige
Bumpy

HPL

Grey-orange
Smooth

HPL

Beige
Ribbed

Type II - Bedroom (floor)

Vinyl

Wood
Smooth

Vinyl

Smooth
Bumpy

Vinyl

Beige
Bumpy

Vinyl

Grey-orange
Smooth

PVC

Light-orange
Rough

PVC

Grey-orange
Smooth

Type II - Hall

Vinyl

Wood
Smooth

Vinyl

Smooth
Bumpy

Vinyl

Beige
Bumpy

Vinyl

Grey-orange
Smooth

PVC

Light-orange
Rough

PVC

Grey-orange
Smooth