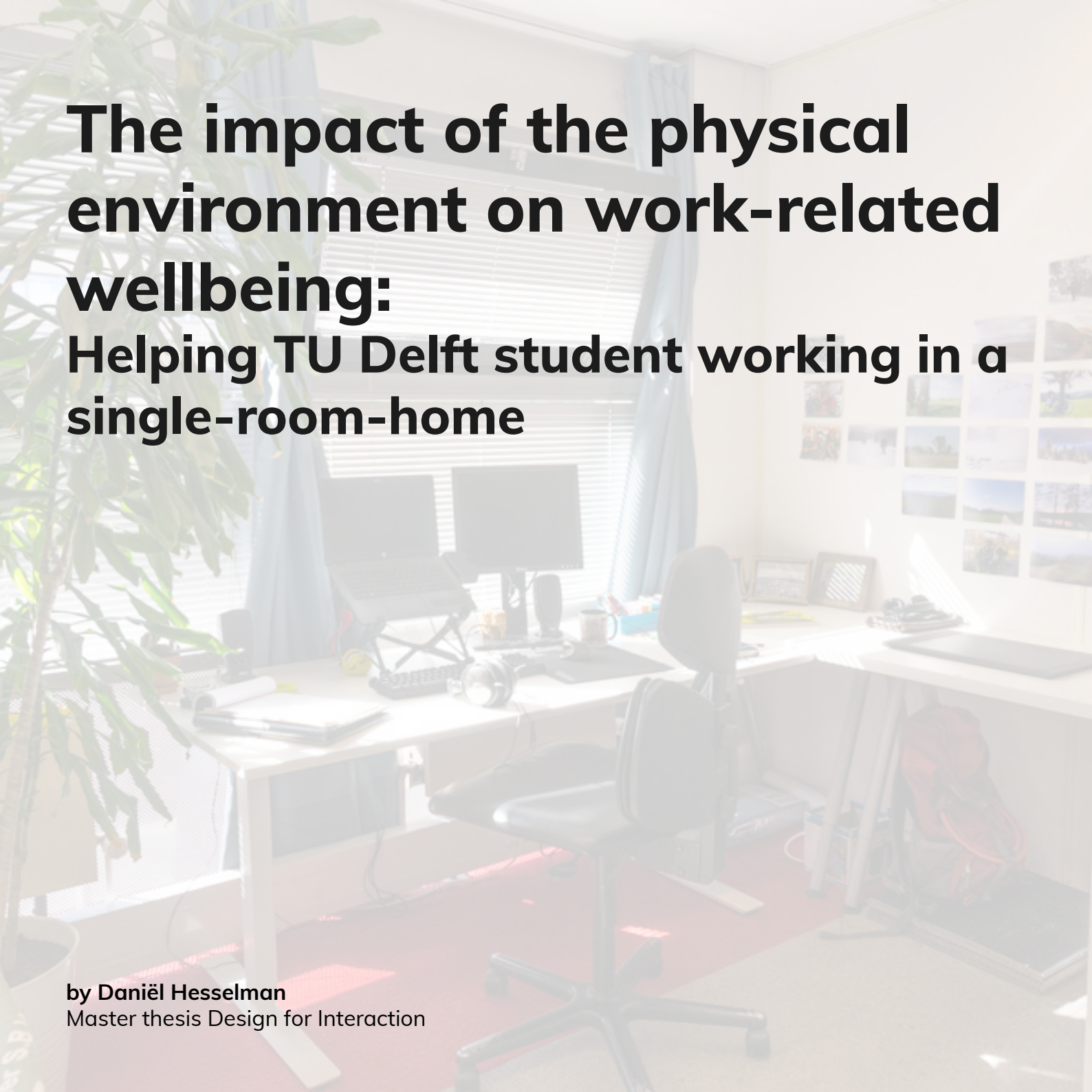


The impact of the physical environment on work-related wellbeing:

Helping TU Delft student working in a single-room-home

by Daniël Hesselman
Master thesis Design for Interaction

Student	**Daniël Hesselman**
Master program	**Design for Interaction**
Date	**March 2021**
Chair of supervisory team	**Derek Lomas**
Mentor of supervisory team	**Peter Vink**

TU Delft

Summary

During the ongoing COVID-19 pandemic, students are having difficulties with working from home. Particularly those living in a single-room-home, where they have to find ways to separate work and private life, while signals from different activities are mixed in a single room.

This thesis focussed on helping TU Delft students quickly, as 81% of the participants in the research of this thesis have a (much) lower satisfaction of working from home, compared to working at the university. And 58% of participants were dealing with a (very) poor ability to separate work and private life. As such, there was a significant need of students to help them through the COVID-19 pandemic.

Throughout this thesis, tips and inspiration for home-work environment modifications were gathered and form the main content of this thesis. This content was distributed and evaluated with an iterative approach. With a focus on improving work-related wellbeing by creating the perception of a second room to work from at home.

The content can be divided into; physical barrier, visual division, and ergonomic setup. And tackle the different aspects of a second room; creating separation within the room, creating a different vibe to a part of the room, and the setup within the room.

This content was implemented in four ways; A booklet, an Instagram campaign, an article in TU Delft Delta, and a website. Combined they reached almost 4.000 views and was considered a success. An Instagram evaluation showed 54% implemented some form of a modification.

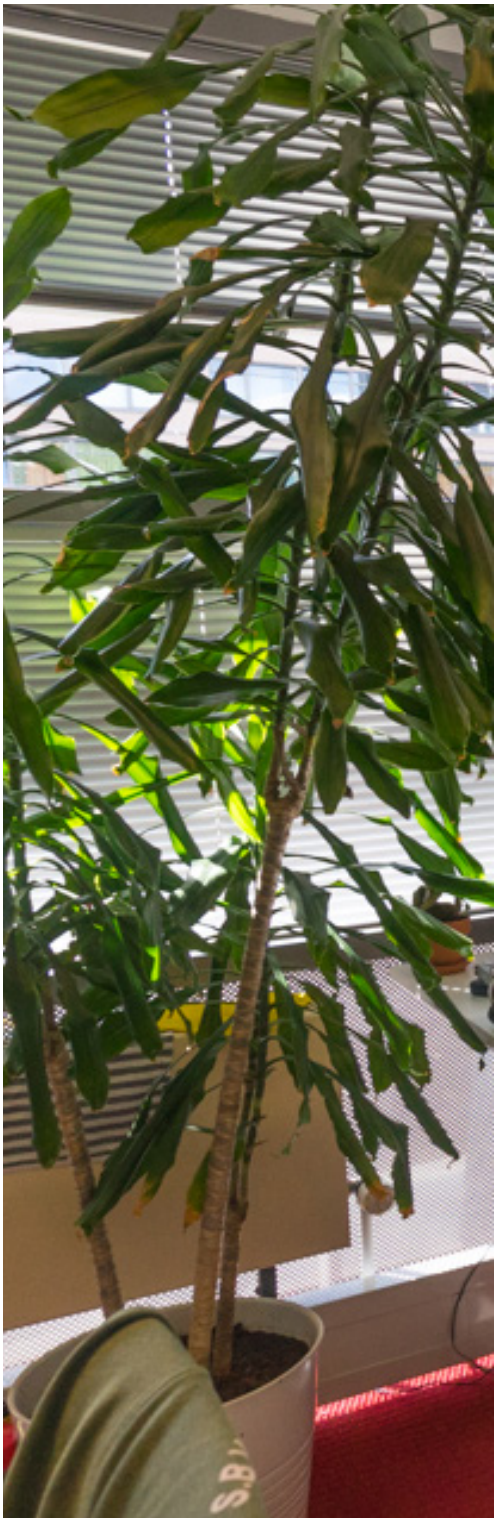
The modifications were evaluated on the change in satisfaction of working from home, and the ability to separate work from private life. In total, 77% of the participants showed an increase in at least one of the two areas, with 23% experiencing an increase in both areas.

This thesis shows the importance of our surrounding environment on our wellbeing, the impact the context in designing for wellbeing, and the impact a design intervention can generate.

Contents

1 Introduction

In this chapter:



1.1 Assignment

This thesis focusses on increasing the wellbeing of students working from single-room-homes.

During the current COVID-19 pandemic, students and employees of all ages have to work from home. However, their home situation might not be optimized for this type of work. Although working from home is not new, the COVID-19 pandemic forced our hand in working from home.

Previous research has shown that people working from single room homes have a decreased satisfaction of working from home as compared to the 'old' situation of working from the university (Hesselman & Vink, 2021). This is most prevalent with students having to work from their student apartment since these most often consists of a single room.

This thesis continues research into this decrease in satisfaction of working from home, compared to working at the university, within the context of single-room-homes to create a meaningful design or intervention to help students increase their satisfaction of work and work-related wellbeing

.

Furthermore, the outcome should be a design or intervention which can be implemented directly since students are currently struggling with working from home. Students might benefit if this will be something they can implement themselves on a student budget. This furthermore allows the design or intervention to be implemented and distributed at scale.

"Improve the satisfaction of working from home for students by bringing the experience of multiple rooms into the single-room-home."

1.2 Approach

This thesis is focused on helping students increase their satisfaction of working from home, and their work-related wellbeing, by creating modifications to their home-work environment. As such, the main focus of this thesis was to find and create a simple solution for helping students, which has a basis in literature.

This thesis will consist of the following steps; exploring the context and related literature, create and test prototypes, and lastly developing and evaluating the final outcome.
Since all activities will create insights into the different parts of this research, an iterative approach was used. See figure 1.1 for an overview of the structure.

Context phase

Chapter 2 - Context

Creation phase

Chapter 3 - Ideation

Chapter 4 - The content

Distribution phase

Chapter 5 - Action!

Chapter 6 - Evaluation

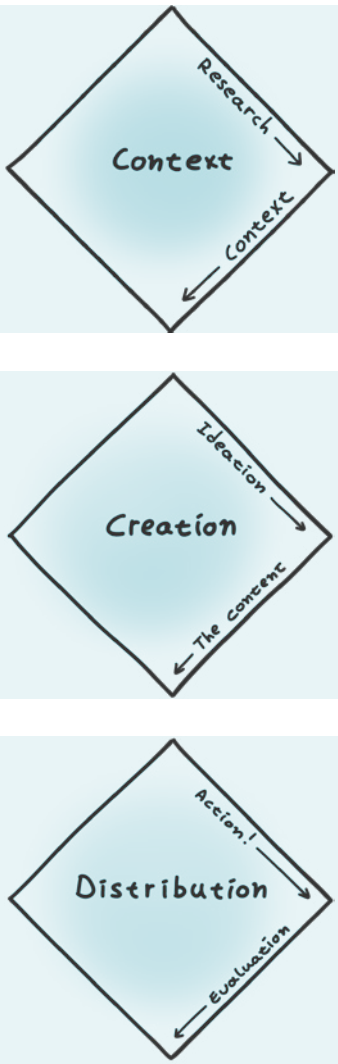
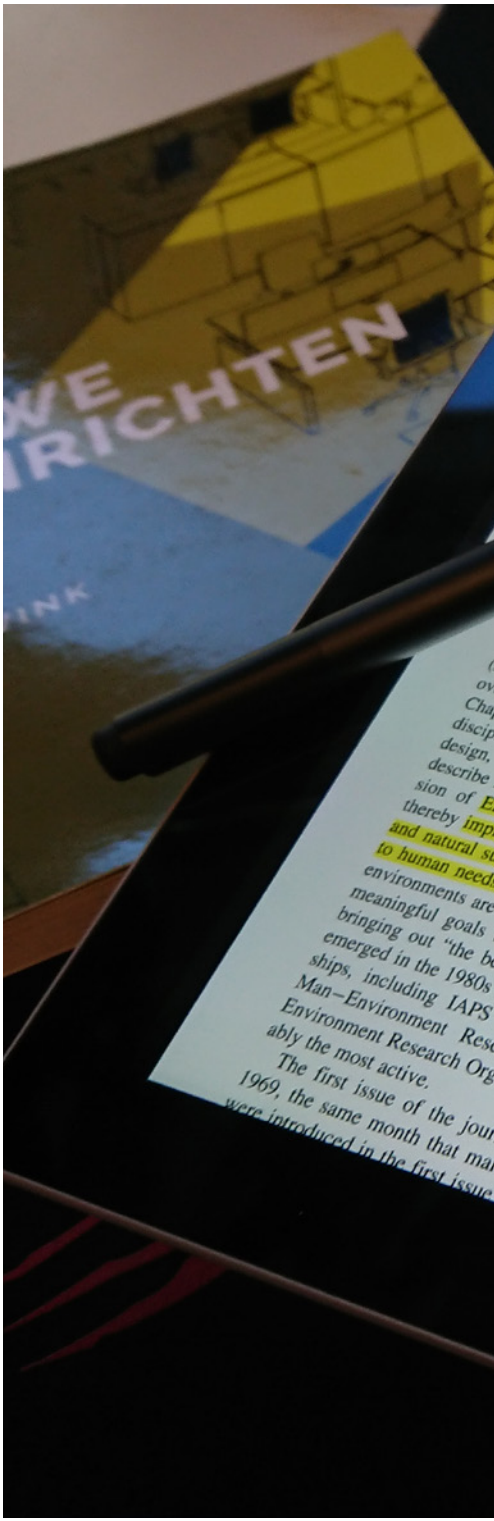
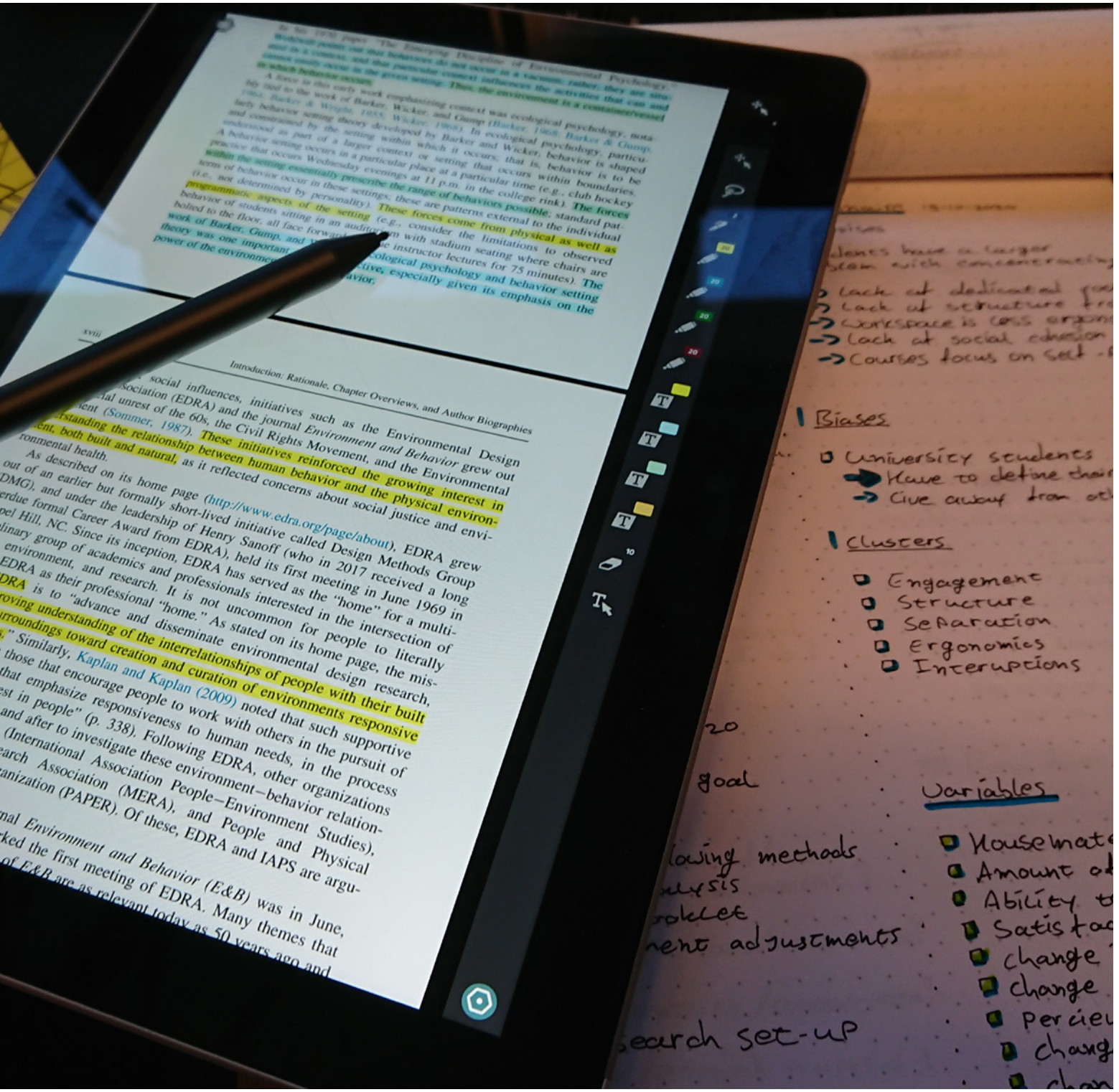


Figure 1.1: An overview of the structure.

2
Context

In this chapter:




Introduction: Rationale, Chapter Overviews, and Author Biographies
Biases
University students
Clusters
Engagement
Structure
Separation
Ergonomics
Interruptions
goal
Variables

2.1 Context

The main target group for this thesis has been university students of the Delft University of Technology, who have to work from home in a single-room-home. Although the outcome of this research might apply to a broader target group.
Throughout the thesis, the scope of participants has been gradually expanded.

During this thesis pictures and panoramas were collected from single-room-homes. The pictures on this page (figure 2.1) provide an example of small spaces where (mostly) students have to work and sleep in the same room. These pictures were used as a reference throughout the thesis since all outcomes have to fit within this context.

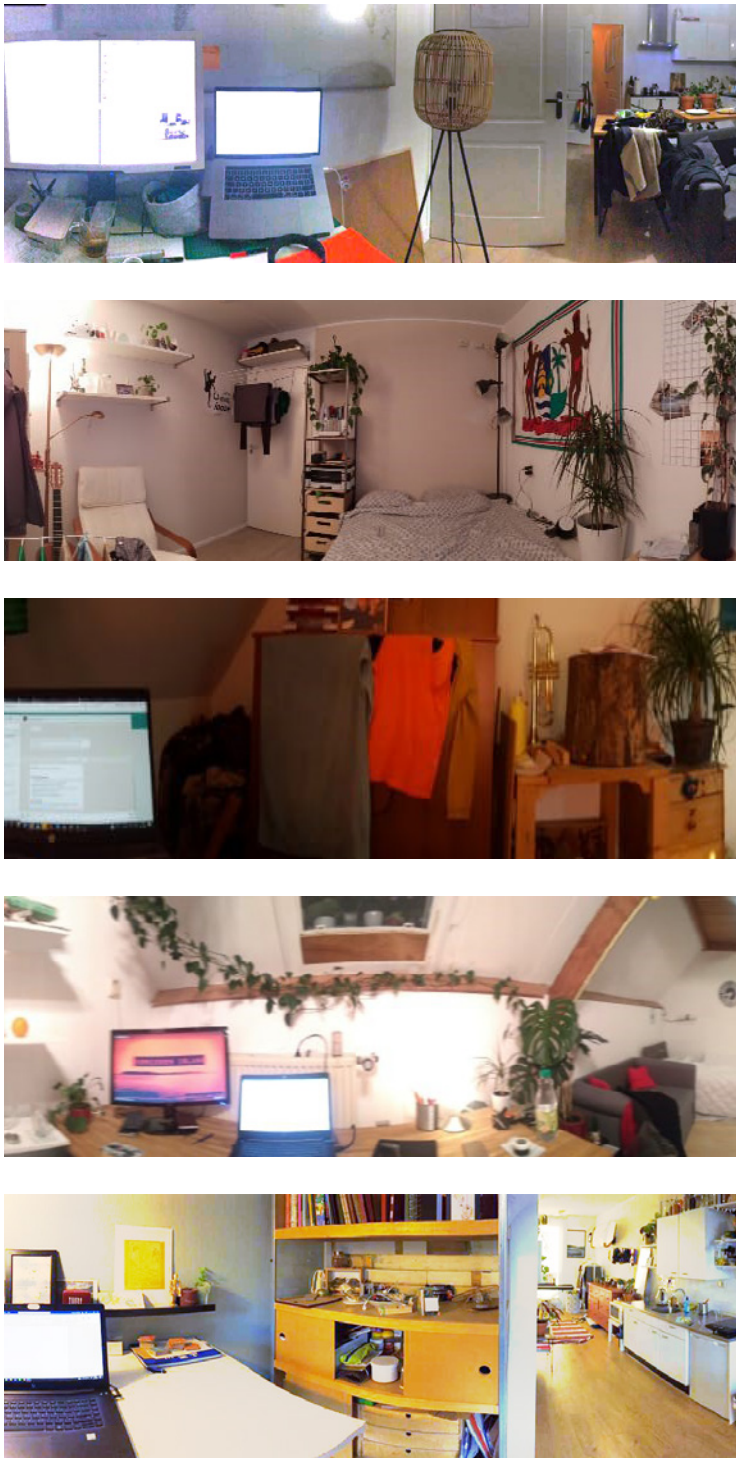
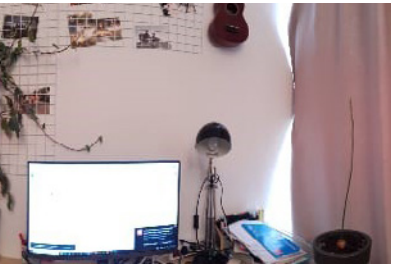
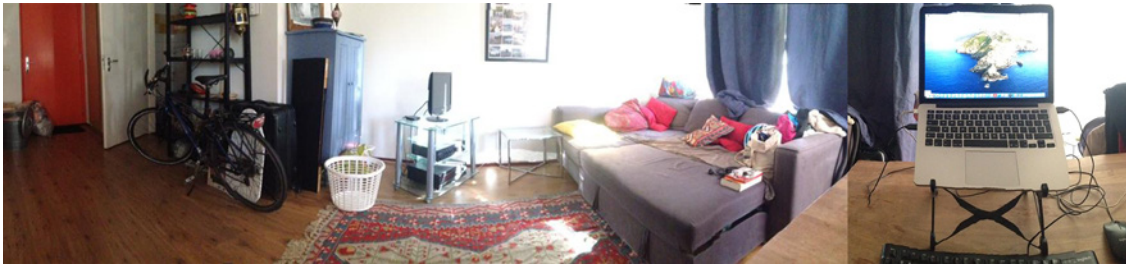
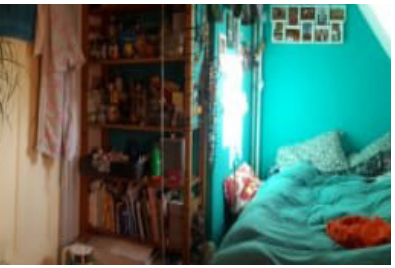
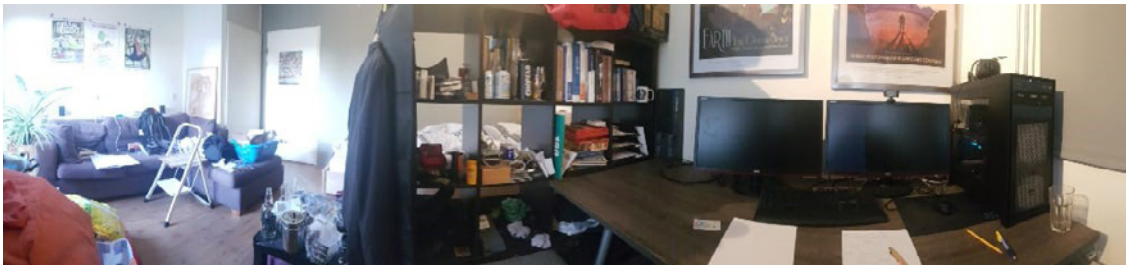
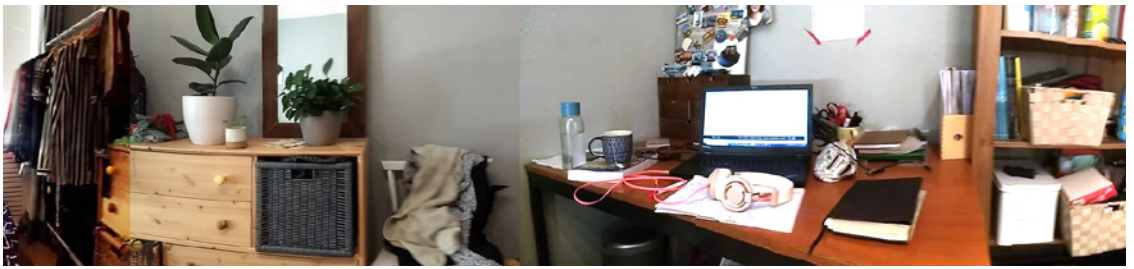


Figure 2.1: An overview of panoramas from student rooms





2.2 Literature

In the current COVID-19 pandemic we had to quickly adapt to work from our single-room-home, which previously has been mostly been used for private life.
In this single-room-home, we have an association on how we utilize this space. And having to work from this space contradicts these associations, which might make it harder to work from home.

In this chapter, we analyzed what consists of a home environment, and how it can influence our perception and perceived productivity.

How do we perceive an environment? Bakker (2014) has formulated a list of physical factors which influence our perception of the environment, as often mentioned in the literature;

- Space, form and proportions
- Materials
- Indoor environment
- Odour
- Facilities
- Colour
- Art
- Plants

These factors are usually experienced as a whole environment, and we are not aware of these individual factors (Vonk, 2003; Dijksterhuis, 2007 from Bakker, 2014). This might make is more difficult to change or measure an individual factor, as we should also be aware of the influence of the other factors.

Furthermore, the model of Kahn (1981) presented in the book of Bakker (2014) describes that the subjective interpretation matters even more than the objective environmental conditions (Scheuerle, 1984; Vonk, 2002; Gaillard, 2003; Dijksterhuis, 2007; Bendin, 2008 from Bakker 2014).
This is further underlined by Miligan (1998), who argues that the interactions with objects are the process which gives these objects meaning. From the scale of a product to the scale of a building.

These interpretations might be further mixed for people living in single-room-homes. A lack of separation between work and relaxation has been identified as an influential factor, combined

with other aspects such as a lack of a dedicated desk, and the room layout, as possible causes for a decrease in satisfaction of work (Hesselman & Vink, 2021).

Csikszentmihalyi (1997) furthermore notes that "different rooms of the house also have their particular emotional profile, in large part because each is the setting for a different kind of activity."(p. 44)
In the context of single-room-homes, the different emotional profiles might be at most linked to a specific part of a room or in a worse case they are largely interwoven and there isn't a clear barrier between different profiles.

Miligan (1998) calls these interpretations the interactional past, as a part of the theory of place attachment. Low and Altman define place attachment as "the bonding of people to places" (1992, p.2) from Miligan (1998). Miligan (1998) adds to this that bonding to a space creates a meaningful place.
Furthermore, Miligan argues that this place attachment is created by interactional processes (interactional past and interactional potential) through which "no two experiences of place will be identical on every level" (1998, p.6) for different people.
Another factor of place attachment can be added from Lewicka (2011), who notes that duration of the residency is also a predictor for place attachment for homes (Kleit & Manzo, 2006; Riger & lavrakas, 1981; Taylor et al., 1985 from Lewicka, 2011)

This interactional past might be especially mixed in a single-room-home, where all activities are performed in the same room. Furthermore, the interactional past in the single-room-home before the current COVID-19 pandemic mostly consisted of spending your private life there. The switch to working from home full time might be further hindered through these associations.

Having to work in a space with different previous associations than the task at hand might make this task take an extra effort to stay concentrated.
In literature, the ability to pay attention has been referred to as a resource that can be depleted. Baumeister et al. (1998), and Muraven (2000) compares it to a muscle, which can be exhausted. Kaplan further mentions that "mental fatigue is the consequence of sustained mental effort that requires focused or directed attention." (1993, p.3)
To recover from this mental fatigue, Kaplan (1993) mentions leaving the room as a restorative activity.
Unfortunately, in single-room-homes,

this ability to walk away from work is limited.

This reduction in the attention resource might be linked to the ability and duration to concentrate.
As Bakker (2014) describes productivity is as an aspect linked to the environment. Robertson & Cooper (2011) furthermore describe a link between productivity and work-related satisfaction.
As such, a reduction in being able to concentrate might be influenced by the environment and linked to wellbeing and satisfaction of work.

In the model of Van der Voordt and De Been (2010), five elements are shown which influence work satisfaction and productivity.
- Organisation
- Facilities
- External factors
- Work processes
- Personal characteristics

This also corresponds with the model of Robertson & Cooper (2011) on the work-related personal wellbeing (PWB). This PWB is influenced by multiple work-related factors, such as the work itself, relationships at work and social support, purpose and clarity of the work performed, and management and leadership related to improving PWB. Only the personal characteristics are missing in this model.

Another effect for a reduction in satisfaction of work could be caused by the current pandemic itself.
Csikszentmihalyi (1997) argues that emotions can cause both "psychic entropy" as well as "psychic negentropy".
The first, "psychic entropy", is caused by negative emotions such as fear, sadness and anxiety, and creates a state of mind where attention can not be used effectively to deal with external tasks.
These emotions might also be caused by the current COVID-19 pandemic, reducing our ability to focus on external tasks.
The second, "psychic negentropy", is a state of mind caused by happiness, strength or alertness, where the psychic energy can be freely be used for external tasks.
Csikszentmihalyi (1997) argues that in order to focus this psychic energy on the tasks at hand we need intentions, goals, and motivation.

This attention can also become partly structured when we have to talk to another person or stranger (Csikszentmihalyi, 1997). "The presence of the other imposes goals

and provides feedback" (p. 42)

A factor in the benefits from multiple rooms might come from the location updating effect, as described by Radvansky (2010). Since he described that "memory for objects decline when people move from one location to another (the location updating effect)" (p.1)
This effect occurs with each change between rooms and the memory of an object does not recover when changing back to an old room (Radvansky, 2011). A significant effect was even measured when people would imagine themselves walking through a door (Lawrence & Peterson, 2014).
They argue that the location updating effect occurs similarly in real-life, virtual, and text-based situations.

"Thus, overall, it is quite clear that memory for recently experienced information is affected by the structure of the surrounding environment" (p.13, Radvansky, 2011)
Unfortunately, in the single-room-home, someone will only walk through a door to go to the bathroom. Which unfortunately means they will probably not experience the same effect of more easily forgetting about work than someone who has to move through a door to end their working day.

All previously mentioned factors seem to converge to the point that the current situation, and especially for those living in single-room-home, are not ideal for working from home, leading to a decrease in satisfaction and wellbeing.

Firstly, from a possible increase in a sustained mental effort to stay concentrated in a place that has a different interactional past.

Secondly, a reduction in the ability to walk away from work to restore this mental fatigue. Though Kaplan (1993) argues the importance of having a window with a view of nature, as her research shows the positive impact of looking out a window towards nature as a restorative activity.

Thirdly, the pandemic itself might lead to more negative emotions in which the mind has difficulty to concentrate.

And lastly, of a lack of meeting other people, as these conversations can help to structure your thoughts.

2.3 Thesis overview

From the literature as discussed a visual overview was created of the connections between the different topics and studies, as can be seen in figure 2.2. This overview shows the main themes and clusters of this thesis.
The lightly coloured topics are interesting for improving the satisfaction of working from home, however, these are not directly related to the home-work-environment and thus received less attention during this thesis.

This overview furthermore introduces two types of clusters. These clusters will be explained later in this thesis, but are included to provide a complete illustration which can be referenced throughout this thesis.
The first cluster of environmental and behavioural factors concerns the different type of impact our home-work environment has on us, and will be explained further in chapter 3.2.

The second cluster (physical barrier, visual separation, and ergonomics) relates to the different areas the content of home-work-environment-modifications focus on. This will be further elaborated upon in chapter 3.3.

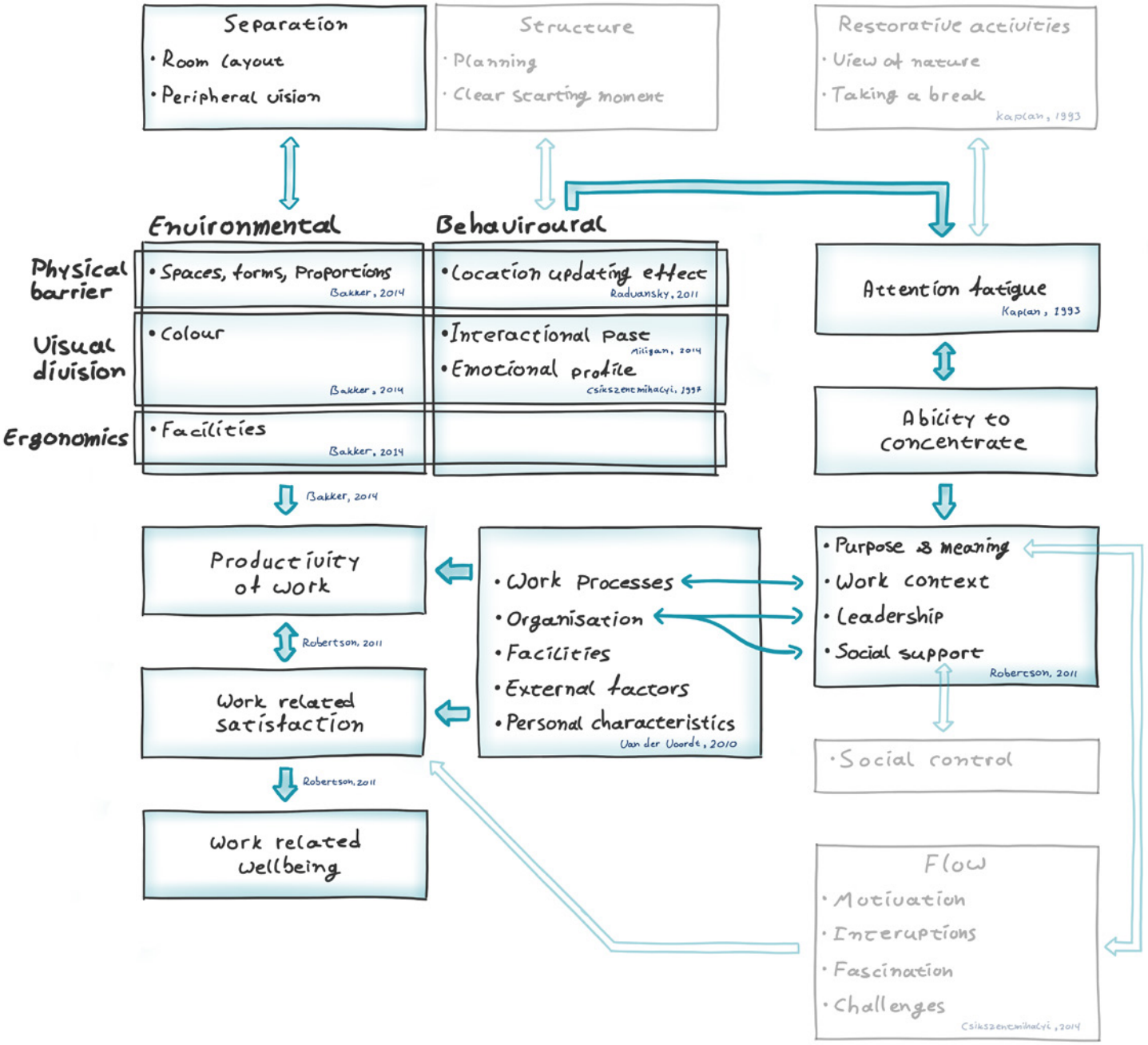


Figure 2.2: An overview of the topics related to this thesis.

2.4 Student rooms

The previous chapter, and research in appendix A2, indicate students have a lack of engagement, structure, separation and ergonomics.
This research focusses on the cluster "separation of work and private life" and aims to identify the environmental factors which might influence this separation. Individual student rooms were analysed through a panorama picture and a matching questionnaire. Factors such as spaces in the peripheral vision, physical separation between spaces, and workspace ergonomics were used in this analysis.
Unfortunately, the results of this research didn't identify a clear influence of the room layout on the ability to concentrate and the satisfaction of work. However, in line with previous research, the number of rooms available did show an impact.

A questionnaire has been sent out to students working from home, in a single-room-home. In total 12 panorama pictures and corresponding questionnaire answers were collected. From these photos and the questionnaire, a visualization of each room was created, as can be seen in figure 2.4. Though these pictures did not identify a clear aspect of the room layout which influences the satisfaction with working from home.

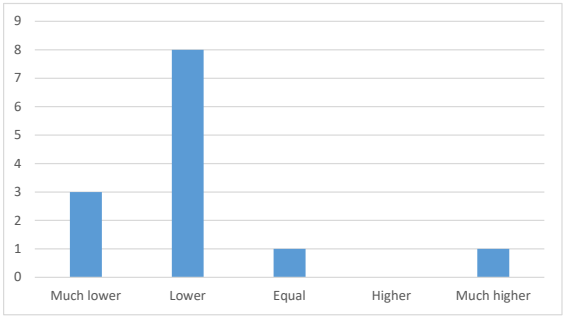


Figure 2.3. The score of 12 participants on the change in satisfaction of working from home compared to the 'old' situation (the number of participants who score the category is on the y-axis)

Figure 2.3 shows the score from the survey on the satisfaction of working from home compared to working at the university. As can be seen, the majority of students noted their satisfaction is (much) lower at home.

A further analysis can be found in appendix A3 and chapter 6.2.

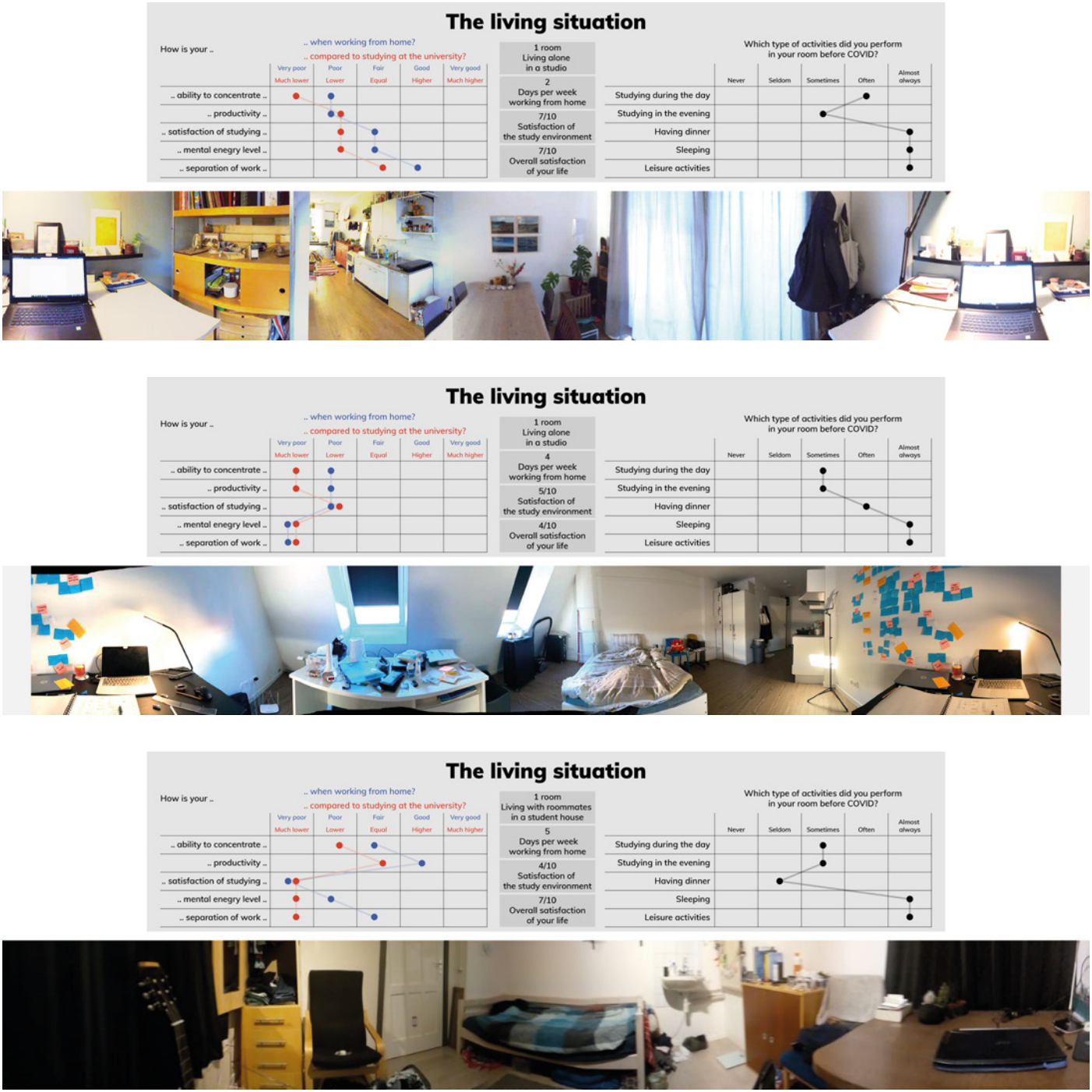


Figure 2.4 An overview of the different rooms with the survey results.

2.5 The second room

This research focuses on the behavioural and perceptual differences between a single space and multiple rooms.
In this research, a gap in the literature was found in describing when space is perceived as a different room or space. Though construction guidelines exist on when space can be counted as a room, they too do not describe the perception of a room.

One behavioural effect was found in the location updating effect, as described by Radvansky (2010), which is the effect of more easily forgetting things related to a room when moving to another room.

During this thesis, philosophical discussions were held with friends, roommates and acquaintances on the differences between rooms and larger spaces, and the different experiences between these rooms. These discussions were instructed, through guided towards finding and describing the moment multiple areas in the same space become multiple rooms.

Ideas were generated which might influence the separation between rooms:

- When you enter a door
- When you move to a different type of floor (height & material)
- When there is a different type of wallpaper
- When you move between walls
- When space has a different colour

See figure 2.5 for an overview.

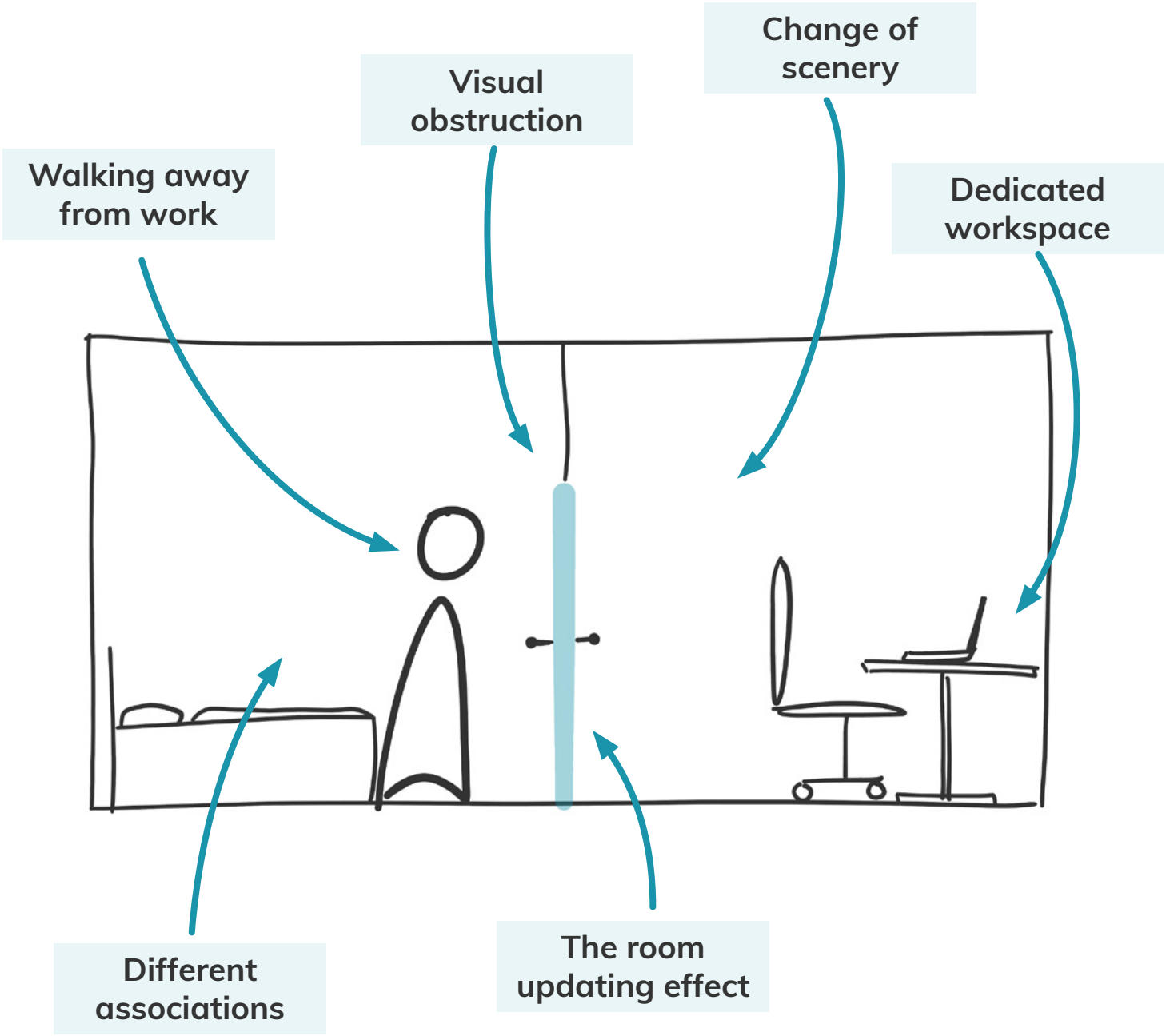


Figure 2.5: An overview of aspects related to the perception of a room.

3
Ideation

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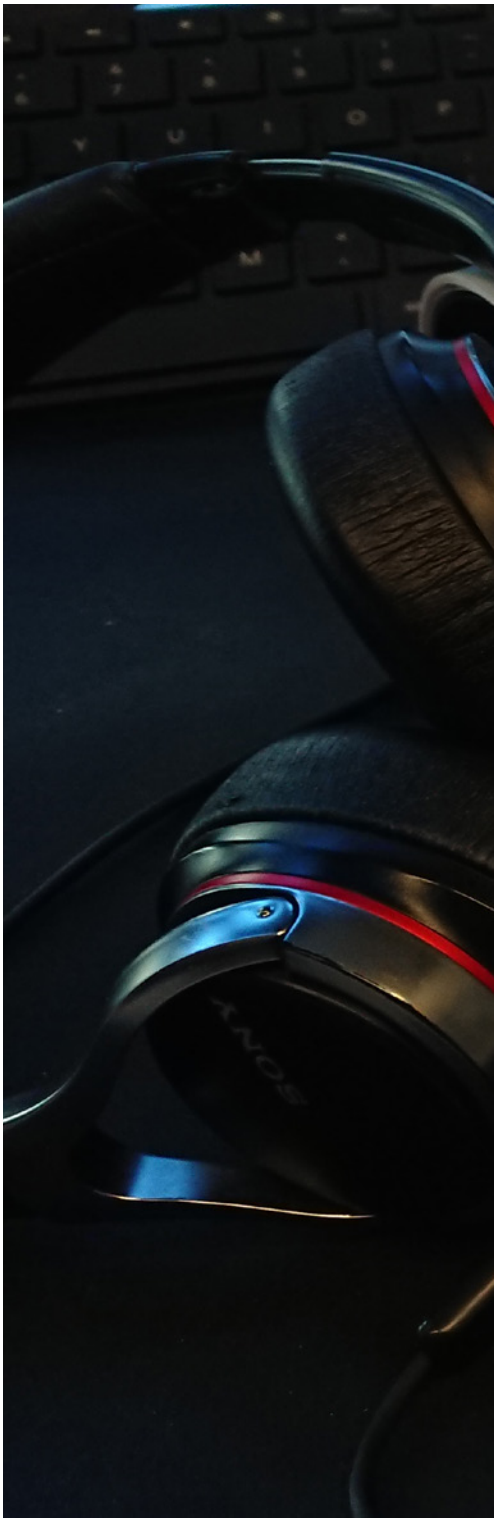
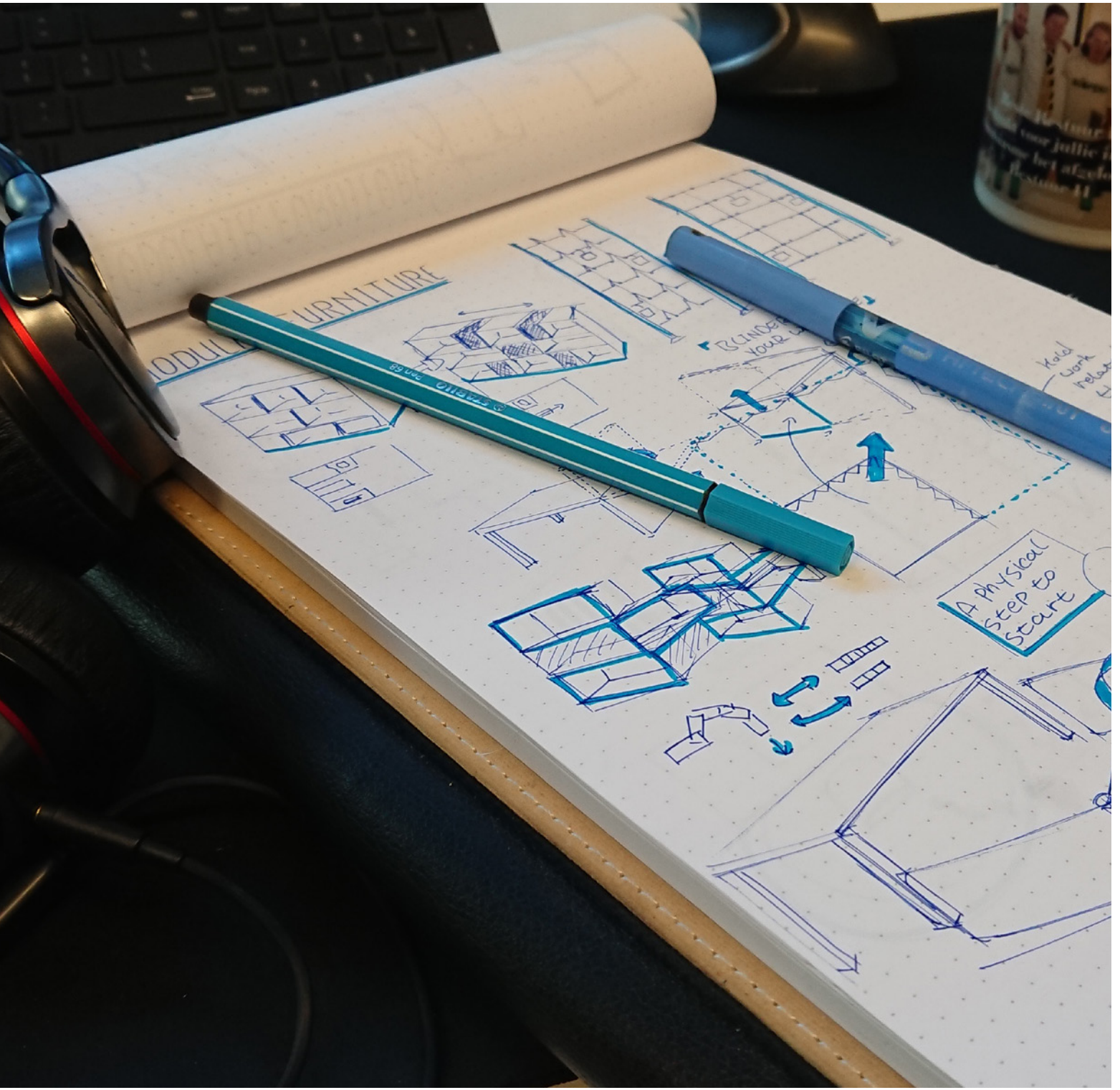



A Physical step to start

3.1 Context

The previous research activities and literature showed the importance of two or more rooms on the satisfaction of work, and their work-related wellbeing.
The goal of this thesis is to help students working from home to experience these benefits of the second room in their single-room-home.

In this chapter, the context and requirements for a design or intervention in the single-room-student-home will be explained.
The main goal is to create a final design or intervention which can be available quickly, while keeping initial investment of students low, and fit in the space of a single-room-home.

To create the perception of the second room in a limited space, this second room should both be experienced as a new room, as well as reduce the influence of the interactional past and emotional profile of the larger room.

Furthermore, within the context of designing for students, their budget and the ability to modify the room should be considered.
To achieve these goals, it was assumed the ideas should:

- Work in the limited budget of students
- Work within the limited size of single-room-student-homes.
- Work in a variety of different student rooms and room shapes.
- Make optimal use of the limited space in the student's room. Such as being foldable.
- Not decrease the usable space in the single-room-home
- Be able to be implemented quickly, so students should be able to use the instructions to improve their room themselves.
- Be desirable to use. Either through aesthetic pleasure, functionality, or ease of use.

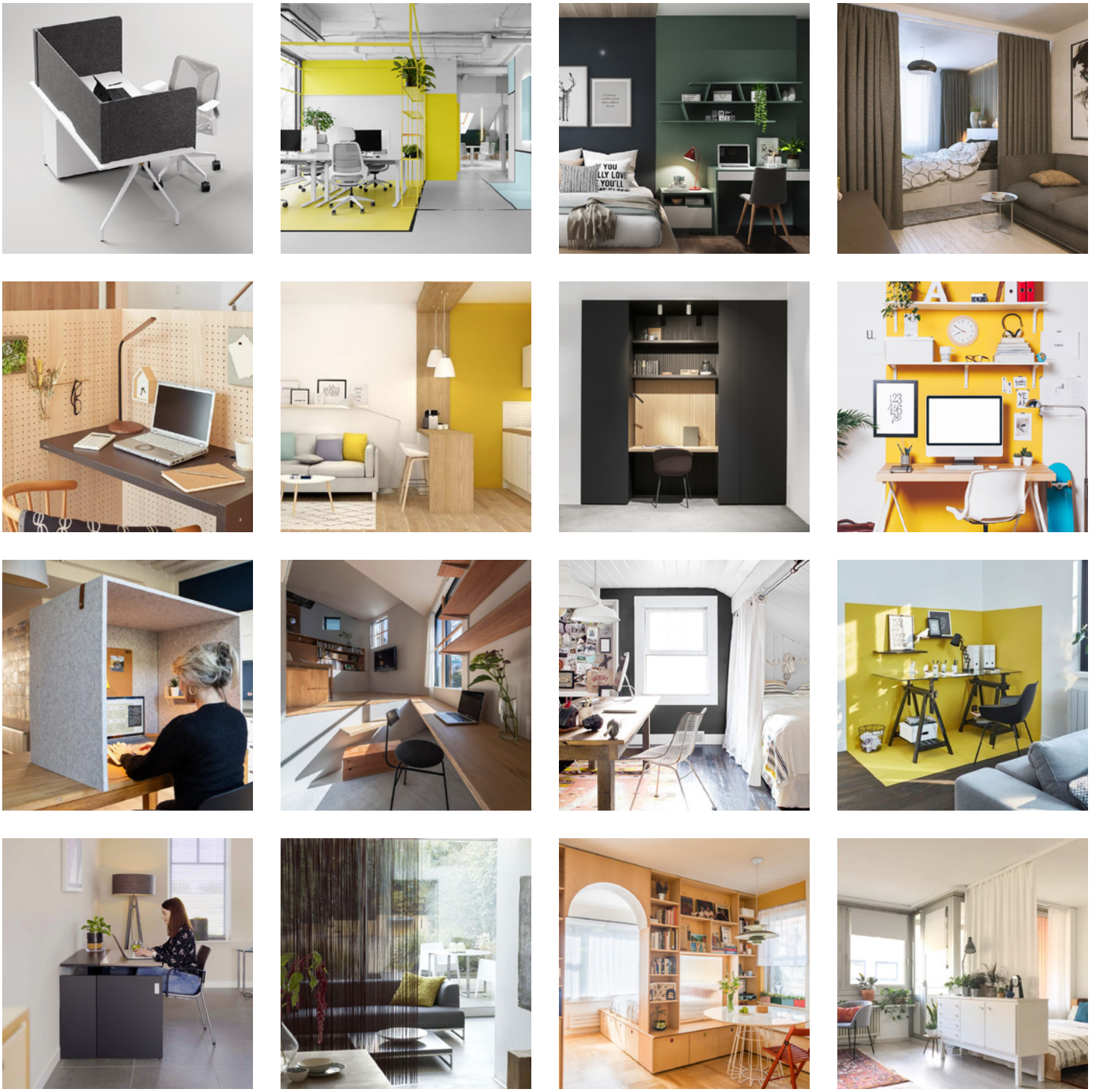


Figure 3.1: An overview of home-work environment modifications.

3.2 Proposed ideas

From the research in chapter 2.4, we concluded that there is no clear separation on the satisfaction of work based on the layout of the student room.
However, literature does provide a strong link to having a second room on the satisfaction of work.
As such, the ideas generated in this chapter will focus on creating the perception of a second room with this basis in literature.

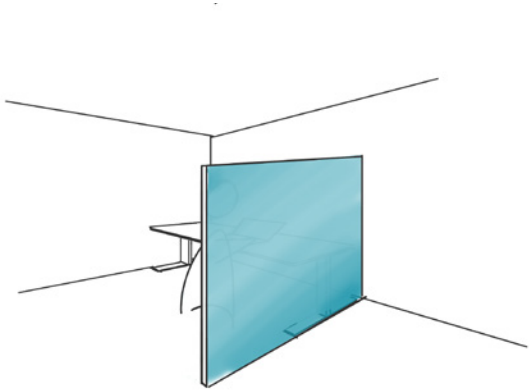
Ideas were generated based on environmental and behavioural factors. The environmental factors are related to how we perceive the environment around us, such as through the proportions, form, and colour of a space (Bakker, 2014).

The behavioural factors describe psychological effects in relation to the perception of a room. These are the emotional profile, interactional past, and location updating effect.
Csikszentmihalyi (1997) argues that rooms have their particular emotional profile, linked to the activity to be performed in that room.

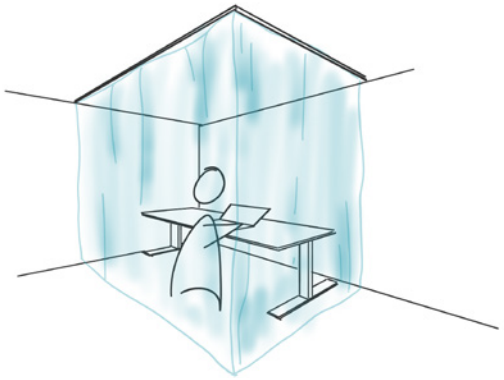
The interactional past (Kaplan, 1993) describes that our previous interactions in a space influence our future interactions.
Lastly, the location updating effect (Radvansky, 2011) reports how we are more likely to forget things about one room when we move, or imagine ourselves moving, through a door to a new room.

These ideas are briefly explained on the following pages, and are clustered into a matrix in figure 3.2.
As shown in this figure, the concepts are based upon a environmental factor, and a behavioural factor.

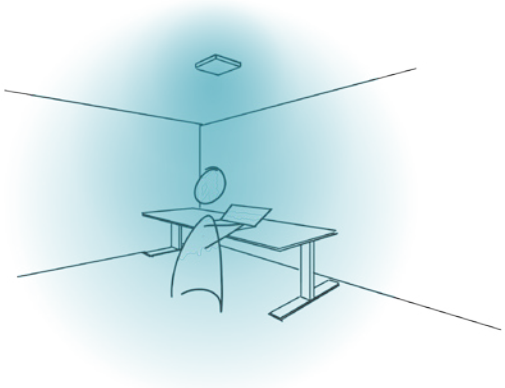
One idea shown in the figure, but not further elaborated upon, is the idea of focussing on breaks and restorative activities. This idea is deliberately kept to the side, since it was evaluated as too much outside of the scope of this thesis.



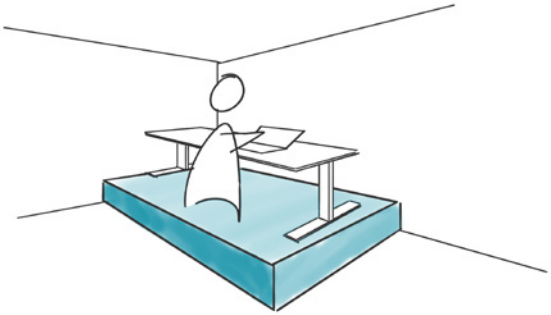
Separation wall
With a separation wall you can close yourself off from the rest of your room, and create an enclosed working space.
When this wall has to be moved to enter the workspace, the workspace might be experienced as another room. This effect might be enhanced with a bright colour.



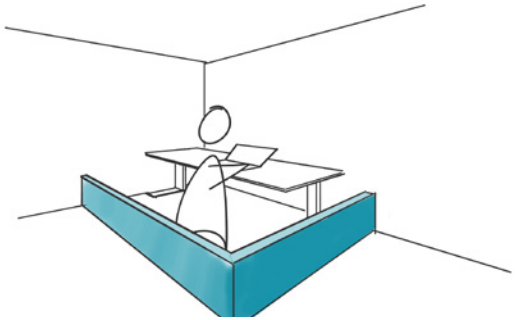
Implement curtains
A second rooms helps people to be more satisfied with working from home.
Curtains can be used to completely divide the room into two rooms during the day when students have to work from home. And close themselves off from the rest of their room.



Activity based lighting
Colour is one aspect on how we can recognize a room.
By giving the room a different colour per different activity. We might associate these colours with the activity and be more comfortable in performing that activity.



Raised platform
A second rooms helps people to be more satisfied with working from home.
By raising a part of the room, the room might subconsciously be divided into two rooms. Furthermore, with this change in height, you have to actively step onto the platform to start working.

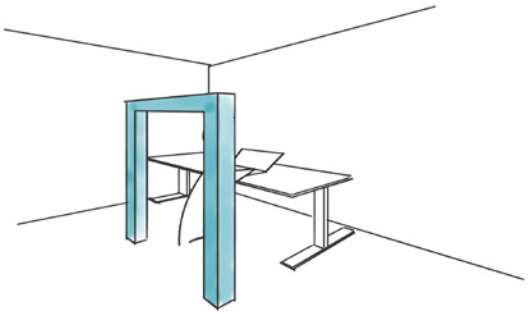


Raised barrier

A second rooms helps people to be more satisfied with working from home.
By placing a barrier in the room, the room might be subconsciously divided into two rooms.
Furthermore, with this barrier you have to actively enter the room to start working.

Colour blocking

Colour is a strong visual indicator, which can be used to create a visual separation of spaces.
By giving the workspace another colour, it might be seen as a different space. Rather than part of the room.



Physical doorway

People more easily forget things of the previous room when they walk through a door, either physical or imagined.
By placing a physical doorway in front of the workspace, people might more easily forget other things, and might be more likely to concentrate on their work.

	Like	Clear	Use	Fit
Separation wall	4,45	6,73	4,82	3,18
Colour blocking	4,55	6,64	3,64	3,09
Physical doorway	4,55	6,18	3,64	2,64
Raised working platform	5,00	6,45	4,36	2,82
Raised barrier	3,82	6,18	3,73	2,45
Implement curtains	5,55	6,73	5,00	4,55
Acitivity based lighting	4,91	5,82	4,45	5,36

Evaluation

These ideas were distributed and evaluated (see appendix A4). The ideas were rated on a scale of 1, not at all, to 7, very much, the averages can be seen in the figure above. In general, the ideas appear clearly communicated, but difficult to fit in a student home.

The experience of a second room

Environmental factors

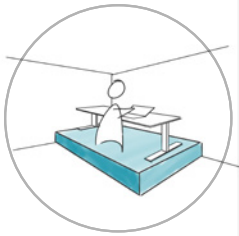
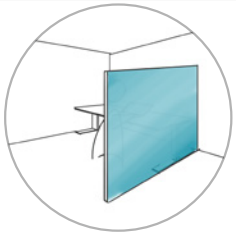
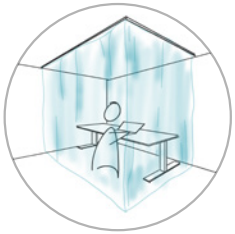
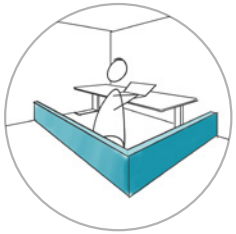
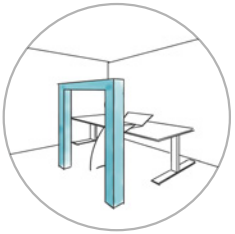
Behavioural factors	Proportions *Bakker 2014*	Form *Bakker 2014*	Colour *Bakker 2014*	Odour *Bakker 2014*	Facilities *Bakker 2014*
Emotional profile *Csikszentmihalyi 1997*					
Restorative activities *Kaplan 1993*					
Interactional past *Miligan 1998*					
Location updating effect *Radvansky 2011*					

Figure 3.2. An overview of the ideas based on their relation to literature.

3.3 Clusters

The ideas as proposed in the previous chapters were used to form two clusters. Since prototyping all ideas would an unrealistic task for the scope of this thesis.
Previous research (Hesselman and Vink, 2021) was used as a guidance for creating these clusters. This research showed the significance of multiple room on the satisfaction of working from home, compared to working at the university. This brought up the hypothesis, if the interventions would focus on creating the perception of a second room in single-room-homes, would this also lead to an increase in work related satisfaction?

The proposed ideas were clustered on how they influence the perception of a room. The characteristics of a separate room, as described in chapter 2.5, were also taken into account.
The created clusters; a physical barrier, and a visual division, can be seen as corresponding to the walls and the interior of a separate room (see figure 3.3).

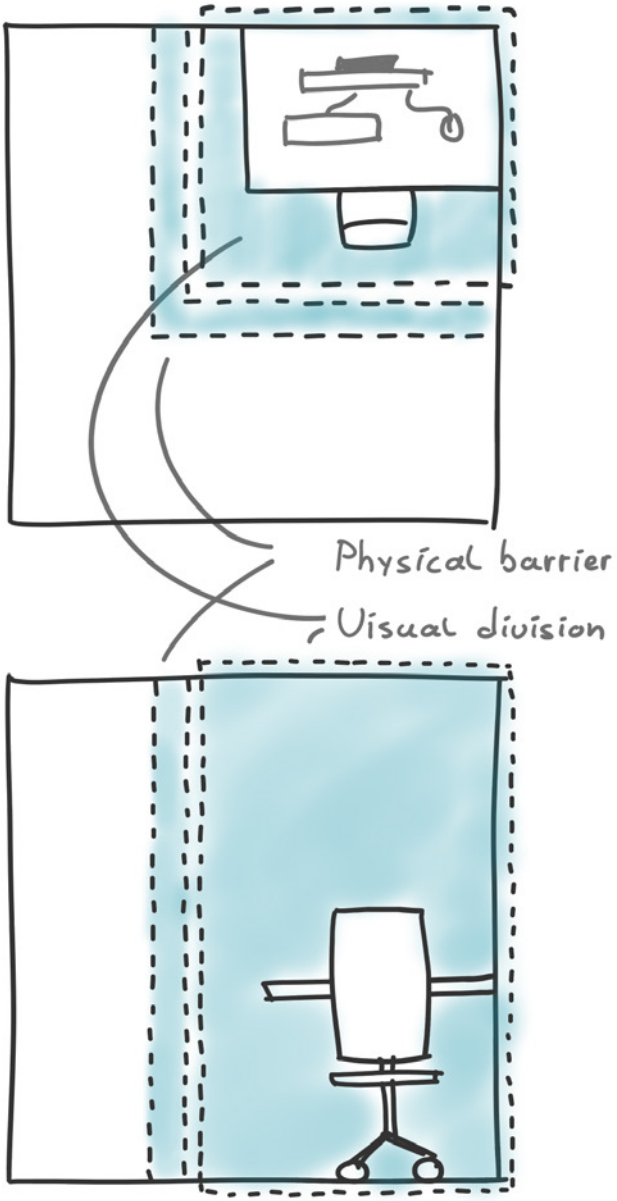
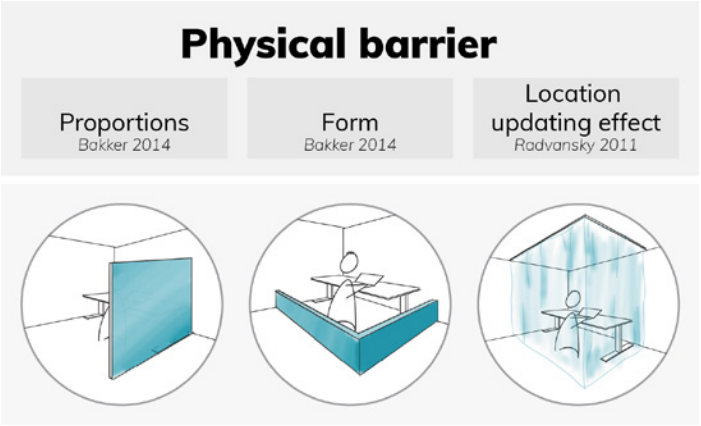
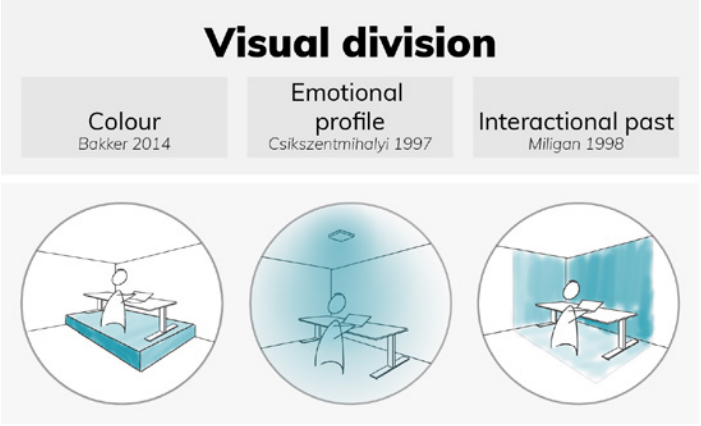


Figure 3.3. The two factors of the workspace



A physical barrier marks the border of one space to another. It can be permanent, such as a bookshelf, or a temporary construction with a movable wall.

By creating a (temporary) physical barrier around your workspace, the perception of the environment might change by altering the proportions and form of the space (Bakker, 2014).
Furthermore, we might benefit from the location updating effect (Radvansky, 2011), where we more easily forget things when we move between spaces.

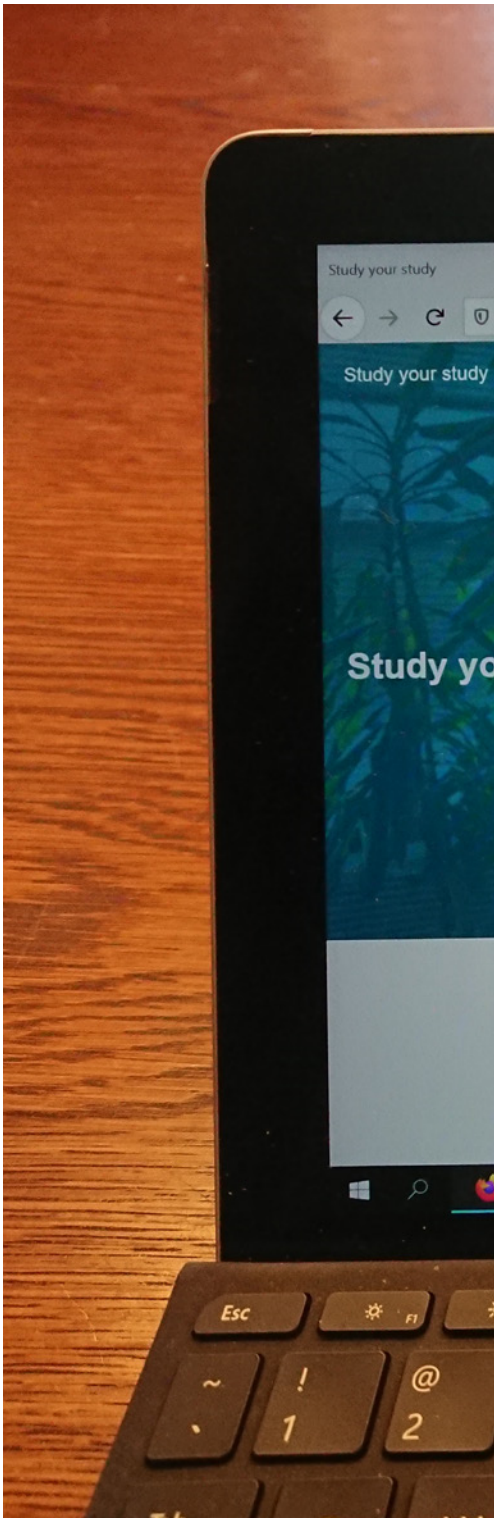


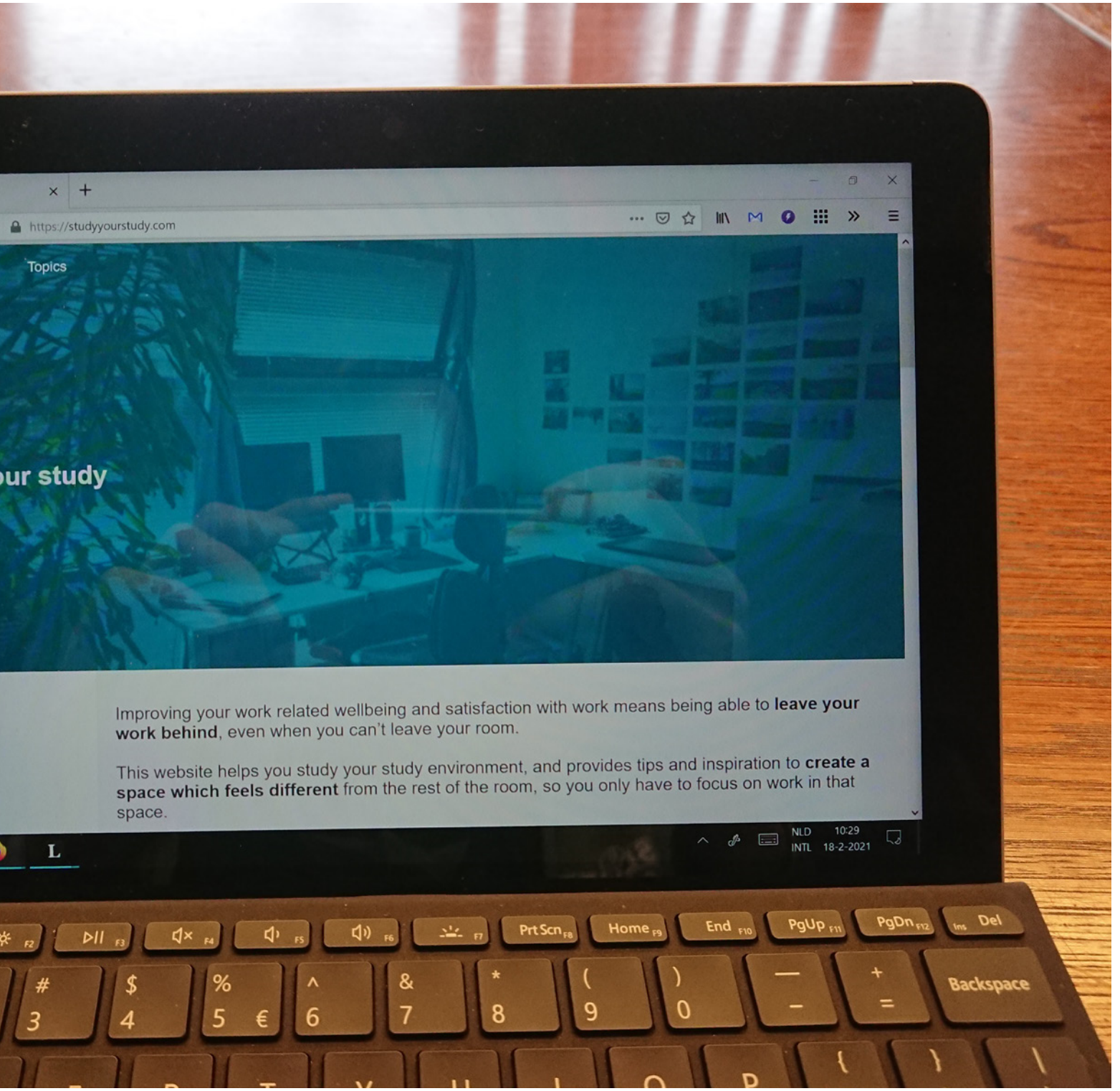
A visual distinction marks the area inside a space, and acts as a reminder that you're inside a different area. These can be temporary, such as coloured light. Or permanent when you paint the walls.

By changing the space itself, it might be perceived as a different place with its own emotional profile (Csikszentmihalyi, 1997) which links your actions to a space or area. While also reducing the effect of the interactional past (Miligan, 1998) which consists of the precious associations with that space or area.

4
The content

In this chapter:




https://studyyourstudy.com
Topics
our study
Improving your work related wellbeing and satisfaction with work means being able to **leave your work behind**, even when you can't leave your room.
This website helps you study your study environment, and provides tips and inspiration to **create a space which feels different** from the rest of the room, so you only have to focus on work in that space.
NLD
INTL
10:29
18-2-2021
Backspace

4.1 The content

The main focus of this thesis is to help students in the ongoing COVID-19 pandemic as quickly as possible. In this situation, creating a classical design solution would take too much time, if it would even be realised in the near future. Examples of this would be a foldable separation wall, or a product for activity based lighting.
The following chapters will show the iterative process the information distribution went through. And gives a more detailed explanation of the most recent form of this information distribution: an online website.

This thesis focussed on providing students the tools which they can apply themselves to improve their home-work environment, based upon the two clusters, on how to create modifications in the rooms. This skips the manufacturing and distribution phase which is normally needed. And allows students to improve their home-work environment during the ongoing COVID-19 pandemic.

Both the form and content of how the information would be distributed went through multiple iterations, as is shown in figure 4.1.
Throughout the thesis, the direction to focus on information distribution became clear. The thesis shifted from a focus on a "do it yourself (DIY)" product idea, towards providing tips and inspiration.

The first iteration of the content distribution came from the DIY direction idea evaluation. For this evaluation a participants guide was create to evaluate these ideas (as can be found in the previous chapter). This iteration will be further explained in chapter 4.2.

During this evaluation, the focus evolved towards a standalone booklet for improving the home-work environment. The iteration linked to these steps can be found in chapter 4.3.
Though a creative session, as discussed in chapter 4.4, the form changed to the final version; a website.
This website is explained is chapter 4.5. And lastly, an overall evaluation of the content was performed in chapter 4.6.

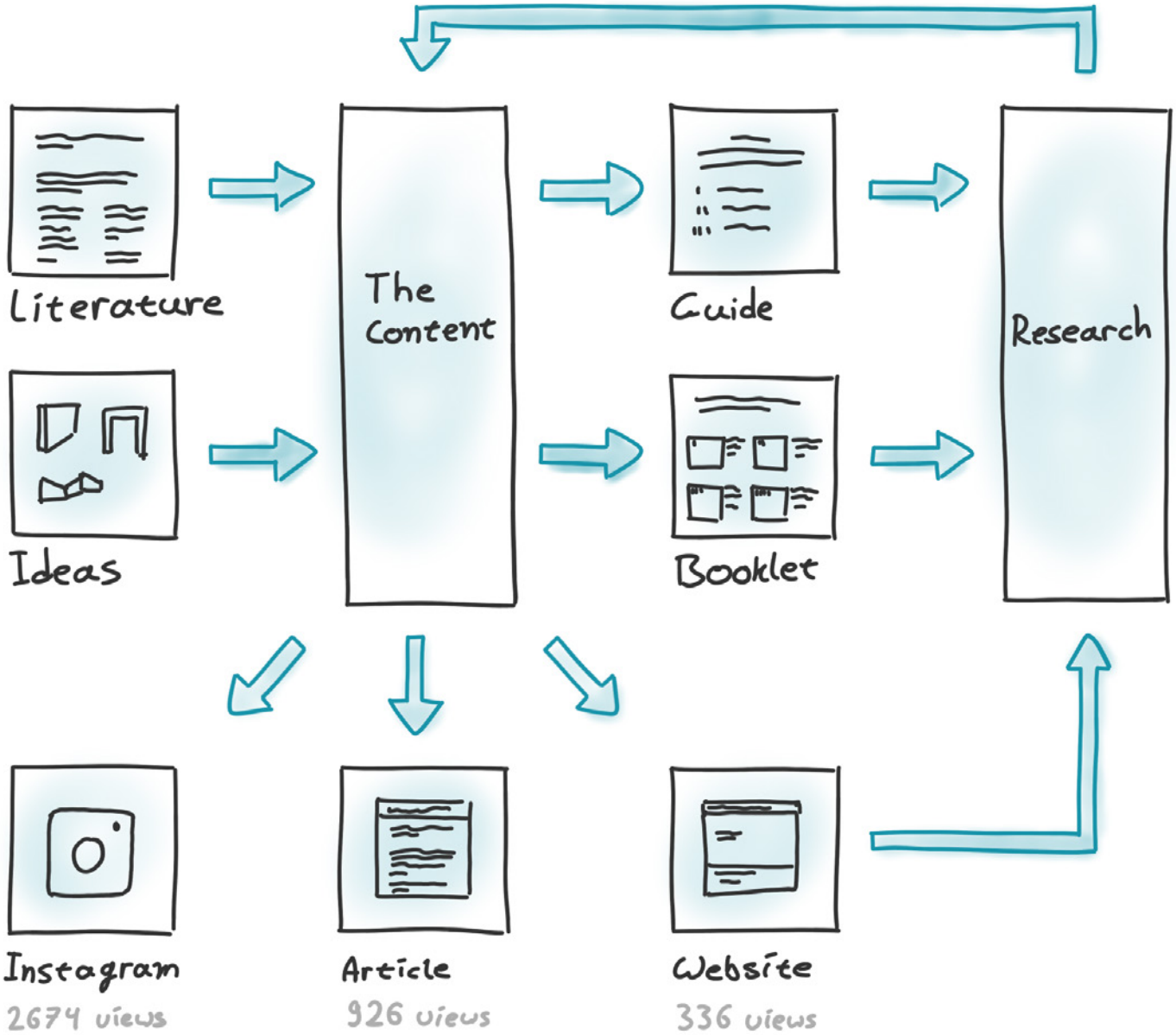


Figure 4.1. An overview of the evolution of the distributed content.

4.2 Participants guide

The first version of distributing the tips was a participants guide used in combination with a research setup. This research focussed on measuring the effect of rearrangements in the home work environment. In the guide 3 adjustments were explained, which students could pick an option form which best suited their situation. These adjustments were further supported by images and tips, and a short explanation for the test.

The participants guide was distributed while still a work in progress. For example, the ergonomics was included at this stage, though no pictures of an ergonomic setup were collected or created yet.

For the research, the proposed adjustments in the guide were;
- Moving your desk to a different part of your room to reduce the effect of your previous associations.
- Rearranging the room to create the perception of a second room.
- Adding an intervention to create separation in the room.

The results of this research can be found in chapter 6.2.

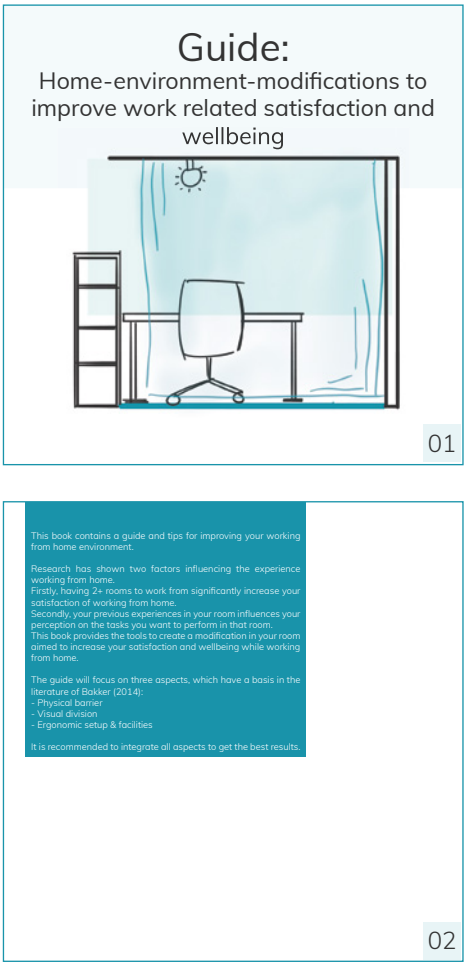


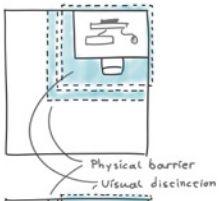
Figure 4.2. An overview of the pages of the participants guide.

Rearranging your room

Rearranging your room could reduce the effect of your previous experiences in your room. Additionally, during the rearrangement, you can focus on creating a second room.

Another room is typically characterized by two factors, the walls surrounding the room, and the interior inside the room.

These are; a physical barrier, and a visual distinction, between the workspace and the rest of the room. As illustrated in figure 1.



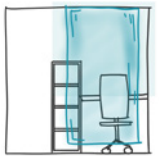


Figure 1: An example of the work environment

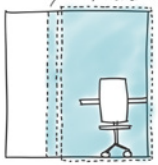


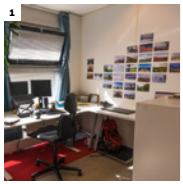
Figure 2: The two factors of the workspace

1 Rearrangement tips

A physical barrier or visual distinction could be added through additional products.
But changing the room itself can also be a great starting point to improving your home work environment. Where the layout of your room can support the perception of a second room.

On this and the following page four tips/best practises are described in giving guidance to create a work environment in a small (student) house. The following pages provide inspiration on what can be achieved with a room rearrangement.

1



2

1
Arrange your furniture and workspace in a way that the open sides of your workspace are limited.

2
Use a different accent colour in your workspace.

3

4

3
Limit the products that you have an association of relaxation with in your peripheral vision.

4
Use your workspace arrangement only for work and study.

The test:

For the test there are two possibilities of rearranging your room:
- Moving your desk to a different part of your room to reduce the effect of your previous associations.
- Rearranging the room to create the perception of a second room.

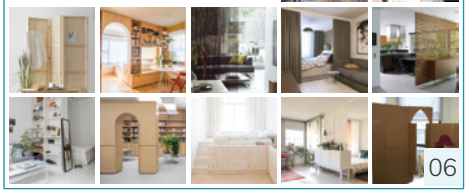
You can select the option you chose in the general survey at the end of this research.

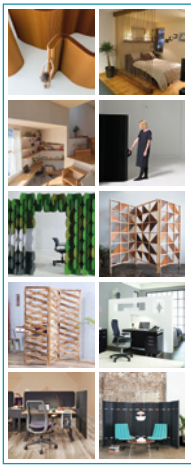
2 Physical barrier

A physical barrier marks the line between one space and another in the same room. A physical barrier can be permanent, such as a bookshelf, or a temporary construction with a movable separation wall.

By creating a (temporary) physical barrier around your workspace, the perception of the environment might be changed by altering two of the factors on how we perceive the environment; proportions and form of the space (Bakker, 2014).
Furthermore, we might benefit from the location updating effect (Radvansky, 2011), were we more easily forget things when we move between spaces.

Figure 3: Examples of physical barriers





Tips:

Some examples related to creating a physical barrier:

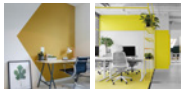
- Create a workspace which you can only access from one direction, with the other 3 directions closed off from the rest of your room.
- Have an action which marks the start and end of your day of working. Such as moving a piece of furniture.
- Limit the products that you have an association of relaxation with in your peripheral vision.

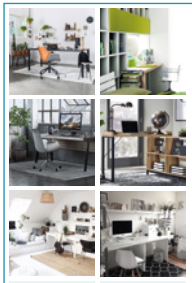
3 Visual division

A visual division consist of something that marks the inside of a space, but is not an obstruction. For example, a different carpet on the ground does not obstruct a person to move throughout the room, and is considered a visual reminder. These can also be temporary, such as coloured light. Or permanent when you paint the walls.

By changing the space itself, it might be perceived as a different place with its own emotional profile (Csikszentmihalyi, 1997) which links your actions to a space or room.
While also reducing the effect of the interactional past (Miligan, 1998) of the precious associations of tasks to that space.

Figure 5: Examples of visual divisions





Tips:

Some examples related to creating a visual division:

- Use your workspace arrangement only for work and study.
- Use a different accent colour in your workspace.

4 Ergonomics

Depening on the tasks you perform, you can prioritize the setup of your workspace to facilitate these tasks.

For more information; check:
http://ergo.human.cornell.edu/ergoguide.html

1

1 - Your computer
Tips for working behind a computer:

- Use a setup where the keyboard is separate from your screen.
- Place your screen(s) at a height where you don't have to tilt or bend your neck, use a separate screen or a lapotp stand.
- *"Sit back in your chair at an angle of around 100-110 degrees (i.e. slight recline) and hold your right arm out horizontally, your middle finger should almost touch the center of the screen."*
(http://ergo.human.cornell.edu)

2

2 - Your workspace
Tips for your workspace:

- Create a stable working surface.
- Pick a comfortable chair with good lumbar support
- Set the back rest angle at around 100 to 110 degrees.
- Keep the things you need close by.

3

3 - Your posture
Your posture is the basis of a good working setup.

- Varying posture is important thoughout the day, consider a height-adjustable desk, or a separate space to work standing.
- *"Make sure the head and neck are as straight as possible."*
- *"Make sure the posture feels relaxed for the user."*
(http://ergo.human.cornell.edu)

4

4 - Miscellaneous

- The background should be the same brighness as your screen.

4.3 The booklet

The content further iterated towards a booklet, which could be distributed through various media channels to students. The goal of this booklet was to provide students with tips, tricks and information to explore possibilities for modifications in the home-work environment to improve their satisfaction with working from home.
These tips are focussed on a student budget, and simple modifications everybody could try.

This booklet was distributed as part of a second iteration on the research into the effects of modifications in the rooms of students. It was distributed through various whatsapp groups, and posters at and around the TU Delft campus.
It builds upon the tips and inspiration as offered in the participants guide. In this version, the information for the test is removed and replaced with examples of other students. The overall clarity and structure was also improved.

The results of the related research can be found in chapter 6.2.

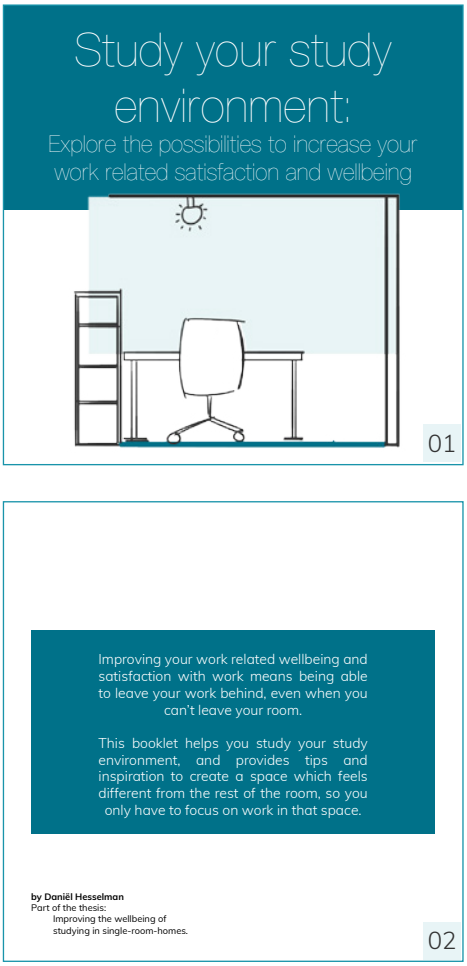
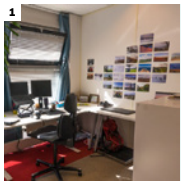


Figure 4.3. An overview of the pages of the booklet.

Contents

Starting point



1 Limit the open sides of your workspace

2 Use a different accent colour in your workspace.

3 Limit what you can see of your relaxation area

4 Use your work setup only for work and study.

Inspiration

The previous tips are a great starting point to improve your ability to work from home.

These tips can be divided into two aspects (as illustrated in figure 1);
- The area bordering your work space (physical barrier),
- The area inside your work space (visual distinction).

When combining tips from both aspects you can create a space which is perceived differently from the rest of your room. And you can enjoy the benefits which you would normally experience from a second room.

The following pages provide background information into these aspects and more inspiration on how to implement these tips.

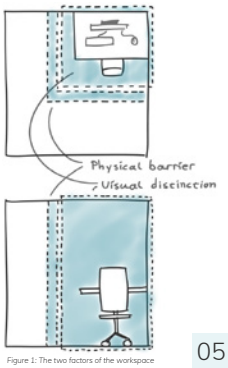


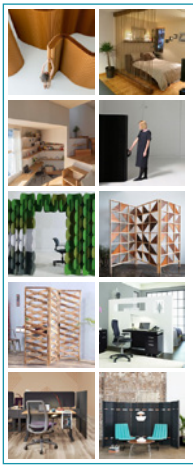
Figure 1: The two factors of the workspace

Physical barrier

A physical barrier marks the border of one space to another. It can be permanent, such as a bookshelf, or a temporary construction with a movable wall.

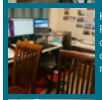
By creating a (temporary) physical barrier around your workspace, the perception of the environment might change by altering the proportions and form of the space (Bakker, 2014).
Furthermore, we might benefit from the location updating effect (Radvansky, 2011), where we more easily forget things when we move between spaces.

Figure 2: Inspiration for physical barriers

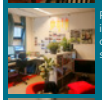


Examples:

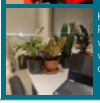
A very cheap (€10) and easy to build barrier can be used to mark the border of your workspace, and also act as a door to your workspace.



Keep it simple!
Placing one or more chair around your workspace can help you divide your room.



Rearranging the furniture in your room can help to create the perception of a second room.



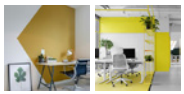
Keep it simple!
Placing plants around your workspace can be an easy way to divide your space and create a nice view.

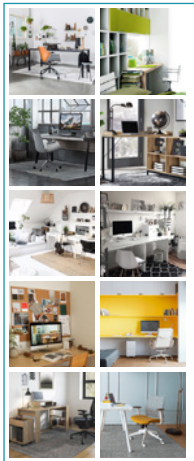
Visual distinction

A visual distinction marks the area inside a space, and acts as a reminder that you're inside a different area. These can be temporary, such as coloured light. Or permanent when you paint the walls.

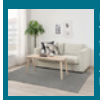
By changing the space itself, it might be perceived as a different place with its own emotional profile (Csikszentmihalyi, 1997) which links your actions to a space or area. While also reducing the effect of the interactional past (Miligan, 1998) which consists of the precious associations with that space or area.

Figure 3: Examples of visual divisions

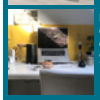




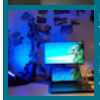
Examples:



Keep it simple!
You can place a carpet on the ground to mark your workspace.
A cheap (€15) carpet could be the IKEA TIPHEDE.



Placing an accent colour around your workspace can be an easy way to view your workspace differently.



Keep it simple!
You can use a coloured lamp, and use a colour setting (e.g. blue) when working in order to associate that colour with work.

Moving your desk to a different part of your room to reduce the effect of your previous associations

Ergonomics

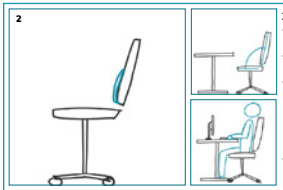
Lastly, it is also important to check the ergonomics of your workspace. Since it will take quite some time before it is possible to work full-time at the university again.

A few small adjustments can make a big difference in your ergonomic setup. And depending on the tasks you perform, you can prioritize the setup of your workspace to facilitate these tasks.

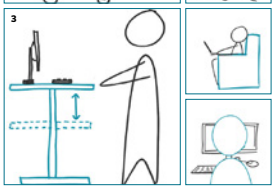
For more information; check:
http://ergo.human.cornell.edu/ergoguide.html

TU Delft students can find discounted accessories at:
https://tudelft.orderitnow.nl/accessories/

1 - Your computer
- Use a separate keyboard, and place it as flat as possible.
- Sit in your chair and hold you arm out horizontally, your fingers should almost touch the centre of the screen.
  Use a laptop stand or stack of books if necessary.
- Avoid direct sunlight shining on your monitor, for example by positioning your desk at a to the window, or by using



2 - Your workspace
- Pick a comfortable chair with good lumbar support
- Set the back rest angle of your seat between 100 to 110 degrees.
- Your desk is at the correct height when your forearms rest horizontally on your desk and your shoulders are relaxed. Keep your arms as close to your body as possible
- Make sure your desk provides a stable working surface.



3 - Your posture
- Your posture is the basis of a good working setup, and should most of all feel relaxed.
- Varying posture is important throughout the day, consider a height-adjustable desk, or a separate space to work standing.
- Make sure your monitor is straight in front of you; this prevents a twisted position.

4 - Other
- Regularly take a break from working at a computer screen.
- The background should be the same brightness as your s
- Limit the influence of the n

4.4 Creative session

Throughout the thesis, the content took shape in the form of a PDF booklet. In order to evaluate the direction of developing a booklet, a creative facilitation session was setup. The goal of this session was figure out which form of the content was best suited to reach students, and help them to improve their home-work environment.
The final result of this session was to create a website to distribute the content.

A creative facilitation session was held with a group of 3 other participants. Which were all in some form involved with this thesis.
During this session, the main focus was on; “How to excite people to improve their home-work environment.”

From this session, the main outcomes are;
- A website is easier to share with friends and other students.
- A website could offer the tools for students to help and inspire each other.

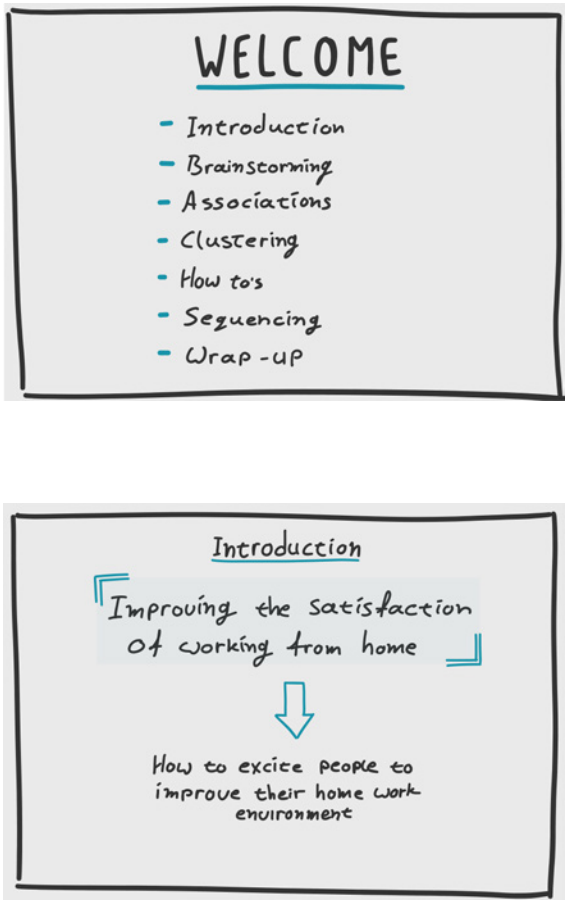
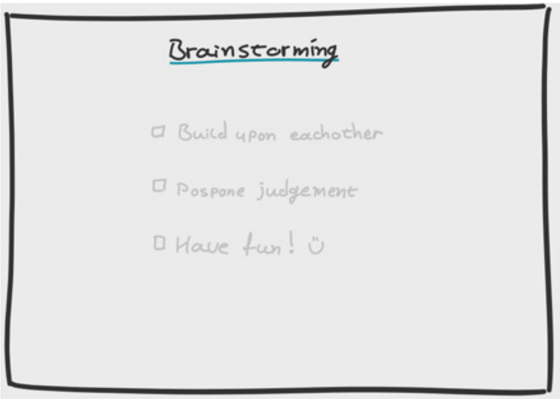
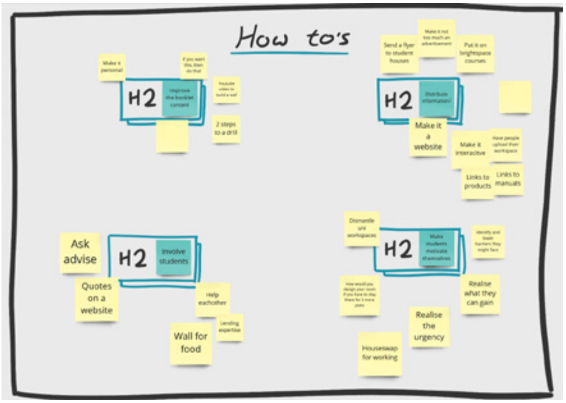
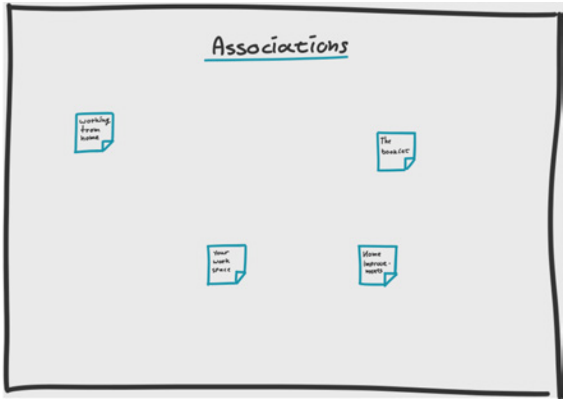
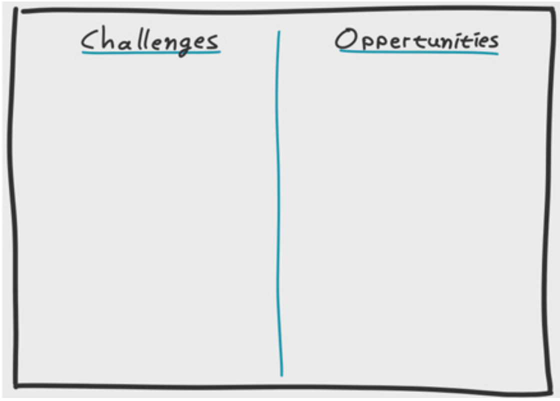


Figure 4.4. An overview of the pages used in the creative session.

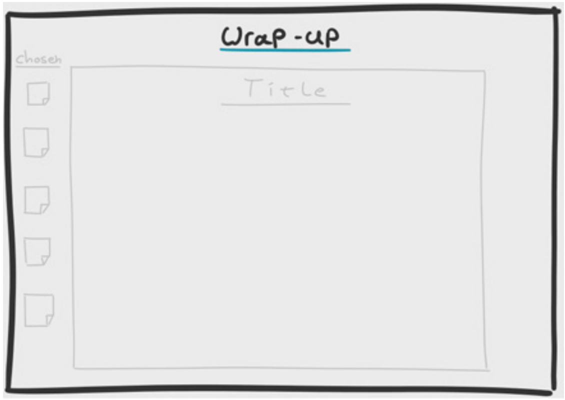

Brainstorming
Build upon eachother
Pospone judgement
Have fun!


How to's
H2
Ask advise
Quotes on a website
Wall for food
Make it a website
Realise the urgency
Realise what they can gain


Associations


Challenges
Oppertunities


Simplicity
Providing means
Personal advice
Make it a course
start to improve
Accessoires
Digital
app / website
Youtub how to video
Student related
When
Using pictures
pop ups
unhealthy work habits
planner


Wrap-up
Chosen
Title

4.5 The website

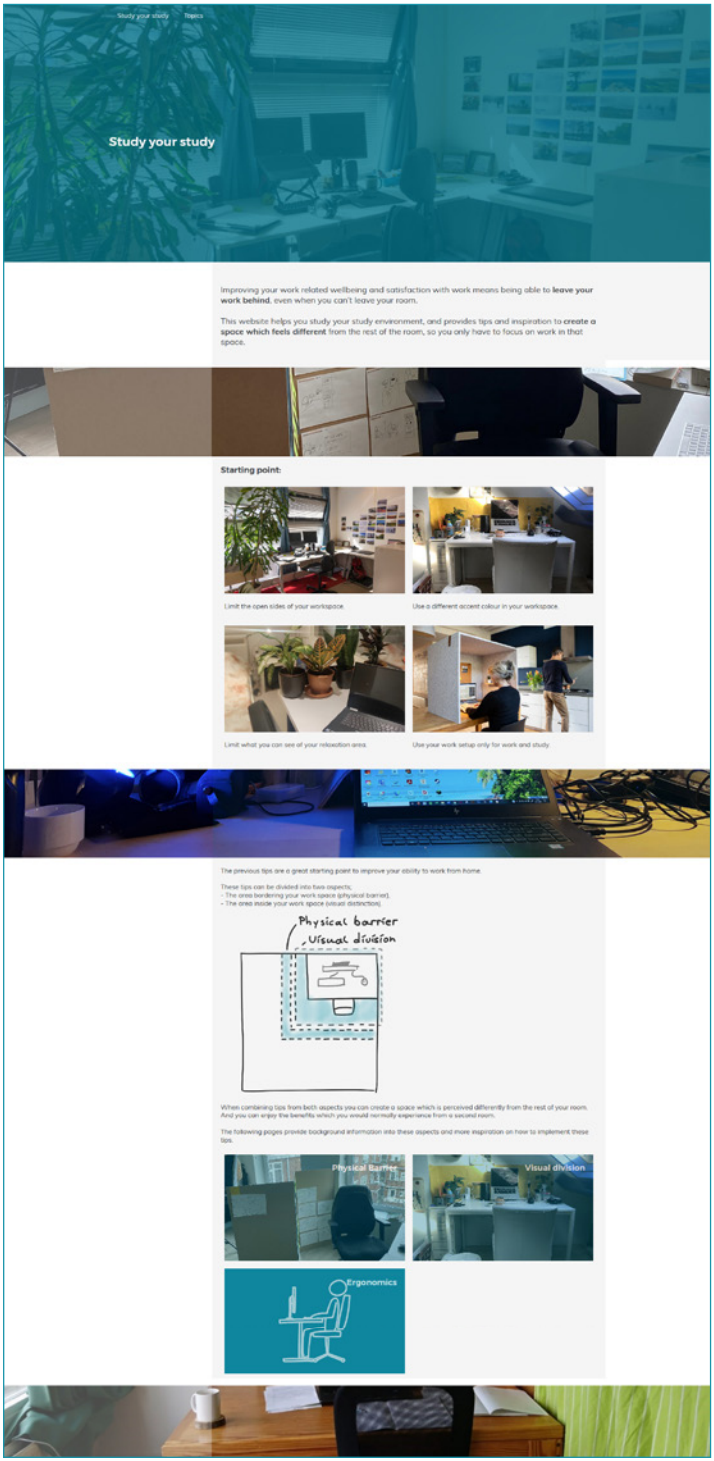
From the creative facilitation session (chapter 4.4), a continuation of the content through a website was recommended, this website can be seen in figure 4.5. This would make certain aspects easier, such as the distribution, sharing of new interventions, and linking to modifications. Additionally, a website would be easier to keep up-to-date and to make sure all who are interested can see the latest version. This chapter shows the evaluation of the website through interviews and quantitative data. The quantitative data was gathered through a small survey and is used as a comparison to the booklet, on four evaluation areas (clarity, interest, use, fit). In total 2 iterations were performed on this website in combination with 2 evaluations.

The first iteration of the website was used to gain an understanding of the interaction and flow of the website.

The first evaluation was performed with 12 participants. All completed a survey, and 8 also participated in a small interview. The main feedback from this evaluation was that some links unexpectedly brought the viewer to a different site, which was linked to an unclear structure of the main page. During 3 interviews the participant was asked to describe a website structure for the booklet, and all 3 described the current setup of pages.

The feedback of the evaluation was incorporated by showing pictures full-screen when clicked upon, with a link when applicable. And changing the structure of the first page, with links towards the other pages near the top.

The second evaluation consisted of a survey with 3 participants. This feedback mainly focussed on the clarity of the website, such as the visual hierarchy and a general complaint of too much text, and a lack of clear headers. Though no complaints were made about how well the content fitted their situation.



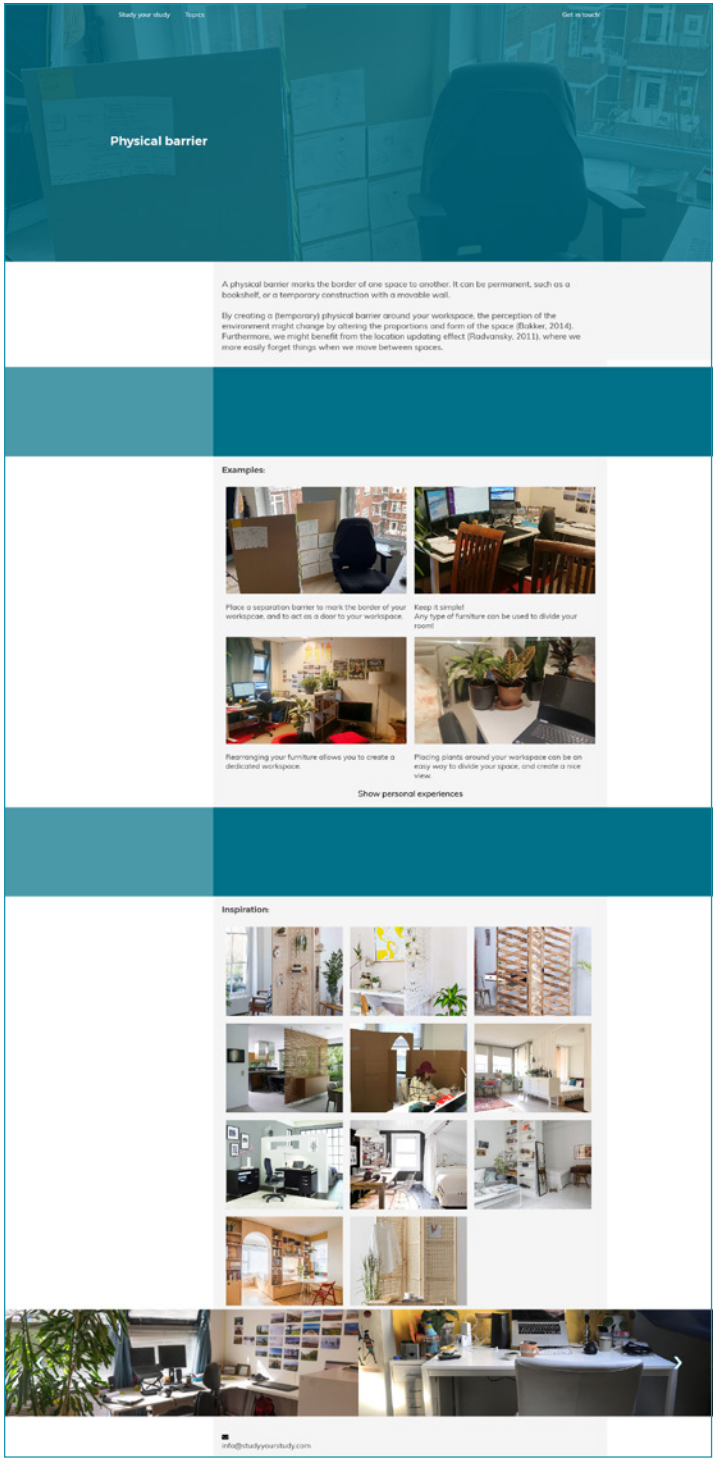


Figure 4.5. The main page, and one sub-page of the website.

4.6 Content evaluation

The content itself was also evaluated and iterated upon. This chapter outlines the steps taken to evaluate the content.
Both the booklet and the website were evaluated with the same criteria; interest, clarity, value and fit.
In total, the content was evaluated at 4 moments throughout this thesis: the ideas, the booklet, and twice the website.

	Interest	Clarity	Value	Fit
The ideas	4.7	6.4	4.2	3.4
The booklet	5.2	5.7	5.3	4.2
The website 1	5.8	5.8	5.7	5.3
The website 2	4.3	5.3	4.0	4.7

Table 4.1. An overview of the four evaluation scores on the four areas of measurement, on a scale of 1 to 7.

The scores of the evaluations can be seen in table 4.1. Overall, the main challenge was to create tips and inspiration for the home-work-environment modifications which fit the single-room-home, and the needs of students.

Going from the first iteration to the first version of the website, all aspects increased in every area.
In these steps, the content was iterated by showing more examples of student rooms and moving away from the inspiration images from the internet.

The last evaluation was performed with 3 participants. However, they mainly gave feedback on the presentation of the content and didn't mention the difficulty of fitting the content to their room. This could be considered a success since the main focus has been on fitting the content to the single-room-home.

5 Action!

In this chapter:

5.1 Generate action

The main goal of this thesis is focussed on helping people in the ongoing COVID-19 pandemic, by giving them the tools to improve their home-work environment.
This and the following chapters focus on the steps taken to approach participants and generate action. The success of generating action is twofold. Firstly through the content reaching a large group of people. And secondly by having a group of participants to evaluate the content. This chapter focusses on the success of reaching students through an Instagram campaign, an article in the TU Delft newspaper Delta, and a website.

Throughout this thesis, multiple outreaches have been made to students, with various success.
The two main outreaches of this thesis have been an Instagram campaign on the TU Delft campus life account, and an article in a series of student wellbeing by TU Delft Delta.

Other attempts consist of hanging posters in student housing, and sharing it in Whatsapp groups. No statistics are known of the success of these approaches. Although the number of participants through these approaches are limited.

The Instagram campaign
The Instagram campaign consisted of multiple stories posted over 5 working days during a holiday week in the TU Delft academic calendar. These posts can be found in figure 5.1.

Per day the stories reached between 2674 and 1116 views. With an average of 1632 views for all stories.
The first stories of the day received the most views, with an average of 1894, and viewership dropped with each consequent story of that day, to an average of 1470 for the last stories of each day.

7 week after this campaign, an evaluation consisting of a poll was posted. This evaluation was seen 1679 times, and 54% marked that they did modify their room. Unfortunately it was not possible to see how many voted in the poll.

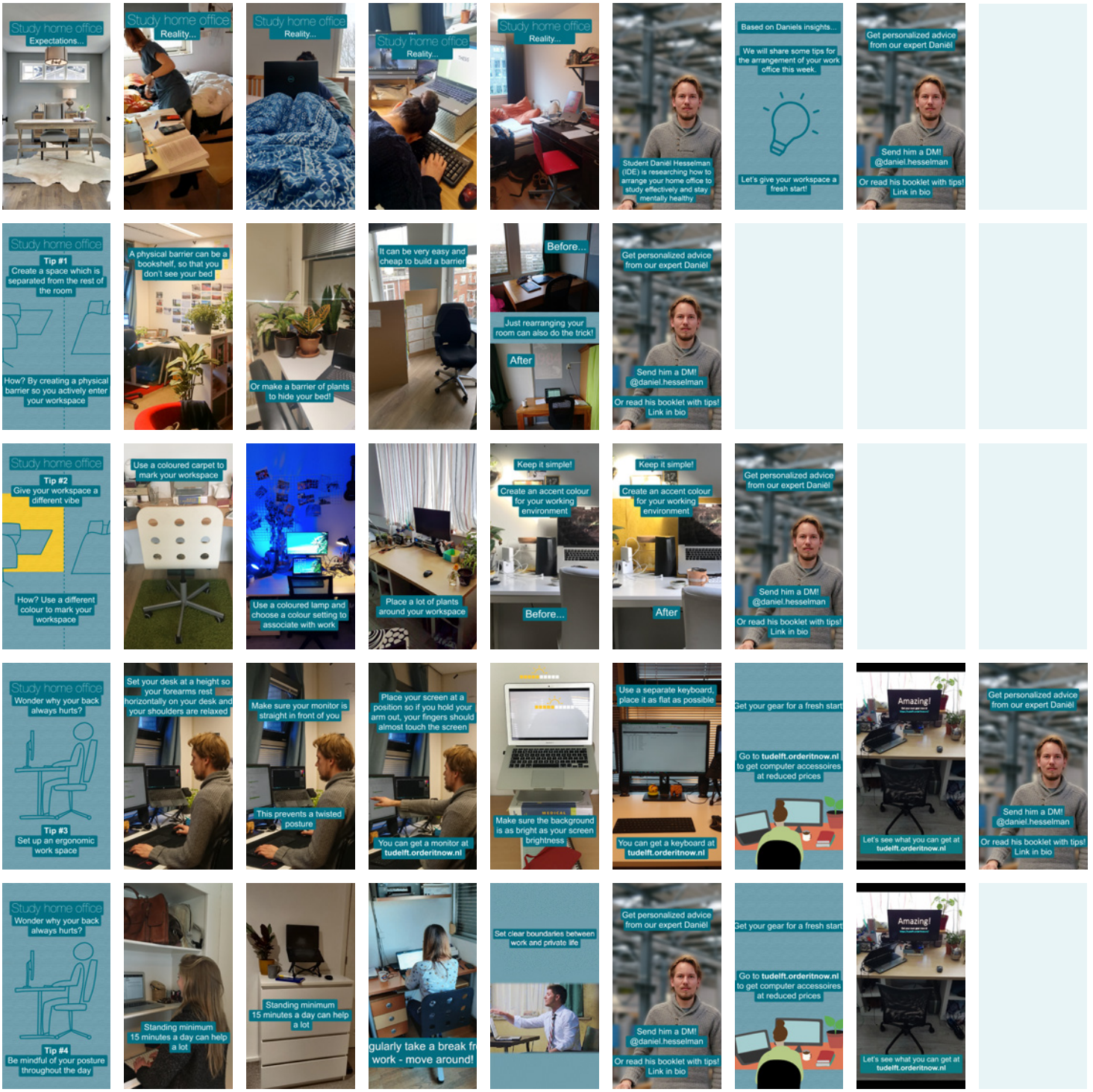


Figure 5.1. An overview of the Instagram posts, each row represents one day.

The TU Delft wellbeing website
Site statistics showed only 3 people clicked the link in the period of 1-1-2021 to 23-2-2021, which corresponds to 1.2% of the page visitors.
Though no information is available on views of the PDF from a direct link, and the Instagram campaign incorporated a direct link.

The Delta article
After the Instagram campaign, I was approached by Delta, if they could write an article on the thesis as part of a series of articles on student wellbeing. The final article can be seen in figure 5.3.

The article was a moderate success for Delta with a total of 926 views (516 for the Dutch version, and 410 for the English version). And an average view time of 59 seconds.

The website
In the period of 1-2-2021 till 22-3-2021 the website studyYourStudy.com received 207 unique visitors, and 336 views.

Total
In total, all activities combined reached 3.936 views.

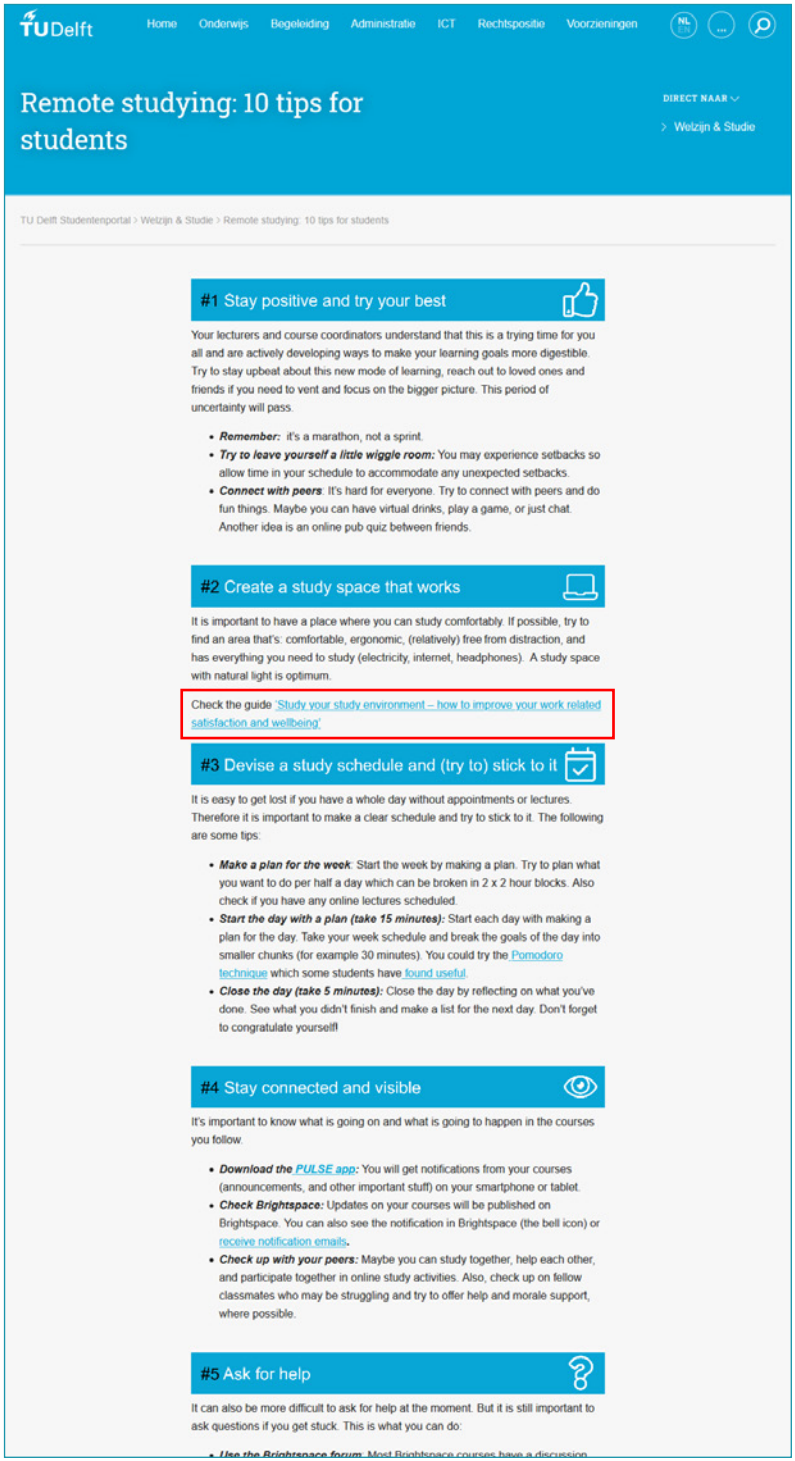
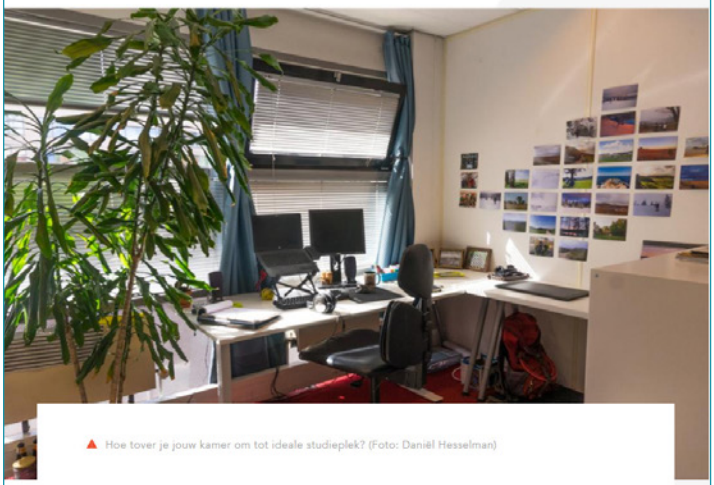


Figure 5.2. The booklet location on the TU Delft wellbeing website.

CAMPUS

19 februari 2021 - 15:30 door Marjolein van der Veldt

Studeren in coronatijd: vijf tips voor een goede studieplek in huis



Hoe tover je jouw kamer om tot ideale studieplek? (Foto: Daniël Hesselman)

Na bijna een jaar online studeren komen de muren inmiddels op je af. Hoe creëer je in een studentenkamer toch een fijne studieplek?

Translation in progress

In een kamer waar je slaapt, eet, films kijkt én studeert, kunnen grenzen soms vervagen. Er is geen onderscheid meer tussen studie en ontspanning en dat kan invloed hebben op welzijn en de productiviteit.

Wat kun je doen om van jouw kamer een prettige studieplek te maken? Dat onderzocht masterstudent Daniël Hesselman (Industrieel Ontwerpen). Zijn belangrijkste advies? "Zorg dat je een duidelijke grens aanbrengt tussen je studieplek en de rest van de ruimte. Je moet je werkdag kunnen afsluiten, zelfs als je je kamer niet kunt verlaten." Zijn bevindingen leiden tot vijf tips, geschikt voor alle soorten studentenkamers, van klein tot groot.

Tip 1: Creëer een ruimte die anders aanvoelt dan de rest van de kamer

Hesselman: "Onderzoek wijst uit dat we makkelijker dingen vergeten als we ons tussen ruimtes verplaatsen. In een studentenkamer kun je dat doen door een fysieke scheiding te creëren tussen je studieplek en de rest van je kamer."

Zet bijvoorbeeld een boekenkast tussen je bureau en bed of bouw, net als Hesselman, een tijdelijke 'muur' van hardboard. "Een goedkope optie, want die hele constructie kostte misschien tien euro." Ook met planten bouw je eenvoudig een 'barrière'. Kies je voor een luchtzuiverende plant, dan zorg je meteen voor een gezonder binnenklimaat.

Tip 2: Geef je werkruimte een andere *look*

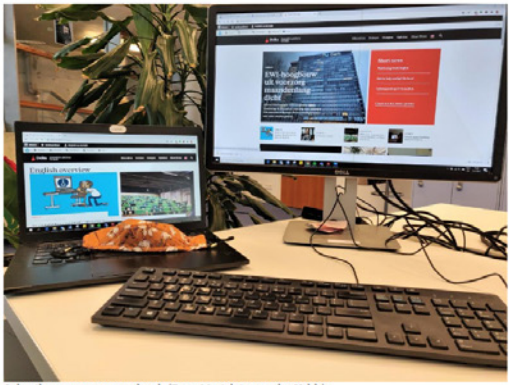
"Door je studieruimte ook van 'binnen' te veranderen, krijg je het gevoel dat je daadwerkelijk in een andere ruimte bent", vertelt Hesselman. "Dit heeft een positief effect op jouw associatievermogen, je herkent de ruimte nu als de plek waar je studeert." Geef je studieplek daarom een likje verf of plaats een van kleur veranderende lamp. Stel de lamp tijdens het studeren in op een vaste kleur, bijvoorbeeld blauw, zodat je deze kleur met studeren associeert. Een andere optie is een kleed op de grond, zo markeer je duidelijk je studieplek.

Geef je studieplek een likje verf. (Foto: Pantip.com)

Tip 3: Zorg voor een ergonomische werkplek

Hesselman: "Omdat het nog wel even kan duren voordat we weer fulltime naar de campus gaan, is het belangrijk dat je studieplek ook ergonomisch goed is ingericht. Met een paar kleine aanpassingen maak je al een groot verschil."

Hij raadt aan een apart toetsenbord te gebruiken en direct zonlicht op je beeldscherm te vermijden. Zorg er daarnaast voor dat je bureau, beeldscherm en stoel zo goed mogelijk op jouw hoogte zijn ingesteld. Bonustip: TU-studenten kunnen tegen gereduceerd tarief online verschillende accessoires als een toetsenbord, muis en laptopstandaard bestellen.



Gebruik een apart toetsenbord. (Foto: Marjolein van der Veldt)

Tip 4: Let op je houding

Je lichaamshouding staat aan de basis van een goede werkplek. Het is belangrijk dat je je houding gedurende de dag verandert, dit kan bijvoorbeeld door staand te werken. "En zorg ervoor dat je monitor recht voor je staat, zo voorkom je een gedraaide positie", waarschuwt Hesseman.

Figure 5.3. The published article on the TU Delft Delta website.

6 Evaluation

In this chapter:

6.1 Research setup

Throughout this thesis, steps for evaluation were taken to measure the impact of the provided tips and inspiration. This chapter provides an overview of the various methodologies and the iterative process of the research setups, to find participants for the studies.
The research setup has been continually simplified to reduce the barrier of entry for the participants. With a final research setup consisting of a single survey after the modification(s) have been implemented.
Two successful research attempts have been identified in these online times, closely guiding the participant and creating a meeting to explain each step. And giving a single survey to be completed afterwards.

To measure the effectiveness of the different home-work environment modifications on increasing the satisfaction of work, the content was evaluated on three areas; satisfaction with working from home, mental energy level when working, and the ability to separate work and private life.
The participants were asked to rate these areas on a 5 point scale (Much lower, Lower, Equal, Higher, Much higher), in comparison to before implementing a modification.
The methods used to gather this data were; surveys, ESM (experience sampling method), and interviews.

Surveys
A survey was used as a research method with a low barrier of entry. All surveys took less than 10 minutes to be completed. They were used before and after implementing a modification in the home-work-environment.
For the closure of this research, one final survey was created which could be sent out to everyone who had been in contact with the booklet. This research is further explained in chapter 6.2.

ESM - Experience sampling method
The ESM was used to measure the experience of working from home through a very short survey (1 to 2 minutes), which is to be completed 3 times a day, throughout 3 to 5 working

"To what degree do the proposed home-work environment modifications improve the satisfaction to work from home?"

days.

Robertson & Cooper (2011), and the model of Van der Voordt and De Been (2010) shows the influence of factors such as; personal characteristics, structure and clarity, and support. The research in appendix A2 identified similar clusters related to satisfaction of work, these are engagement, structure and separation.

In the ESM survey questions are included which aim to identify the effect of these factors by asking; if they're motivated, if the task is clear, if they could choose the tasks, and if they feel an external pressure to complete the task.
Unfortunately, only a single participant completed the ESM surveys.

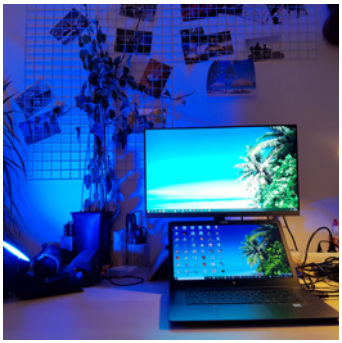
Interviews
Interviews were used to gain insights into two areas; the experiences of using/fitting the modifications of the content to their room and how they would rate it on the four areas of measurement, and secondly their experience of working in their home-work environment after applying a modification and the change in the three areas of interest.
The interviews were semi-structured and focussed on gaining personal insights, struggles, and motivation.

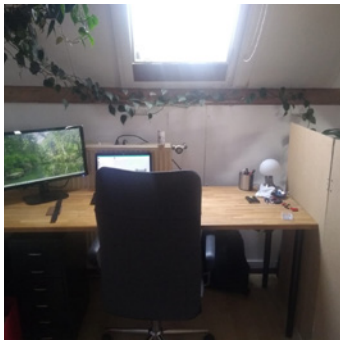
Participants
At the start of the evaluation process of the booklet, participants who are a student and living in a single-room-home were selected.
Through with the troubles of finding participants. Both criteria have been relaxed, and everyone could participate in the final evaluation.

6.2 Evaluation

This chapter focusses on the evaluation of the home-work environment modifications with the research methods as described in the previous chapter.
Overall, 4 evaluations have been performed with a combined total of 36 participants. All research setups were kept as close as possible to each other with questions overlapping to a large degree, which allowed for an analysis of 36 responses for some questions. Of these, 24 are living in a single-room-home, and 12 in a 2 or more room home. In total, 13 have tested a home-work environment modification.
This chapter first continues on the research as shown in chapter 2.4, then shows the validity of using the ESM for analysis, and closes with an evaluation of the modifications.

Table 6.1 shows an overview of the 4 evaluations.
Overall, the best methods for gathering participants have been; sharing a single survey, and guiding the participants through the process.
A single survey, which can be completed at any moment, allows the participant to find a moment that suits them. While guiding the participant through the process requires them to plan a moment for the research.





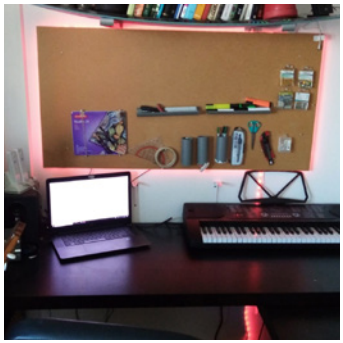


Figure 6.1. An small selection of the different home environment modifications of participants.

Room experience survey

Target group: Students
Modification: No modification
Total respones: 14

Description:
This survey focussed on the experience of working from home, and is a continuation of the research as performed in chapter 2.4.

The main goal of this research was to identified factors of the home-work environment on the satisfaction of working from home. As well as gaining insights into the current satisfaction and wellbeing of students working from home.

No modifications were implemented during this study.

ESM evaluation

Target group: Students
Modification: 3 possible modification
Total respones: 1

Description:
This study applied the ESM to measure the effect of one of three home-work environment modifications.

Before applying a modification, the ESM was completed 3 times a day for 3 days, in order to gain a baseline.

The participants could then chose one modification to implement. And the ESM was competed over 5 more days, and closed off with a survey.

Survey evaluation

Target group: Students
Modification: Booklet modification
Total respones: 5

Description:
As a more accessible method of evaluation, a set of surveys were created.
The first was to be completed before implementing a home-work environment modification, in order to set a baseline.
The second survey was to be completed a week after the implementation.

Participants could freely choose from the booklet to pick and implement a home-work environment modification.

Final evaluation

Target group: Everyone
Modification: Booklet modification
Total respones: 16

Description:
After the success of distributing the tips through the Instagram campaign, a single survey was created to reach the people the booklet also reached. The aim was to create a survey wit a low barrier of entry.

Though a before and after survey would be preferred. It was assumed people would already have implemented a home-work environment modification, and both surveys would then be completed at the same time.

Table 6.1. An overview of the multiple research setups, and gathered participants.

Room experience survey

This paragraph continues and elaborates upon, the analysis as shown in chapter 2.4 since some questions were repeated throughout all surveys. These questions could be analysed over all 36 participants.

This analysis was performed on the three areas of interest, and all factors showed an overall poor score. For example, figure 6.2 shows 81% of participants have a lowered satisfaction of working form home compared to working at the university. And 58% of participants have a poor ability to separate work from private life (figure 6.3. For more graphs, see appendix A5.

Furthermore, the study environment and their overall wellbeing were rated on a scale of 1 to 10. An overview of the score in relation to the different factors can be seen in table 6.2.

Overall, almost all factors correlate to a deviation above or below the average. Only the factors of a dedicated desks correlates to an improved physical study environment, but a decrease in overall wellbeing. This difference is unclear and would require additional research. Furthermore, structure appears to be the most positive factor, and performing leisure activities at the study desk is the most negative factor.

Figure 6.2. The score of 36 participants on their satisfaction of working from home compared to the 'old' situation (the number of participants who score the category is on the y-axis)

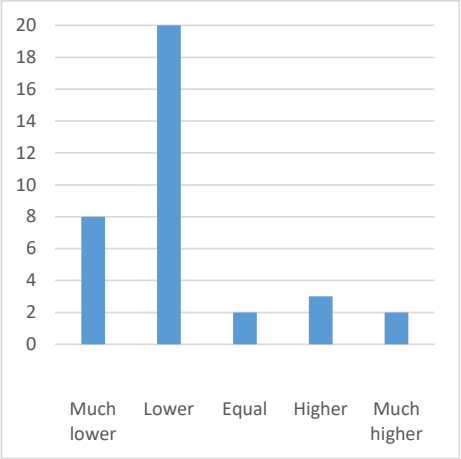


Figure 6.3. The score of 36 participants on their satisfaction of working from home compared to the 'old' situation (the number of participants who score the category is on the y-axis)

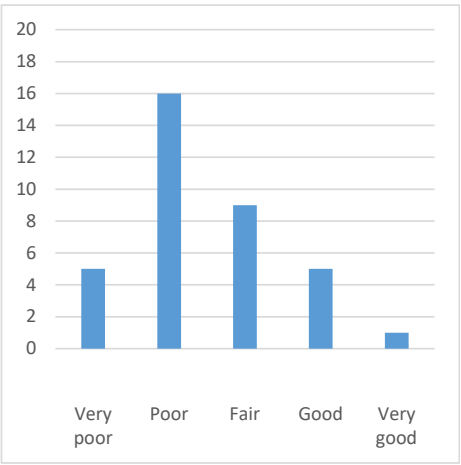


Table 6.2. The average of 30 participants on the rating of their physical study environment and overall wellbeing, over various factors.

	Environment	Wellbeing
I have rearranged my room during corona	6,50	6,50
I have purchased new furniture for my room during corona	6,00	5,89
I have a dedicated desk for working at home	7,14	5,93
I eat and study at the same desk	5,75	5,19
I perform leisure activities and study at the same desk	5,91	5,45
I sleep in the same room as where I study	6,21	5,88
I am motivated in the subjects of my online courses	6,60	6,60
Online courses at the university provide structure	7,50	7,25
I have dificulty separating working/studying from relaxing	5,47	5,00
I am satisfied with my work/life balance	7,14	7,14
My study environment is not ergonomic	5,50	4,60
I am satisfied with my ability to concentrate	6,88	6,75
I physically change the room to work or to relax	6,71	6,43
I have enough space to put the things I need around me	6,38	5,75
Overall (1 to 10)	6,27	6,00

ESM evaluation

Although only one person completed the ESM evaluation. The results were analysed to measure the effect of the separation wall modification and to show the ESM as a valid method of measuring a change in the areas of interest.

Comparing the results from before and after a modification, three interesting factors emerge. The factor of moving furniture increased from 0% before, to 40% after. Which most likely corresponds to moving the separation wall. And an increase of the factor, "I had enough to place the things I need around me", since the wall was being used as an extension of the workspace by hanging notes on it.
Lastly, a general decrease in motivation in the activity; 90% before to 40% after.

Even though the participant was generally less motivated, two of the three areas showed a slight increase. These ratings were translated to a numeric scale (Very poor = 1, Poor = 2, etc), and the averages were calculated. The satisfaction of work increased from 2.6 to 2.9, and the ability to separate work increased from 2.4 to 2.9. Mental energy level lowered slightly from 2.4 to 2.3, however, this decrease might be linked to the decrease in the motivation of the activities.

Figure 6.4. The results of the ESM analysis over multiple data points (x-axis) against the overall **satisfaction** *on a 5-point-scale on the y-axis. (1 = very poor; 2 = poor; etc).*

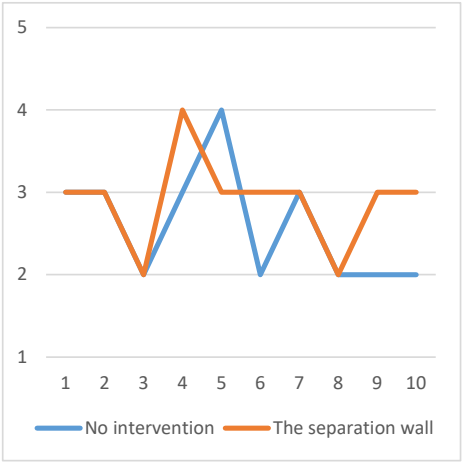


Figure 6.5. The results of the ESM analysis over multiple data points (x-axis) against the overall **mental energy level** *on a 5-point-scale on the y-axis. (1 = very poor; 2 = poor; etc).*

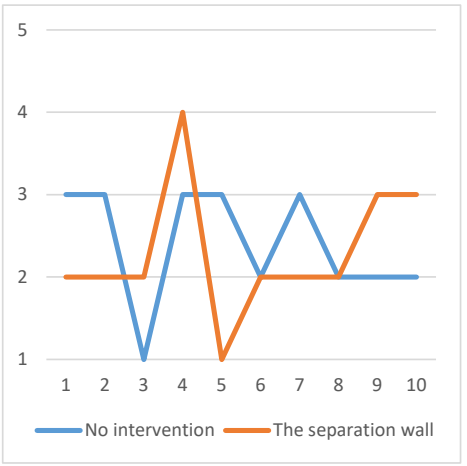
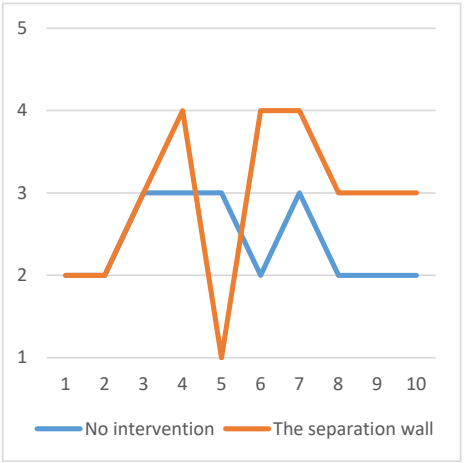


Figure 6.6. The results of the ESM analysis over multiple data points (x-axis) against the overall **ability to separate work and private life** *on a 5-point-scale on the y-axis. (1 = very poor; 2 = poor; etc).*



Final evaluation

In total, the results of 13 participants can be analysed on the effect of the home-work environment modifications. In figures 6.7 to 6.9, the change in the three main areas of interest is shown.
Overall, the largest impact can be seen in the area of satisfaction with working from home, and the ability to separate work and private life. In total, 77% of the participants showed an increase in at least one of these two areas, with 23% experiencing an increase in both areas.
Analysing the difference between different home environment modifications was deemed unreliable, as the participants per modification fluctuate between 1 and 6.

From interviews with 5 of those who implemented a modification, all mentioned they would continue using the modification. Even with an increase in one area which could not be directly linked to the modification. They furthermore noted that using the intervention made their home-work environment feel more official and used to mark the start and end of the day, creating more structure to their day.
Lastly, the most popular home-work environment modifications were all relative easy and cheap to implement, and didn't require a drastic change to the room. (See appendix A6)

Figure 6.7. The score of 13 participants (y-axis) on their change in **satisfaction**, *compared to before the modification on a 5-point-scale.*

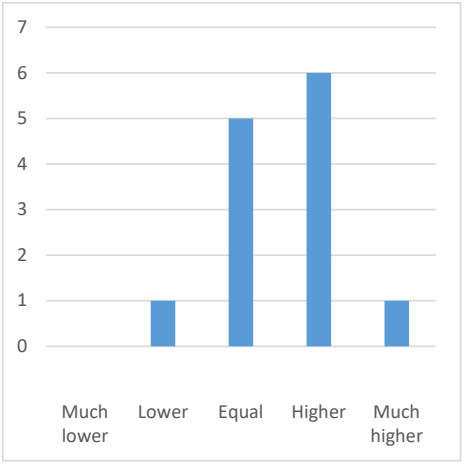


Figure 6.8. The score of 13 participants (y-axis) on their change in **mental energy level**, *compared to before the modification on a 5-point-scale.*

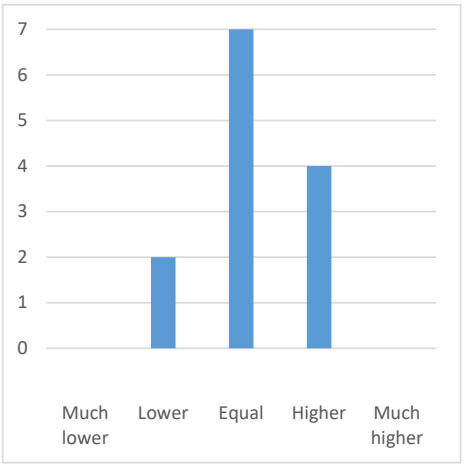
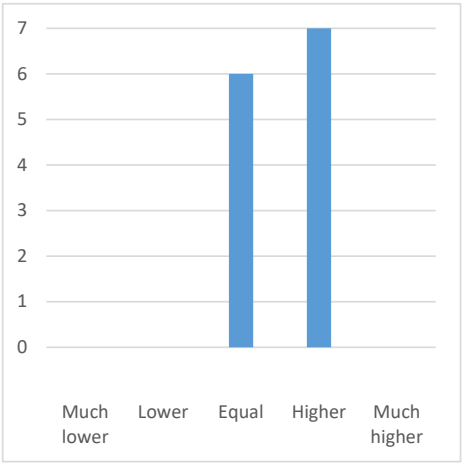


Figure 6.9. The score of 13 participants (y-axis) on their change in **ability to separate work and private life**, *compared to before the modification on a 5-point-scale.*



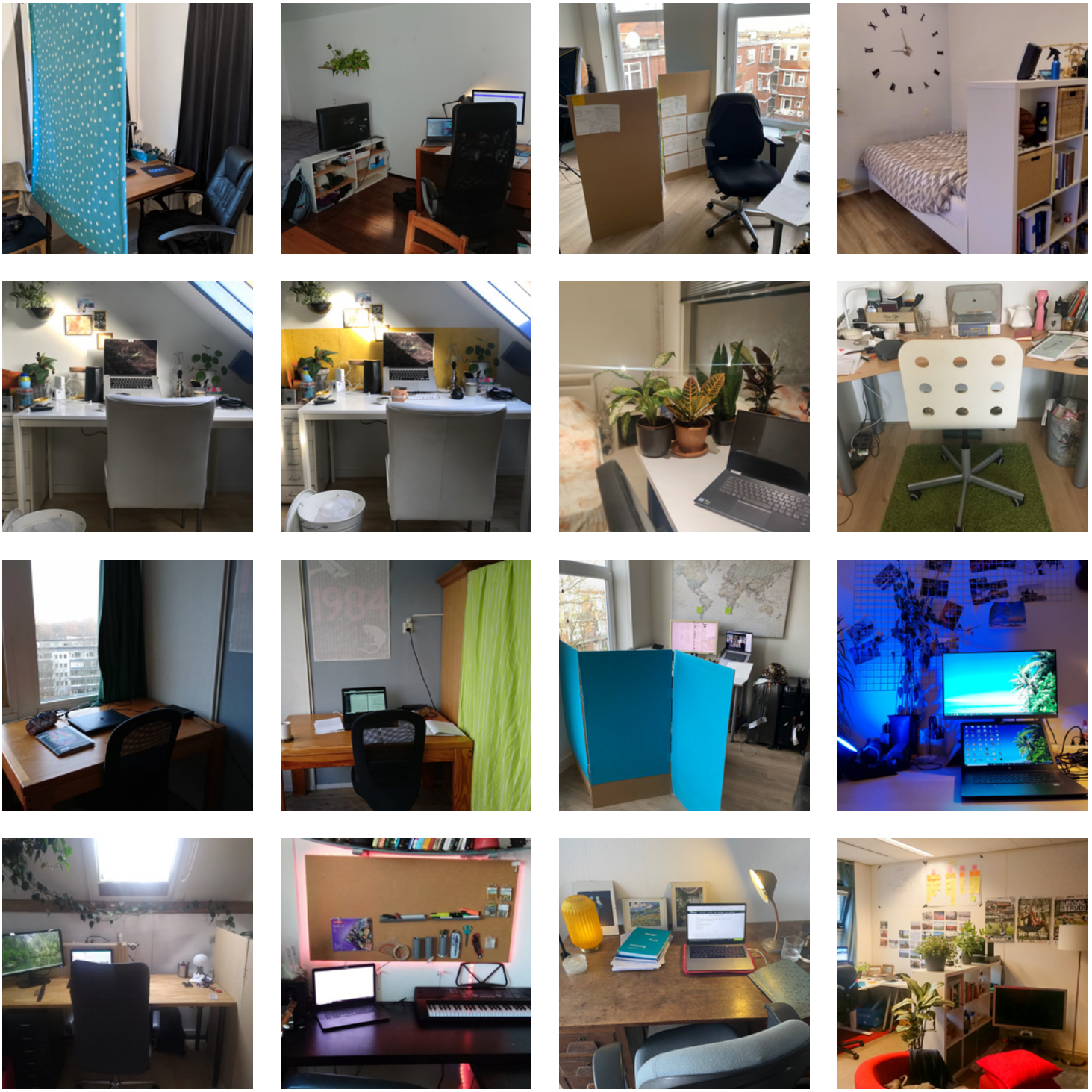


Figure 6.10. An overview of the different home environment modifications, some from participants, and some used as examples.

7 Closing

In this chapter:

7.1 Recommendations

Three directions have been identified in the continuation of this research area; corresponding to a short term, mid term, and long term strategy.
During the thesis, we were in contact with students and staff at the Delft University of Technology from the faculty of Industrial Design Engineering and the faculty of Architecture. In both fields, the knowledge on how the experience of the room influences work-related wellbeing and satisfaction of work seemed lacking. Continuing research into this area would be recommended.

While the ongoing pandemic shows the feasibility of working from home, the knowledge on how to create a home-work environment still seems lagging.
Though the field of architecture has studied the effect of mixing work and private life on the scale of a building or a community, the knowledge on mixing work and private life on the scale of an individual home or single room seems to certainly not get enough attention. This same gap in knowledge might also exist in the field of environmental psychology since no literature was found on the scale of individual housing.

The short term evolution would further iterate on the content, to better fit the single-room-home, and to continue helping everyone who is struggling with their work-related wellbeing.
A midterm evaluation was outside of the scope of this thesis but is valuable for understanding a positive long term effect.
Lastly, for the long term, researching individual factors might bring further insights into the impact of the home-work environment, and how to implement them in a variety of situations.

Short term
In the short term, it's recommended to continue supporting students to improve their work-related wellbeing during the ongoing pandemic and broaden the scope to all employees working from home in single-room-homes. Since it might be assumed companies see the feasibility of working from home, and they might

not return to the office occupancy from before the pandemic.
A further iteration on the content and the distribution can be performed. Continuing to add more examples of home-work environment modifications, incorporating a method to gather examples of those who have implemented a modification, as well as improving the clarity and representation of the examples on the website.

Mid term
A short term evaluation of the home-work environment modifications was performed during this thesis. To more accurately determine the effects of the proposed modifications, a further study of 3 months would be advised since a short term evaluation also measures the mood of the moment. (Robertson & Cooper, 2011).
For a longer evaluation, it is recommended to follow a handful of participants closely and giving them personal guidance. The use of a variant on an ESM study is furthermore recommended. This evaluation would also provide insights into the lasting effects of the modifications since the positive effects might subside after the participant spend some time in the new environment.

This positive change could also be reinforced or reduced by the behaviour of the participant. Creating a separate room for work might only prove beneficial if that space is only used for work. When this room is used in the same way as the rest of the room, the separate emotional profiles might mix again, reducing the benefits. In the short term, these effects are assumed to be of little influence, but they might be of impact over a longer period.

Long term
This thesis focussed primarily on the modifications of the home-work-environment in the single-room-home. Though insights on the impact of the environment on our behaviour might be applied in a broader range of environments. Further research could be performed on the individual factors which influence the perception of a space.
These insights could be used to modify our environments where a form of separation is desirable. In the context of work, for multiple-room-houses, it could strengthen the link between a space and working from home, and for (open-plan) offices it could support the separation between various activities.

Experiments on the individual factors could be based upon the location-updating-effect, as described by Radvansky (2011) which describes

how people might more easily forget things when moving through a door, either physically or imagined. Using this methodology, the separation of spaces might be identified through the degree of participants forgetting things when moving from one place in space to another.

Other directions

Throughout this thesis, the main focus has been on the experience of separation in the environment on our work-related wellbeing. The analyses of chapter 6.2 on the impact of various factors on our overall wellbeing showed the structure of online courses, and motivation, as additional factors which could play an important role.
Expanding research into these areas and broadening the goal of improving work-related wellbeing through structure can also be recommended. Especially the role of structure in the single-room-home can be further investigated. As it's a large factor for those living in 2 or more rooms, though it's absent for all living in a single-room-home, as can be seen in appendix A5.
Furthermore, a combination of structure and the environment can be found in the concept of flow, as described by Csikszentmihalyi.

Discussion

This thesis has identified a possible lack of knowledge on the impact of the environment on the satisfaction of work and work-related wellbeing on a personal level.
The proposed home-work environment modifications showed an increase in the satisfaction of working from home, and the ability to separate work from private life. In figure 7.1, the areas of impact from these modifications are shown in the literature overview from chapter 2.3 in green. The other directions are also shown in this overview, in red.

With the current amount of people working from home and the expected amount of people continuing to work from home after the pandemic, it is advised to continue research into this area.

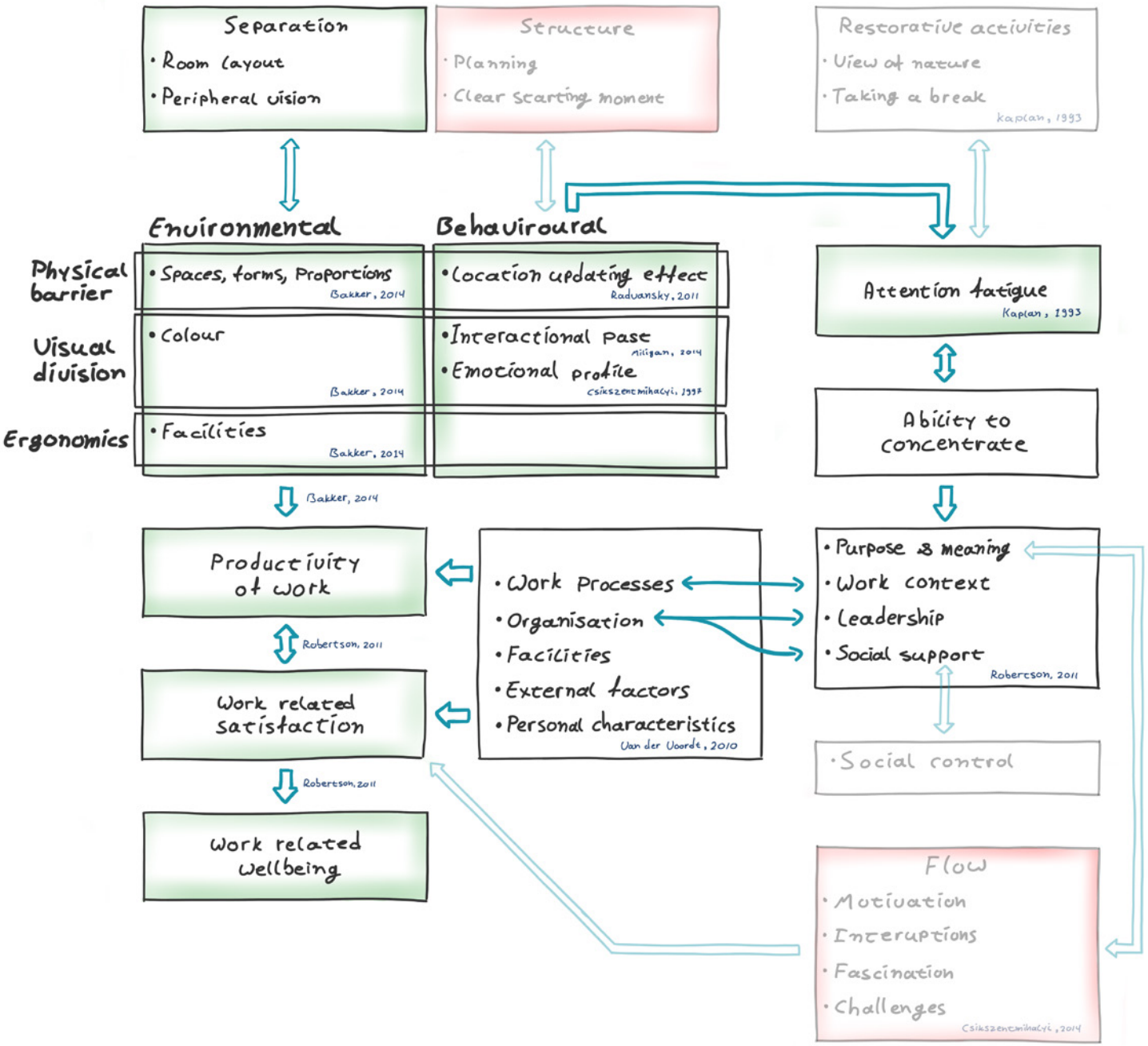


Figure 7.1. An overview of the related topics to this thesis, with the influence of the modifications marked in green. And further directions marked in red.

7.2 Reflection

During one of the first introduction lectures of the master program, it was said the program could also be called 'Design for Impact'. This thesis shows the validity of both names of the program, designing for our interaction with the environment surrounding us, and the impact of reaching almost 4.000 views and helping some to increase their work-related wellbeing.

This thesis has been shaped by the ongoing COVID-19 pandemic. Mainly from the relevance of the topic. Though also the availability of some methodologies, such as the ability to prototype, and the ease of finding participants. The first because of the closure of the hardware stores, and the second since gathering participants through personal contact was found to be the most effective, and something that was lacking during the pandemic.
Furthermore, creating a clear storyline in the activities of this thesis was challenging. From defining the direction and focus, the iterations all aspects of this thesis went through and creating an overall coherence.

It took until at least halfway in this thesis for the direction to become clearly defined. During this thesis, we went with the flow of the outcomes, and decided on the most logical continuation on those, without imposing a strict preference for the course of the thesis. This led to an outcome I would not have expected, but it's one I am proud of.

It has been a very enjoyable project to work on. The experience of working with the supervisory team has been great. The balance between structure and freedom James Lomas and Peter Vink provided helped me overcome the various obstacles, while still giving me control over the thesis, together with good support and motivation!
Furthermore, the topics of the thesis itself combined two areas of interest: ergonomics, and the interaction with our environment. Since most previous projects were in one area or the other, though before this thesis they weren't combined yet.
Overall, this thesis has been a great experience to work on, even when the pandemic isn't taken into consideration.

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A1 Graduation brief

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Hesselman
initials: D.C.N. given name:
student number:
street & no.:
zipcode & city:
country:
phone:
email:

Your master programme (only select the options that apply to you):

IDE master(s): ( ) IPD (★) DfI ( ) SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: ( ) Honours Programme Master
specialisation / annotation: ( ) Medisign ( ) Tech. in Sustainable Design ( ) Entrepeneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Derek Lomas dept. / section: HCD
** mentor: Peter Vink dept. / section: HCD
2nd mentor:
organisation:
city: country:

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

comments (optional): Both supervisors offer valuable insights and perspectives on this project. P. Vink (ergonomics and research into working from home) and D. Lomas (wellbeing). Combined will create a meaningful project

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

TU Delft

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Derek Lomas date - - signature derek lomas Digitally signed by derek lomas Date: 2020.11.26 13:22:33 +01'00'

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 30 EC
Of which, taking the conditional requirements into account, can be part of the exam programme 30 EC
List of electives obtained before the third semester without approval of the BoE

(★) YES all 1st year master courses passed
( ) NO missing 1st year master courses are:

name C. van der Bunt date 30 - 11 - 2020 signature C. van der Bunt Digitally signed by C. van der Bunt Date: 2020.11.30 09:14:16 +01'00'

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: (★) APPROVED ( ) NOT APPROVED
Procedure: (★) APPROVED ( ) NOT APPROVED

comments: - also approved for Medisign - the projectbrief has been submitted much too late, after explanation chair OK

name Monique von Morgen date 07 - 12 - 2020 signature

Initials & Name D.C.N. Hesselman Student number

Title of Project The influence of the home environment on work related wellbeing

The influence of the home environment on work related wellbeing — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 08 - 09 - 2020 — 17 - 03 - 2021 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

During the current COVID-19 pandemic, students and employees of all ages have to work from home. However, their home situation might not be optimized for this type of work. Of course, working from home is not new, but this time the preparation time was limited.

From previous research we learned that work satisfaction is lower compared to the 'old' situation of working at an office or university. Where one of the main factors related to this lowered satisfaction consists of living in a single-room-house. In houses with more rooms the problem seems to be less pertinent.

A topic for research on this lower satisfaction might be the decrease of the influence of the home environment on the psychological state of mind. As home environments might have a unconscious influence. Where the office or university might create an atmosphere that set the mind in a state of work, the single-room-home emits a multitude of signals which could confuse the brain. Furthermore leading to an decrease in wellbeing.

This graduation project aims to continue this research into this decrease in satisfaction of working from home, within this context of single-room-houses to create a meaningful design or intervention.
Furthermore, since the problem is present today, the focus will be on a design that can be implemented on the short-term, and make use of the current technology.
Another challenge for an intervention of this graduation project will be to stay confined to the boundaries of a single-room-house.

This project can be summarized into the following question; how does the home environment influence students work-related behaviour in the context of single-room-homes where work and relaxation becomes increasingly mingled (and its effect on the wellbeing and satisfaction of working from home).
Which will then be used to design or recommend an intervention which should increase the satisfaction and wellbeing of working from home.

The single-room-home is defined as a home where realistically there is only a single room available to work from.

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introduction (continued): space for images

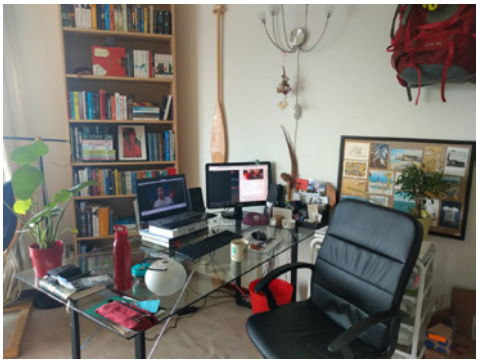


image / figure 1: The context of working from home, working at the only table available

image / figure 2: A floor plan of a single-room-home from DUWO (Korvezeestraat, Delft)

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The main goal of this project will be to improve the wellbeing of people, together with the satisfaction of working from home.
One of the factors related to the wellbeing is the lack of a barrier between work and relaxation. As such, this project aims to increase wellbeing through an increase in the barrier between work and relaxation.

This project includes, but is not limited to, the following steps;
- Research on how product or spatial affordances influence behaviour, as well as the ergonomic effects of these products or the room layout.
- Interventions through design and rituals will be considered as solutions.
- A company might be approached for implementation.

This project will limit its cope to single-room-houses. As from previous research this situation proved to be most problematic for working from home. Although this project will not limit its scope based on age-groups, it might be excepted that this target group will consists mostly of younger people.
Additionally, this project will focus on the problems identified with working from home in The Netherlands along with the work-culture in The Netherlands.

The project will be considered successful when there is an improvement in the satisfaction of working from home compared to working at an office or university.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Improve the wellbeing of people who have difficulty separating work from relaxation. Through research on the influence of products and the immediate surrounding on the work related behaviour in a single-room-houses to design an intervention that improves the working from home situation, and consequentially the wellbeing.

Two directions are identified as an approach to the assignment above:

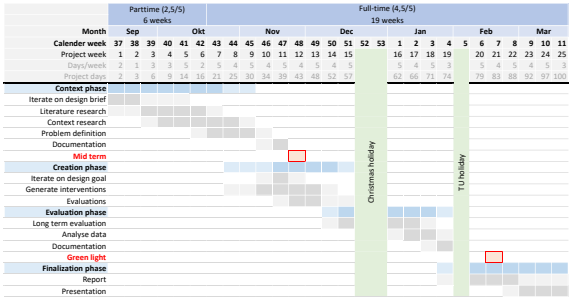
A focus on research in order experiment with the possibilities of simulating behaviour based upon nearby products and the room layout of single-room-homes. Where most influential factors will be identified and used as a basis for recommendations of working from home.
A system will be set up to share the most significant factors on how to separate work and relaxation.

A focus on an intervention for reducing the mixed signals coming from the single-room-home-environment. Which should furthermore increasing the barrier between work and relaxation. Either through a modification of the physical space, or through an action or ritual to mark the boundaries of work.

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 8 - 9 - 2020 17 - 3 - 2021 end date



Context phase – learn the context of this graduation project from literature, interviews and experts.
- How people work from home
- How products influence behaviour
- Is there a change in mental energy expenditure of working from home

Creation phase – Build interventions to create the desired separation.
- Test desired methods that could influence the perception of a space
- Create a full-scale intervention to be used for evaluation

Evaluation phase – Evaluate the impact of the interventions
- Setup a (long-term) test for evaluation
- Evaluate the tests, and propose further improvements

Finalization phase – Closure of the project
- Wrap-up the project, though analysation, documentation, and writing of the report
- Create a final presentation.

For this project I will use the following methods to keep track of my tasks and progress.
The Gantt chart above is the top-level planning, which will be updated and adjusted, if needed, at the start of every phase. From this, a to-do list will be created that shows the most important next steps, and to keep track of progress. This to-do list will furthermore be used to plan a week in a physical to-do agenda.

Personal Project Brief - IDE Master Graduation

TU Delft

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

Technical prototypes
During my studies I've always enjoyed the prototyping together with embedding programmable functions into these prototypes. In this area I would like to further expand my knowledge and experience.
Though it's possible to use wearables and phone applications as means to grab the attention of the user, my personal preference is to design physical objects that just works, and where minimal direct input from the user is needed. And that feels intuitive to use.

Contact with the users
Through my studies I've relied on users for testing and interviews, though I feel that my involvement of these users in the project is still subject to improvement.
The learning object will be to further improve the relation with the users. E.g. through mailing lists to keep participant updated on the project, or otherwise create informative visuals to more easily convey the research to participants.

Furthermore, other means to keep participants more involved is to use the knowledge I gained from the DFI course context and conceptualization, as well as the skill of create facilitation (CF) from the CF elective course.

FINAL COMMENTS

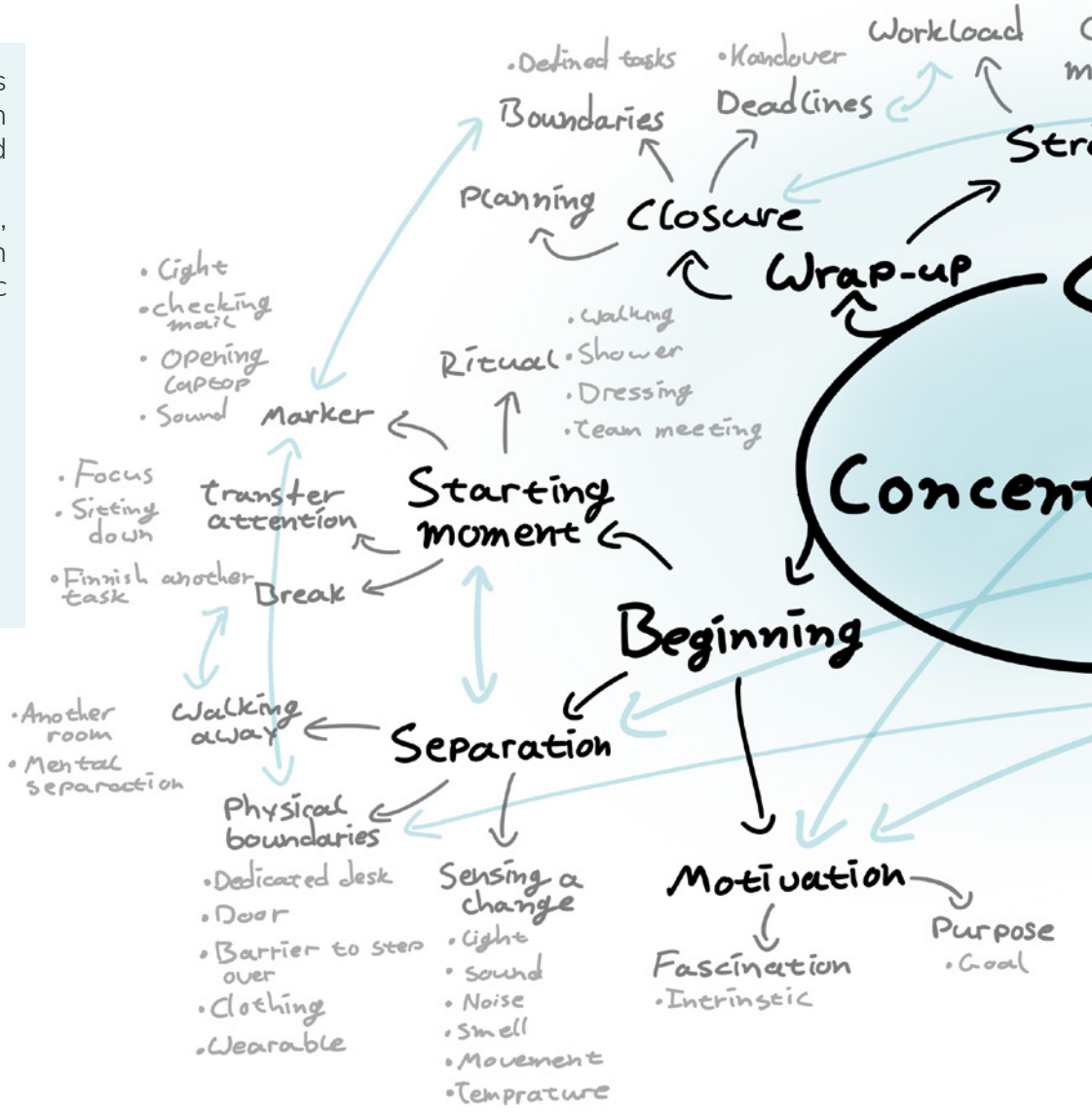
In case your project brief needs final comments, please add any information you think is relevant.

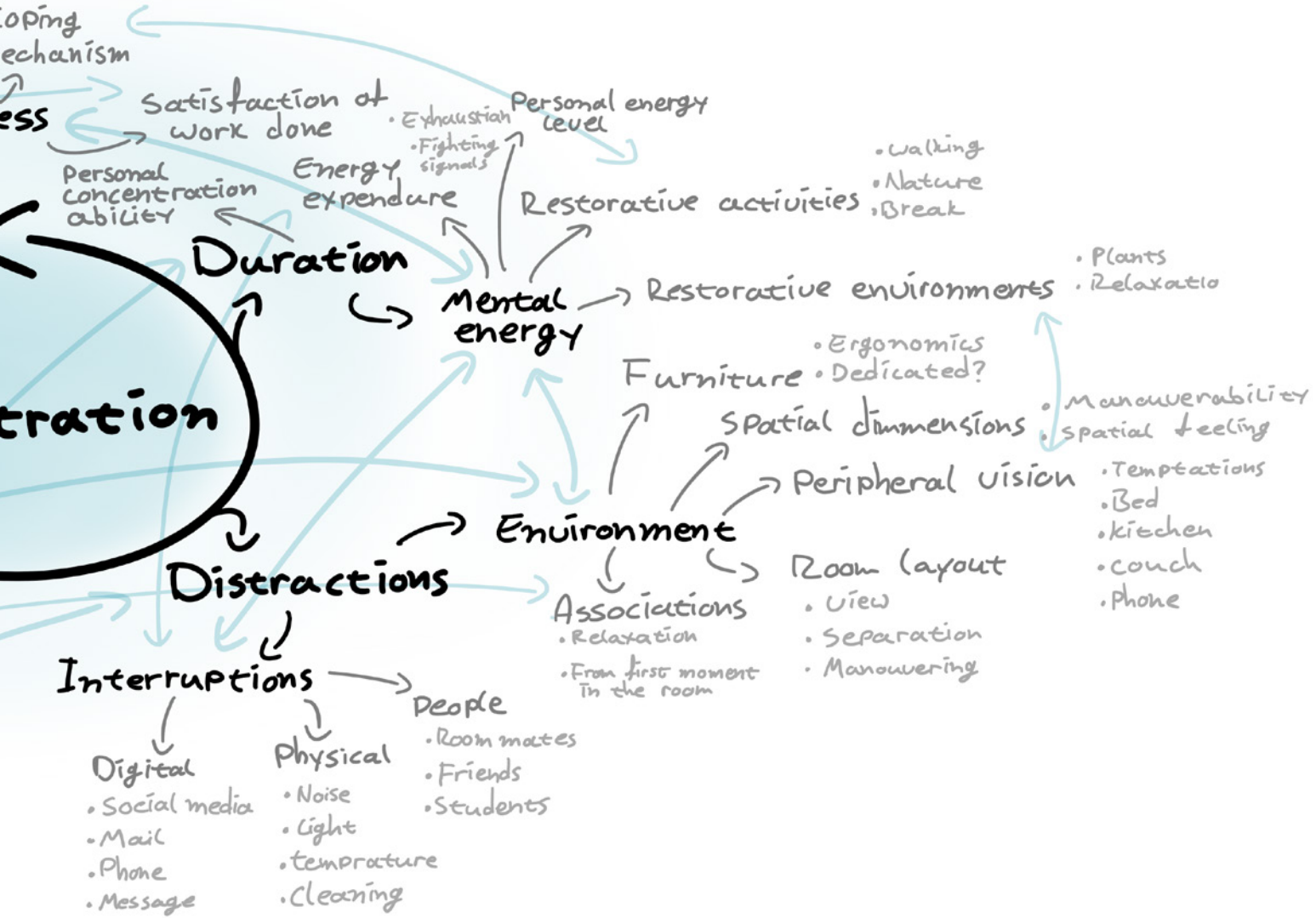
Initials & Name D.C.N. Hesselman Student number

Title of Project The influence of the home environment on work related wellbeing

A2 Concentration

The figure on the right shows an overview of a first version of the thesis topics, focussed around concentration.
This direction was explored, though no further action was taken on the specific area of concentration.

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Restorative environments
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Furniture
Dedicated?
Manouverability
Spatial dimmensions
Spatial feeling
tration
Peripheral vision
Temptations
Bed
kitchen
couch
Phone
Environment
Distractions
Room layout
View
Separation
Manouvering
Associations
Relaxation
From first moment in the room
Interruptions
People
Room mates
Friends
Students
Digital
Social media
Mail
Phone
Message
Physical
Noise
Light
temprature
Cleaning

A2 Concentration

From the overview of the previous page, a simplified version was created (see figure A2.1). This version was used as a tool for discussing the working from home situation during COVID-19 with 10 participants in qualitative interviews.

From these interviews, four clusters of needs were identified. These clusters are; engagement, structure, separation, and ergonomics.

Interviews of 20 to 40 minutes were conducted with 10 participants in order to learn how they cope and in which areas they struggle in the context of the ability to concentrate when working from home. These participants were all either students, or living in a single-room-home, or both.

Furthermore, a questionnaire was sent out to participants of a working-from-home challenge. Where 11 participants, mostly employed, filled out the questionnaire.

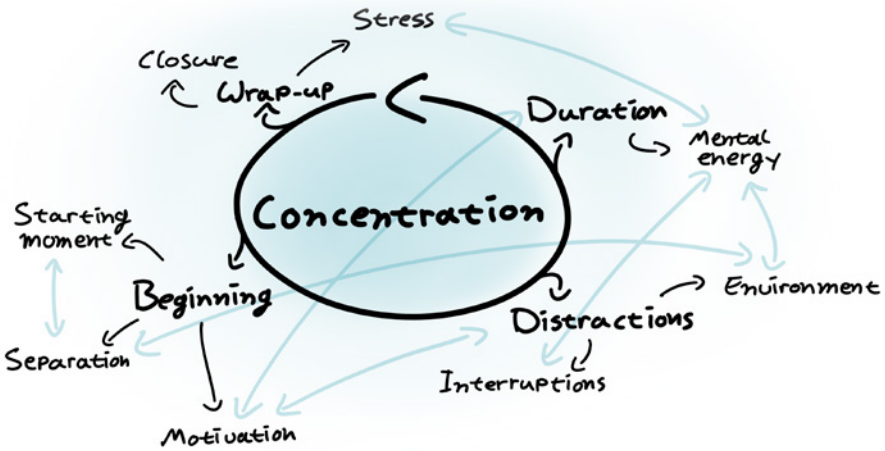


Figure A2.1. An simplified version of the created concentration model.

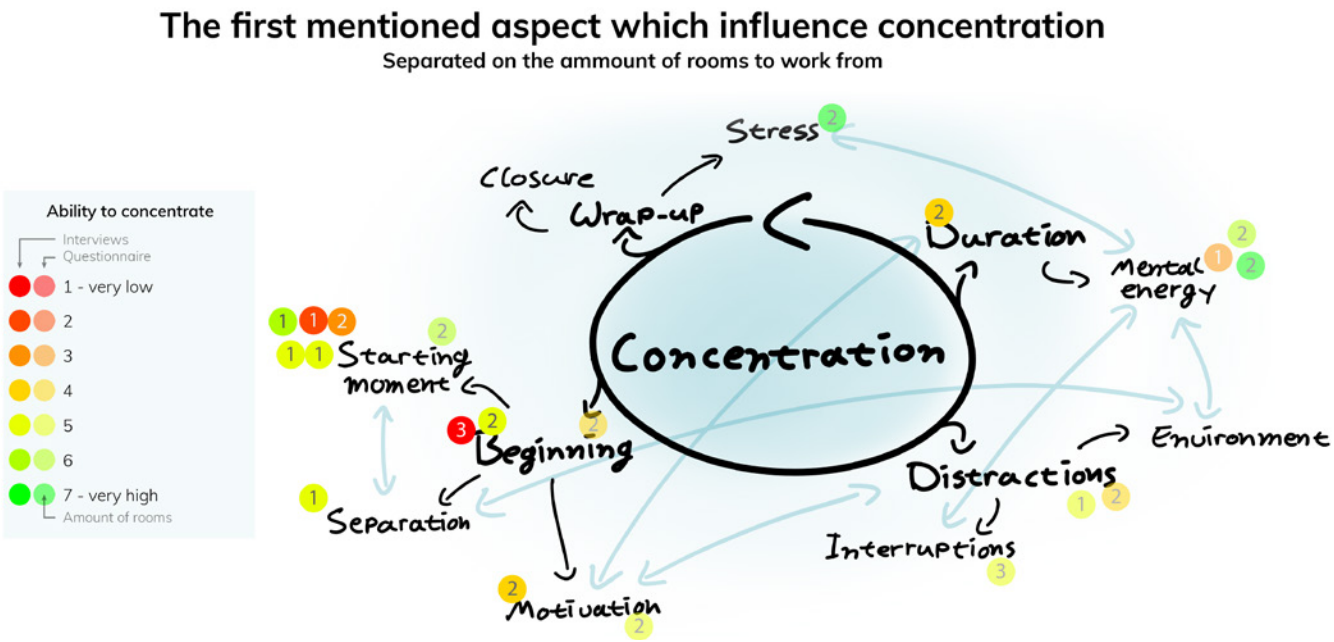


Figure A2.2. The first mentioned aspects during the interviews on concentration.

A clear division can be seen between the answers of the interviews and the questionnaire.
The students of the interviews mostly perceive the start of work to be the biggest bottleneck for the ability to concentrate.
While the participants perceive distractions and the mental energy to continue working to be the main bottleneck in the ability to concentrate.

This might be attributed to the morning stand-up meetings common in the working environment. As well as the possibility that employed have a clearer structure to their day with the assumption they work the standard office hours.

From the student interviews, clusters of needs can be created. These are a need for; engagement, structure, separation and ergonomics.
The need for engagement and structure is also found in the literature of Csikszentmihalyi (1997) as he describes we need goals and motivation in order to focus our psychic energy.

A3 Student rooms

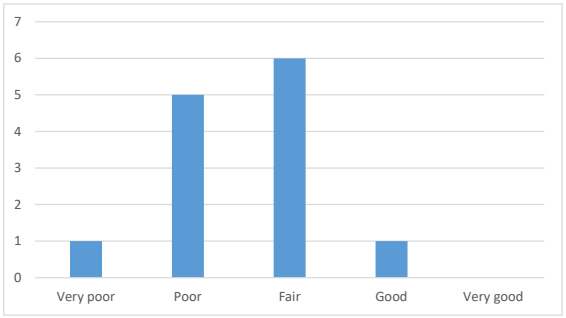


Figure A3.1. The score of 12 participants on their overall satisfaction of working from home (the number of participants who score the category is on the y-axis)

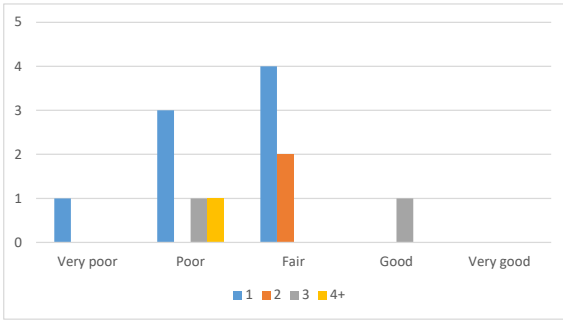


Figure A3.2. The score of 12 participants on their overall satisfaction of working from home (the number of participants who score the category is on the y-axis), divided over the amount of rooms available to work from (x-axis; 1= one room, 2= two rooms, etc).

When analysing the general satisfaction of working from home, a slightly more optimistic graph can be seen in comparison to the graph in chapter 2.4. With a majority of the students noting their satisfaction as fair or low.

Separating the general satisfaction over the amount of rooms the participants can work from is shown in figure A3.2. All students which have to work from home in a single room find their satisfaction to be at least lower.
A minimal response from students in the category of 2 to 4+ rooms is to be expected, as most students that were approached live in single-room-homes.

	General satisfaction																			
	Very poor				Poor				Fair				Good				Very good			
	Amount of rooms availible to work from																			
	1	2	3	4+	1	2	3	4+	1	2	3	4+	1	2	3	4+	1	2	3	4+
I have rearranged my room during corona.	0%	0%	0%	0%	33%	0%	100%	100%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I have purchased new furniture for my room during corona	0%	0%	0%	0%	33%	0%	100%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I have a dedicated desk for working at home	0%	0%	0%	0%	33%	0%	100%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I eat and study at the same desk	0%	0%	0%	0%	67%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I perform leisure activities and study at the same desk	100%	0%	0%	0%	100%	0%	0%	0%	75%	50%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%
I sleep in the same room as where I study	100%	0%	0%	0%	33%	0%	0%	100%	25%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I am motivated in the subjects of my online courses	0%	0%	0%	0%	33%	0%	0%	100%	25%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Online courses at the TU Delft provide structure	0%	0%	0%	0%	0%	0%	100%	100%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I have dificulty separating working/studying from relaxing	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I am satisfied with my work/life balance	100%	0%	0%	0%	0%	0%	0%	100%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
My study environment is not ergonomic	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I am satisfied with my ability to concentrate at home	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I physically change the room to work or to relax	0%	0%	0%	0%	33%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
I have enough space to put the things I need around me	100%	0%	0%	0%	67%	0%	0%	0%	75%	50%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%

Table A3.1 The responses on different home work environment factors (y-axis) grouped on their general satisfaction with working from home (x-axis), and further divided over the amount of rooms available to work from (x-axis; 1= one room, 2= two rooms, etc) shown as a percentage of responses of that x-axis.

In table A3.1, an overview of the responses to the multiple-choice questions can be seen. The participants could select all applicable statements. The response of the choices is divided over the general satisfaction of working from home, and further divided on the amount of rooms the respondents can work from. The percentage of responses in a particular category is shown. For example, 100% of the participants who have a very poor general satisfaction, and who live in a single-room-home, perform leisure activities and study at the same desk.

Though caution should be taken when making claims from this graph, as table A3.1 shows only 1 participant has a very poor general satisfaction (and lives in a single-room-home).

A4 First impressions

The ideas as shown chapter 3.2 were distributed among students in the form of a PDF idea booklet, which can be seen in figure A4.3. This PDF was used to gather feedback on the proposed ideas, and recruit participants for evaluating these ideas.
In the PDF, the participants could fill-out questions embedded into the PDF, as well as select a checkbox next to the ideas they were interested in testing.

In total, only a single prototype was send out (the separation wall) since the thesis changed course away from prototyping, and towards proving tips, inspiration, and instructions to the students themselves.

The booklet was filled out by 11 participants. All are students at the TU Delft.

The open answers on how the participants might improve the idea, and their open answer on their reasoning on why they would or wouldn't want to test the ideas, were analysed by counting how many times a certain topic was mentioned. The three most mentioned factors were;

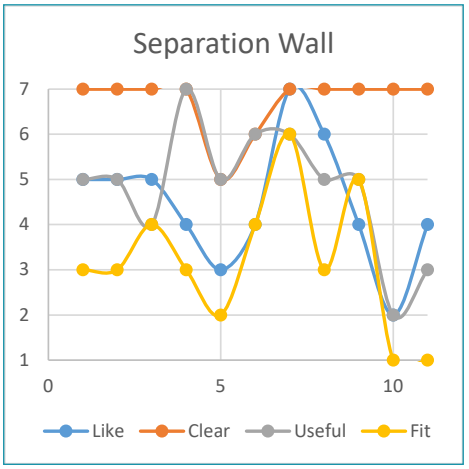
- It should be easy to (dis)assemble
  (Mentioned 15 times)
- The idea seems to large to fit in the room
  (Mentioned 13 times)
- The product should fit the room layout better
  (Mentioned 18 times)

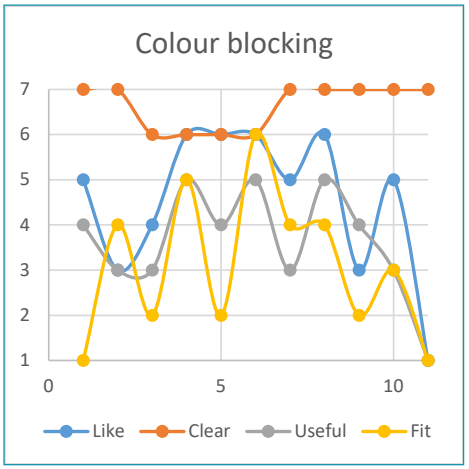
The participants also rated the ideas based on four factors; likability, clarity, useful, fitting. These were rated on a scale of 1, not at all, to 7, very much. The scores can be seen in figure A4.1.

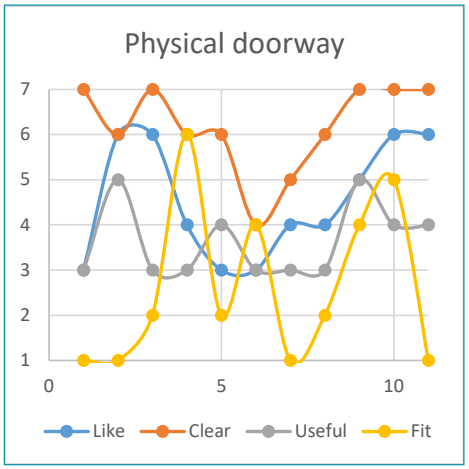
In general, the ideas appear to be communicated clearly, but they seem difficult to fit in the student rooms.

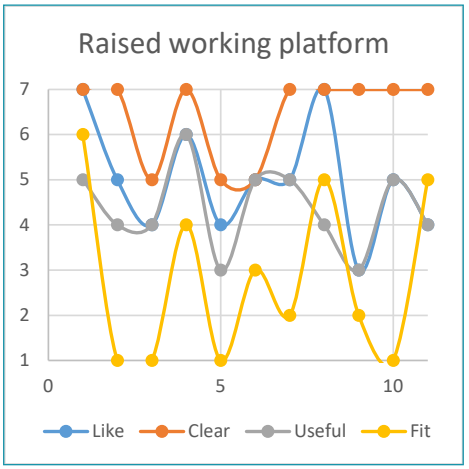
Figure A4.1: The first image shows the averages to each idea on the four measurment factors (like, clear, usefull, fit). The graphs shown the 11 responses to the idea booklet (x-axis), and the corresponding rating from 1 (not at all) to 7 (very much) on the y-axis.

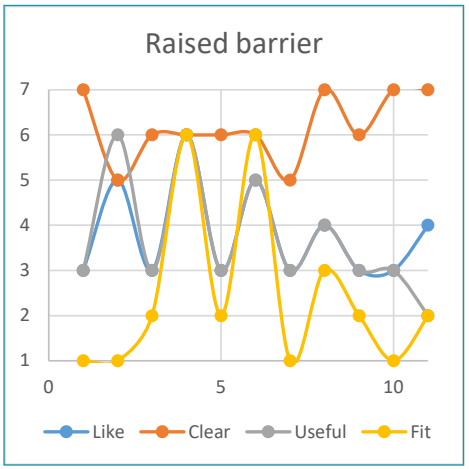
	Like	Clear	Use	Fit
Separation wall	4,45	6,73	4,82	3,18
Colour blocking	4,55	6,64	3,64	3,09
Physical doorway	4,55	6,18	3,64	2,64
Raised working platform	5,00	6,45	4,36	2,82
Raised barrier	3,82	6,18	3,73	2,45
Implement curtains	5,55	6,73	5,00	4,55
Acitivity based lighting	4,91	5,82	4,45	5,36

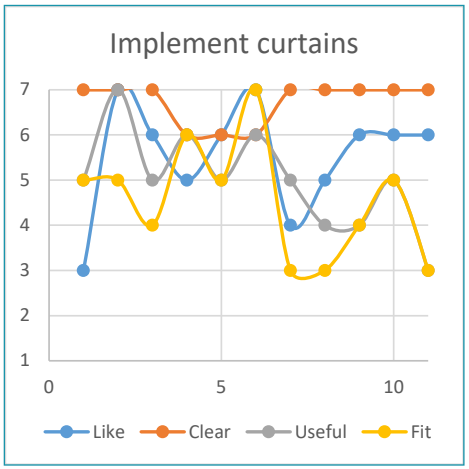


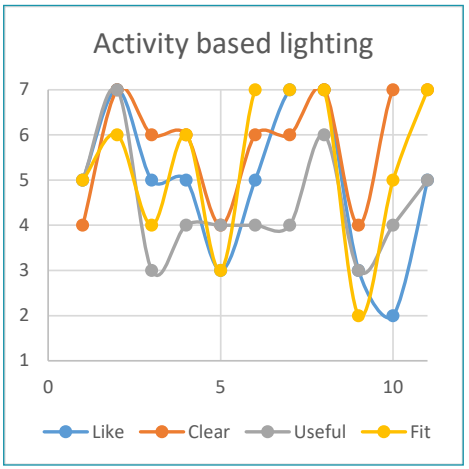












After the impressions were gathered, and the participants stated their preferences for testing certain ideas, the thesis focussed on how to prototype these ideas. And which instructions could be provided to the participants, in order for them to also be able to create these ideas themselves.

Though early in this process, it became clear that some ideas are quite difficult to prototype, and a new direction for the thesis was necessary. The thesis narrowed it´s focus on two directions, which are explained in chapter 3.3.

Figure A4.2. The prototypes created for evaluation.

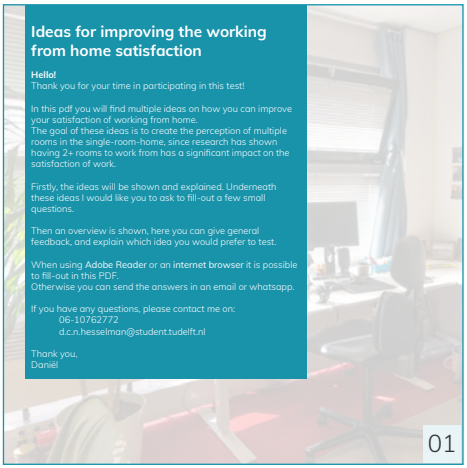
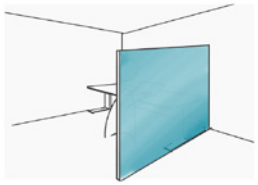


Figure A4.3. The pages of the idea book.

Separation wall

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements



Close yourself off from the rest of your room by placing a separation wall

With a separation wall you can close yourself off from the rest of your room, and create an enclosed working space. When this wall has to be moved to enter the workspace, the workspace might be experienced as another room. This effect might be enhanced with a bright colour.



Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

02

Colour blocking

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements

Create the experience of two rooms in your single room by painting your workspace

Colour is a strong visual indicator, which can be used to create a visual separation of spaces.
By giving the workspace another colour, it might be seen as a different space. Rather than part of the room.



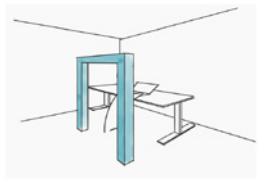
Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

03

Physical doorway

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements



Create the feeling of having two rooms by walking through a doorway when starting work

People more easily forget things of the previous room when they walk through a door, either physical or imagined.
By placing a physical doorway in front of the workspace, people might more easily forget the things from the other part of their room, and might be more likely to concentrate on their work.



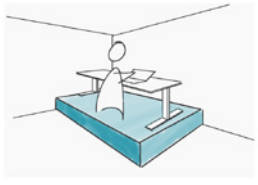
Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

04

Raised working platform

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements



Create a dedicated working space in your room by raising the floor

A second rooms helps people to be more satisfied with working from home.
By raising a part of the room, the room might subconsciously be divided into two rooms.
Furthermore, with this change in height, you have to actively step onto the platform to start working.



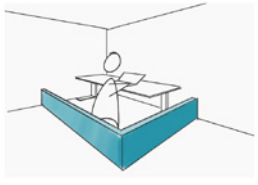
Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

05

Raised barrier

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements



Separate your workspace from the rest of your room with a raised barrier

A second rooms helps people to be more satisfied with working from home.
By placing a barrier in the room, the room might be subconsciously divided into two rooms.
Furthermore, with this barrier you have to actively enter the room to start working.



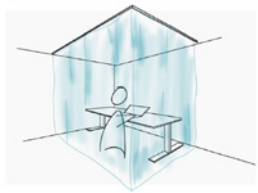
Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

06

Implement curtains

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements



Create your cozy working space by hanging curtains in your room to close yourself off

A second rooms helps people to be more satisfied with working from home.
Curtains can be used to completely divide the room into two rooms during the day when students have to work from home. And close themselves off from the rest of their room.



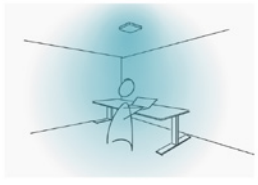
Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

07

Activity based lighting

Creating a new product or intervention
Implementing an existing product
Sharing guidelines for improvements



Create a different atmosphere in your room by changing the light colour per activity

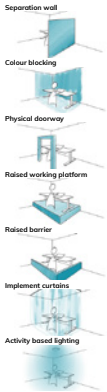
Colour is one aspect on how we can recognize a room.
By giving the room a different colour per different activity. We might associate these colours with the activity and be more comfortable in performing that activity



Questions

How much do you like this idea?	
How clear is this idea?	
How generally useful or valuable is this?	
How well does this fit your situation?	
How might you improve upon this idea?	

08



Select the idea(s) you want to test:	Why would or wouldn't you want to test this idea?
☐	
☐	
☐	
☐	
☐	
☐	
☐	

09

Thank you!

If you would like to further help out with testing one (or more) of these ideas, you can expect the following steps:

General questionnaire
I will ask you to fill out a general questionnaire about your living situation.

3 day measuring
Following the general questionnaire, a very short (1 to 2 minutes) questionnaire (based upon the experience sampling method) is used to track your current experience of working from home.
This short questionnaire is to be filled-out over a period of 3 **working** days, 3 times per day (morning, midday and evening)

5 day evaluation
After gathering data on your experience of working from home, a prototype of your chosen idea is placed in your home working environment.
This prototype will also be evaluated with the short questionnaire, during a 5 **working** day period.

Further evaluation
If you would like to continue with testing, new prototypes can be placed which will be evaluated over a new 5 day period.

Closing interview
After the evaluation of the idea(s), a closing interview will be held to gather qualitative information about your experience with the prototype(s).

10

A5 Evaluation data

Table A5.1. An overview of the deviation of the average score of the three areas of evaluation (satisfaction, mental energy level and separation) based on the different factors. On a scale of 1 to 5 (much lower / very poor to much higher / very good).

	General satisfaction	General mental energy level	General separation	Change in satisfaction	Change in mental energy level	Change in separation
I have rearranged my room during corona	0,14	0,19	0,22	0,02	-0,03	0,19
I have purchased new furniture for my room during corona	-0,28	-0,56	0,08	-0,28	-0,36	-0,17
I have a dedicated desk for working at home	0,12	0,02	0,39	0,03	0,04	0,14
I eat and study at the same desk	-0,32	-0,32	-0,30	-0,34	-0,32	-0,20
I perform leisure activities and study at the same desk	-0,11	-0,13	-0,29	-0,10	-0,13	-0,20
I sleep in the same room as where I study	0,06	-0,18	0,03	0,13	-0,15	-0,06
I am motivated in the subjects of my online courses	0,14	0,11	0,03	0,08	-0,28	0,11
Online courses at the university provide structure	-0,11	0,19	1,28	-0,17	-0,28	0,44
I have dificulty separating working/studying from relaxing	-0,28	-0,42	-0,67	-0,23	-0,23	-0,39
I am satisfied with my work/life balance	0,67	0,73	1,10	0,55	0,26	0,37
My study environment is not ergonomic	-0,21	-0,56	-0,77	-0,27	-0,43	-0,26
I am satisfied with my ability to concentrate	0,39	0,44	0,40	0,08	0,10	0,19
I physically change the room to work or to relax	0,10	0,16	-0,04	0,40	-0,03	0,52
I have enough space to put the things I need around me	0,19	0,14	0,13	0,18	0,02	0,04
Overall (1 much lower or very poor - 5 much higher or very good)	2,61	2,56	2,47	2,17	2,03	2,06

Table A5.2. An overview of the averages of 30 particpant on various factors on the physical study environment and overall wellbeing. Shown with the deviation from the overall average, and in 3 catagories, all rooms, 1 room, and 2+ rooms.

	All rooms				Only 1 room				2 or more rooms			
	Environment		Wellbeing		Environment		Wellbeing		Environment		Wellbeing	
I have rearranged my room during corona	6,50	0,23	6,50	0,50	6,20	0,20	6,50	0,55	7,00	0,20	6,50	0,40
I have purchased new furniture for my room during corona	6,00	-0,27	5,89	-0,11	5,00	-1,00	5,40	-0,55	7,25	0,45	6,50	0,40
I have a dedicated desk for working at home	7,14	0,88	5,93	-0,07	7,38	1,38	6,13	0,18	6,83	0,03	5,67	-0,43
I eat and study at the same desk	5,75	-0,52	5,19	-0,81	5,42	-0,58	5,33	-0,62	6,75	-0,05	4,75	-1,35
I perform leisure activities and study at the same desk	5,91	-0,36	5,45	-0,55	5,56	-0,44	5,50	-0,45	6,83	0,03	5,33	-0,77
I sleep in the same room as where I study	6,21	-0,06	5,88	-0,13	5,94	-0,06	5,82	-0,13	6,86	0,06	6,00	-0,10
I am motivated in the subjects of my online courses	6,60	0,33	6,60	0,60	5,75	-0,25	6,50	0,55	7,17	0,37	6,67	0,57
Online courses at the university provide structure	7,50	1,23	7,25	1,25	-	-	-	-	7,50	0,70	7,25	1,15
I have dificulty separating working/studying from relaxing	5,47	-0,80	5,00	-1,00	5,42	-0,58	5,00	-0,95	5,67	-1,13	5,00	-1,10
I am satisfied with my work/life balance	7,14	0,88	7,14	1,14	7,20	1,20	7,40	1,45	7,00	0,20	6,50	0,40
My study environment is not ergonomic	5,50	0,77	4,60	1,40	5,50	0,50	4,63	1,33	5,50	1,30	4,50	1,60
I am satisfied with my ability to concentrate	6,88	0,61	6,75	0,75	6,80	0,80	6,40	0,45	7,00	0,20	7,33	1,23
I physically change the room to work or to relax	6,71	0,45	6,43	0,43	6,25	0,25	6,00	0,05	7,33	0,53	7,00	0,90
I have enough space to put the things I need around me	6,38	0,11	5,75	-0,25	6,08	0,08	5,75	-0,20	7,25	0,45	5,75	-0,35
Overall (1 to 10)	6,27		6,00		6,00		5,95		6,80		6,10	

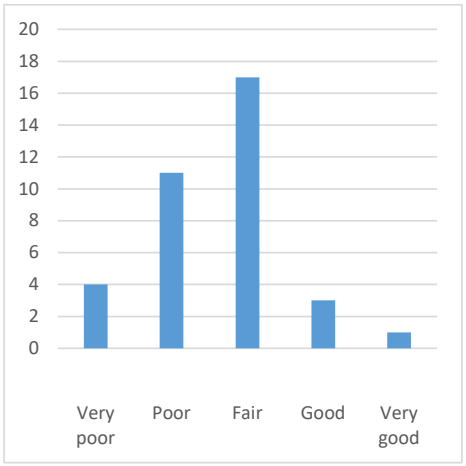


Figure A5.1. The score of 36 participants on their **satisfaction of working from home** *(the number of participants who score the category is on the y-axis)*

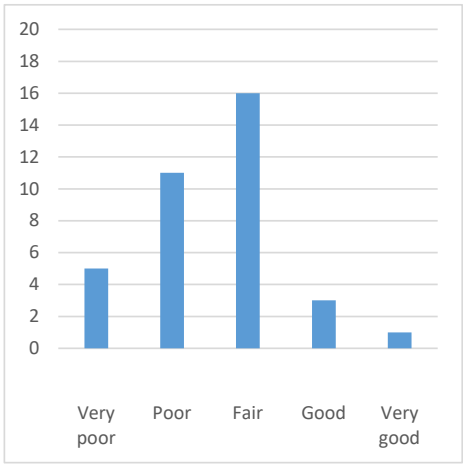


Figure A5.2. The score of 36 participants on their **mental energy level** *(the number of participants who score the category is on the y-axis)*

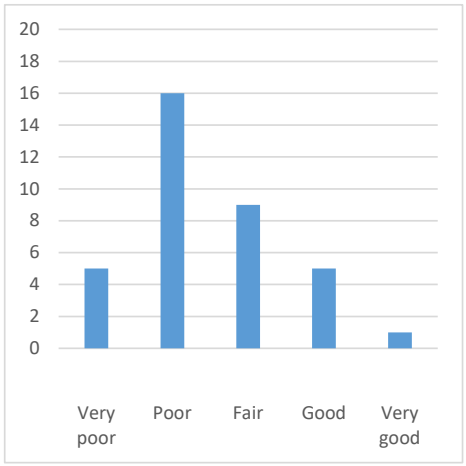


Figure A5.3. The score of 36 participants on their **ability to separate work and private life**, *(the number of participants who score the category is on the y-axis)*

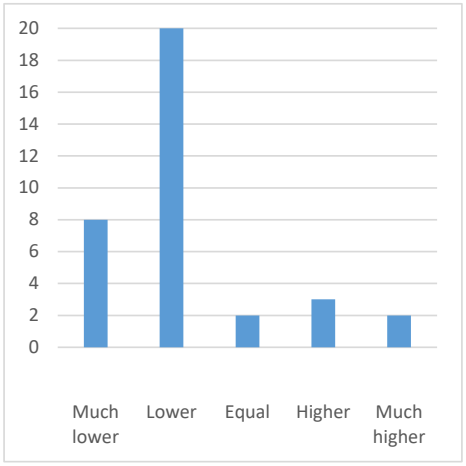


Figure A5.4. The score of 36 participants on their **satisfaction of working from home** *compared to the 'old' situation of working from the university (the number of participants who score the category is on the y-axis)*

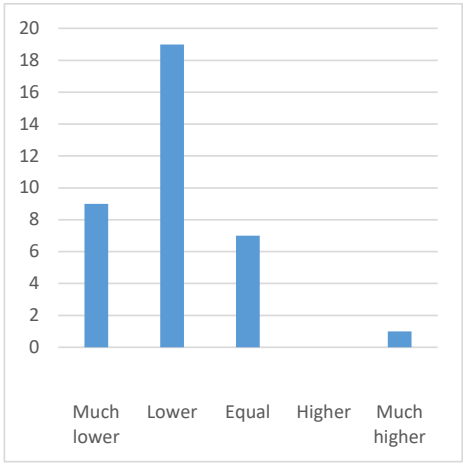


Figure A5.5. The score of 36 participants on their **mental energy level** *compared to the 'old' situation of working from the university (the number of participants who score the category is on the y-axis)*

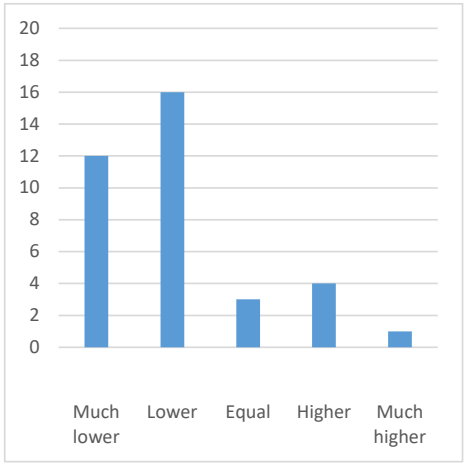


Figure A5.6. The score of 36 participants on their **ability to separate work and private life** *compared to the 'old' situation of working from the university (the number of participants who score the category is on the y-axis)*

A6 Modification data

Change in: Satisfaction

Physical barrier	Much lower	Lower	Equal	Higher	Much higher
I limited the open sides of my workspace	0	0	0	3	0
I placed a separation between my workspace and the rest of my room	0	1	2	2	0
I created separation through my furniture	0	0	0	1	0
I limited what I can see of my relaxation area	0	1	0	3	0
	0	2	2	9	0
Visual distinction					
I moved my desk to a different part of my room	0	1	0	2	0
I used a different accent colour in my workspace	0	0	1	0	0
I placed a carpet on the ground of my workspace	0	0	0	0	0
I used a coloured light when working	0	0	2	2	0
	0	1	3	4	0

Change in: Mental energy level

Physical barrier	Much lower	Lower	Equal	Higher	Much higher
I limited the open sides of my workspace	0	0	2	1	0
I placed a separation between my workspace and the rest of my room	0	1	3	1	0
I created separation through my furniture	0	0	0	1	0
I limited what I can see of my relaxation area	0	1	2	1	0
	0	2	7	4	0
Visual distinction					
I moved my desk to a different part of my room	0	1	2	0	0
I used a different accent colour in my workspace	0	0	1	0	0
I placed a carpet on the ground of my workspace	0	0	0	0	0
I used a coloured light when working	0	1	2	1	0
	0	2	5	1	0

Change in: Ability to separate

Physical barrier	Much lower	Lower	Equal	Higher	Much higher
I limited the open sides of my workspace	0	0	1	2	0
I placed a separation between my workspace and the rest of my room	0	0	3	2	0
I created separation through my furniture	0	0	0	1	0
I limited what I can see of my relaxation area	0	0	2	2	0
	0	0	6	7	0
Visual distinction					
I moved my desk to a different part of my room	0	0	2	1	0
I used a different accent colour in my workspace	0	0	1	0	0
I placed a carpet on the ground of my workspace	0	0	0	0	0
I used a coloured light when working	0	0	0	4	0
	0	0	3	5	0