

# Table of Contents

Abstract .....	ii
Sammanfattning .....	iii
Table of Contents .....	iv
Acknowledgements.....	xiv
Abbreviations .....	xv
Programmes.....	xv
1 Introduction.....	6
1.1 Background .....	6
1.2 Objectives .....	6
1.2.1 Research Questions .....	6
1.3 Company information.....	7
1.4 Delimitations .....	7
1.5 Disposition .....	7
1.5.1 Introduction.....	7
1.5.2 Theoretical Background.....	7
1.5.3 Method .....	8
1.5.4 Approach and Implementation.....	8
1.5.5 Result .....	8
1.5.6 Conclusion and discussion.....	8
1.5.7 Attachment .....	8
2 Theoretical Background.....	9
2.1 Overcrowded household .....	9
2.2 Design Science .....	10
2.2.1 Science in design .....	10
2.2.2 Future of design science.....	10
2.3 Approaches when designing .....	11
2.3.1 User-based approach.....	11
2.3.2 Designer-based approach.....	11
2.3.3 Research-based approach.....	11
2.3.4 Theory-based approach.....	11
2.4 Bootcamp Bootleg.....	12
2.4.1 Empathize .....	12

2.4.2	Define.....	13
2.4.3	Ideate.....	13
2.4.4	Prototype.....	14
2.4.5	Test.....	15
2.5	Double Diamond.....	16
2.5.1	Discover.....	16
2.5.2	Define.....	16
2.5.3	Develop.....	17
2.5.4	Deliver.....	17
2.6	Appearance.....	18
2.7	Human Factors.....	19
3	Method.....	22
3.1	Design Brief.....	22
3.2	PERT-Chart.....	22
3.3	WBS – Work Breakdown Structure.....	22
3.4	Gantt-Schedule.....	22
3.5	Stakeholder Analysis.....	23
3.6	Questionnaire Study.....	23
3.6.1	Observation: Structured.....	23
3.6.2	Interview: Conjoint Analysis.....	23
3.6.3	Interview: Close Ended Questions.....	23
3.7	Brainstorming.....	23
3.8	Target group.....	24
3.9	Personas.....	24
3.10	Functional analysis.....	25
3.11	Image Board.....	26
3.12	Sketching.....	26
3.13	Design Analysis.....	26
3.14	CAD - modelling.....	26
3.15	Rendering.....	26
3.16	Physical Model.....	27
3.16.1	Design model and Functional Model.....	27
4	Approach and Implementation.....	28

4.1	Empathizing.....	28
4.1.1	Design brief.....	28
4.1.2	Planning.....	28
4.1.3	Questionnaire Study.....	29
4.1.4	Design analysis.....	30
4.2	Define.....	32
4.2.1	Stakeholder Analysis.....	32
4.2.2	Target group.....	33
4.2.3	Image board.....	33
4.2.4	Persona.....	34
4.2.5	Functional analysis.....	36
4.3	Ideate.....	36
4.3.1	Sketching.....	36
4.3.2	More sketching and CAD-models.....	39
4.3.3	Final CAD- model and Renderings.....	39
4.3.4	Name and Logo.....	40
4.4	Prototype.....	41
4.4.1	Physical Model.....	41
4.4.2	Frame.....	42
4.4.3	Legs.....	42
4.4.4	The board.....	43
4.4.5	Hangers for the door.....	43
4.4.6	Steps for painting.....	44
5	Result.....	45
5.1	Final Concept.....	45
5.2	CAD – model.....	45
5.3	Renderings.....	46
5.3.1	Main components.....	46
5.3.2	Ironing board folded up.....	47
5.3.3	Ironing board folded down.....	48
5.3.4	Inside of the ironing board.....	49
5.3.5	Cover.....	49
5.3.6	Hanging over the door.....	50

5.3.7	Different styles .....	51
5.4	Main Dimensions .....	53
5.5	Mounting the ironing board.....	54
5.6	Physical Model.....	55
5.6.1	Frame.....	55
5.6.2	Board .....	55
5.6.3	Locking the board in place .....	56
5.6.4	Back of the model.....	57
5.6.5	Inside .....	57
5.6.6	Hinges.....	58
5.6.7	Hangers for the door.....	59
5.6.8	Legs.....	60
5.6.9	Straps for the legs.....	60
5.6.10	Style.....	61
5.6.11	Final model .....	61
6	Conclusion and discussion .....	62
6.1	Design process .....	62
6.2	Design brief and direction.....	63
6.3	Planning .....	63
6.4	Design process .....	64
6.5	Questionnaire study .....	64
6.6	Design analysis - Stockholm and London.....	65
6.7	Stakeholder and functional analysis .....	66
6.8	Image board and Scandinavian style .....	66
6.9	Target group and Personas.....	66
6.10	Sketching.....	67
6.11	Final design.....	67
6.11.1	Styles .....	67
6.11.2	Mounted on the wall.....	67
6.11.3	Hanged over a door .....	68
6.11.4	Hooks .....	68
6.11.5	Cover.....	68
6.12	Name and Logo .....	68

6.13	Physical model.....	69
6.13.1	Frame.....	69
6.13.2	Board.....	69
6.13.3	Mirror.....	69
6.13.4	Hinges.....	70
6.13.5	Legs.....	70
6.13.6	Straps for the legs.....	70
7	References.....	71
8	Attachments.....	73
8.1	Attachment 1 – PERT-chart.....	74
8.2	Attachment 2 – WBS-chart.....	75
8.3	Attachment 3 – Gantt-schedule .....	76
8.4	Attachment 4 – Stakeholder.....	81
8.5	Attachment 5 – Questionnaire study.....	82
8.5.1	Questionnaire .....	82
8.5.2	Answers .....	84
8.6	Attachment 6 – Trend analysis .....	91
8.6.1	Furniture and light fair, Stockholm .....	91
8.6.2	Skandium, London .....	92
8.7	Attachment 7 – Image board.....	93
8.8	Attachment 8 – Personas.....	94
8.8.1	Felix and Amanda .....	94
8.8.2	Henrik Lundberg.....	95
8.8.3	Emelie Andersson.....	96
8.9	Attachment 9 – Functional analysis .....	97
8.10	Attachment 10 – Sketches .....	99
8.11	Attachment 11 – Renderings of the four concepts.....	105
8.12	Attachment 12 – Renderings of the final concept .....	109
8.12.1	Main components .....	109
8.12.2	Ironing board folded up.....	110
8.12.3	Ironing board folded down .....	112
8.12.4	Inside the Ironing board .....	113
8.12.5	Mounted on the wall.....	114

8.12.6	Hanging over a door.....	115
8.13	Attachment 13 – Different styles .....	120
8.14	Attachment 14 – Physical model .....	124

### **Table of Figures**

Figure 1 -	Showing the different steps in the Bootcamp Bootleg design process [6] .....	12
Figure 2 -	Showing the first step in the Bootcamp Bootleg design process [8] .....	12
Figure 3 -	Showing the second step in the Bootcamp Bootleg design process [8] .....	13
Figure 4 -	Showing the third step in the Bootcamp Bootleg design process [8] .....	13
Figure 5 -	Showing the fourth step in the Bootcamp Bootleg design process [8] .....	14
Figure 6 -	Showing the fifth step in the Bootcamp Bootleg design process [8].....	15
Figure 7 -	Showing the design process Double Diamond [7].....	16
Figure 8 -	Showing the first stage in the double diamond design process [9] .....	16
Figure 9 -	Showing the second stage in the double diamond design process [9].....	17
Figure 10 -	Showing the third stage in the double diamond design process [9] .....	17
Figure 11 -	Showing the fourth stage in the double diamond design process [9].....	17
Figure 12 -	Showing the height when standing straight up [10] .....	19
Figure 13 -	Showing the height from the feet to the eyes when standing straight up [10]	20
Figure 14 -	Showing the elbow height, to bony point with straight arm [10].....	20
Figure 15 -	Showing recommended height of work surface for different types of work [12] .....	21
Figure 16 -	Showing target group and market .....	24
Figure 17 -	Showing the different ironing board which were tested during the first section of the questionnaire study.....	29
Figure 18 -	Showing the design analysis that where made based on Furniture and Light Fair in Stockholm.....	30
Figure 19 -	Showing the design analysis that where made based on the visit to "Skandium" in London .....	31
Figure 20 -	Showing the a visual image of the Stakeholder Analysis that was created.....	32
Figure 21 -	Showing the image board that was made to represent the target group .....	33
Figure 22 -	Showing image board that was made to represent the competitors' products	34
Figure 23 -	Showing a summary of the Felix and Amanda persona .....	34
Figure 24 -	Showing a summary of the Henrik Lundberg persona .....	35
Figure 25 -	Showing a summary of the Emelie Andersson persona.....	35
Figure 26 -	Showing Concept 1 .....	37
Figure 27 -	Showing Concept 2 .....	37
Figure 28 -	Showing Concept 3 .....	38
Figure 29 -	Showing Concept 4 .....	38
Figure 30 -	Showing the logo that was created for the ironing board.....	40
Figure 31-	Showing the components that have been milled.....	41
Figure 32-	Showing image of mounting the top of the frame (Part 1).....	42
Figure 33 -	Showing the steps of mounting the top of the frame together (Part 2).....	42

Figure 34 – Showing the step of mounting the top with the frame legs.....	42
Figure 35 - Showing the legs with the bent metal rails mounted .....	42
Figure 36 - Showing the wood skeleton with a mounted mesh net on.....	43
Figure 37 - Showing the hangers for the door.....	44
Figure 38 - Showing the frame and shelves covered in several layers of filler .....	44
Figure 39 - Showing the front of the CAD-model.....	46
Figure 40 - Showing the back of the CAD-model .....	46
Figure 41 - Showing the ironing boards main components.....	46
Figure 42 - Showing the front of the ironing board when it is folded up.....	47
Figure 43 - Showing the back of the ironing board when it is folded up .....	47
Figure 44 - Showing the top of the ironing board when it is folded up.....	47
Figure 45 - Showing the an enlarged image of the leather strap hooked on rifle button the front of the ironing board when it is folded up.....	47
Figure 46 - Showing the bottom of the ironing board when it is folded up .....	47
Figure 47 - Showing the front when the ironing board is folded down.....	48
Figure 48 - Showing the ironing board from the side when it is folded down .....	48
Figure 49 - Showing a zoom view of how the ironing board looks folded down without the frame .....	48
Figure 50 - Showing the metal hook in side view.....	49
Figure 51 - Showing the metal hook in front view .....	49
Figure 52 - Showing the shelves, hangers and hooks when the frame is removed .....	49
Figure 53 - Showing the pattern chosen for the ironing board .....	49
Figure 54 - Showing the front with the door hangers are mounted .....	50
Figure 55 - Showing a perspective view of the ironing board when the door hangers are mounted .....	50
Figure 56 - Showing the door hanger from the side .....	50
Figure 57 - Showing the door hanger from the front.....	50
Figure 58 - Showing an exploded view of the door hanger .....	50
Figure 59 - Showing the ironing board folded up and hanging over a door .....	51
Figure 60 - Showing the ironing board folded down and hanging over a door.....	51
Figure 61 - Showing the black concept with a mirror .....	51
Figure 62 - Showing black concept with a black board.....	52
Figure 63 - Showing the white concept with a mirror.....	52
Figure 64 - Showing the white concept a black board.....	52
Figure 65 - Showing the frame of the physical model.....	55
Figure 66 - Showing the leather strap mounted with rivets .....	55
Figure 67 - Showing the board with the fabric side up .....	56
Figure 68 - Showing the board with the mirror side up .....	56
Figure 69 - Showing an enlarged view of top piece, leather strap and the rifle button.....	56
Figure 70 - Showing the push lock inactivated without the board .....	57
Figure 71 - Showing the push lock activated without the board.....	57
Figure 72 - Showing the top of the back of the ironing board on the inside .....	57
Figure 73 - Showing the bottom of the back of the ironing board on the inside .....	57
Figure 74 - Showing the inside of the ironing board .....	58

Figure 75 - Showing the hinges which fasten the legs to the frame which holds the mirror .....	58
Figure 76 - Showing the hinges which mounts the ironing board to the holder .....	59
Figure 77 -Showing the door hangers in a front view .....	59
Figure 78 - Showing the door hangers in a side view .....	59
Figure 79 - Showing the supporting legs for the ironing board when the board is in use	60
Figure 80 - Showing the supporting legs for the ironing board when the board is not in use .....	60
Figure 81 - Showing the straps which are mounted to the leg and frame .....	60
Figure 82 - Showing some part painted in a black semi-gloss spray paint.....	61
Figure 83 - Showing one of the hooks painted in a silver paint.....	61
Figure 84 - Showing the finished physical model when folded up and mounted on a wall .....	61
Figure 85 - Showing the finish physical model when mounted on a wall.....	61
Figure 86 - Showing the different stages of the design process Bootcamp Bootleg [6] ....	62
Figure 87 - Showing the double diamond design process.....	62
Figure 88 - Showing the logo for the product .....	69
Figure 89 - Showing the PERT-chart that was created for this thesis .....	74
Figure 90 - Showing the WBS - chart created for this thesis .....	75
Figure 91 - Showing Gantt-schedule part 1 of 5 .....	76
Figure 92 - Showing Gantt-schedule part 2 of 5 .....	77
Figure 93 - Showing Gantt-schedule part 3 of 5 .....	78
Figure 94 - Showing Gantt-schedule part 4 of 5 .....	79
Figure 95 - Showing Gantt-schedule part 5 of 5 .....	80
Figure 96 - Larger image of the stakeholder analysis.....	81
Figure 97 - Graph showing the gender division on the people who took part in the questionnaire study .....	84
Figure 98 - Graph showing the age division on the people who took part in the questionnaire study.....	84
Figure 99 - Graph showing answer for Question 1 in the questionnaire study .....	84
Figure 100 - Graph showing answer for Question 2 in the questionnaire study .....	85
Figure 101 - Graph showing answer for Question 3 in the questionnaire study .....	85
Figure 102 - Graph showing answer for Question 4 in the questionnaire study .....	85
Figure 103 - Graph showing answer for Question 5 in the questionnaire study .....	86
Figure 104 - Graph showing answer for Question 6 in the questionnaire study .....	86
Figure 105 - Graph showing answer for Question 7 in the questionnaire study .....	86
Figure 106 - Graph showing answer for Question 8 in the questionnaire study .....	87
Figure 107 - Graph showing answer for Question 9 in the questionnaire study .....	87
Figure 108 - Graph showing answer for Question 10 in the questionnaire study .....	87
Figure 109 - Graph showing answer for Question 11 in the questionnaire study .....	88
Figure 110 - Graph showing answer for Question 12 in the questionnaire study .....	88
Figure 111 - Graph showing answer for Question 13 in the questionnaire study .....	88
Figure 112 - Graph showing answer for Question 14 in the questionnaire study .....	89
Figure 113 - Graph showing answer for Question 15 in the questionnaire study .....	89



Figure 114 - Graph showing answer for Question 16 in the questionnaire study ..... 89

Figure 115 - Graph showing answer for Question 17 in the questionnaire study ..... 90

Figure 116 - Showing a larger image of the trend board from the Furniture and light fair in Stockholm..... 91

Figure 117- Showing a larger image of the trend board from the store Skandium in London..... 92

Figure 118 - Showing a larger image of the image board created for compact living ..... 93

Figure 119 - Showing detailed information about the persona Felix and Amanda ..... 94

Figure 120 - Showing detailed information about the persona Henrik..... 95

Figure 121 - Showing detailed information about the persona Emelie..... 96

Figure 122 - Showing sketches of iron holders ..... 99

Figure 123 - Showing sketches of ironing boards for compact living (1 of 4) ..... 100

Figure 124 - Showing sketches of ironing board for compact living (2 of 4)..... 101

Figure 125 - Showing sketches of ironing boards for compact living (3 of 4) ..... 102

Figure 126 - Showing sketches of ironing boards for compact living (4 of 4) ..... 103

Figure 127 - Showing hooks and hangers for the interior of the ironing board ..... 104

Figure 128 - Showing a larger image of Concept 1 ..... 105

Figure 129- Showing a larger image of Concept 2 ..... 106

Figure 130 - Showing a larger image of Concept 3 ..... 107

Figure 131 - Showing a larger image of Concept 1 ..... 108

Figure 132 - Showing a larger image of the main components of the ironing board..... 109

Figure 133 - Showing larger images of the ironing board when it is folded up ..... 110

Figure 134 – Showing a larger image of the leather strap on the front of the ironing board when it is folded up ..... 111

Figure 135 - Showing a larger image of the top of the ironing board, when it is folded up ..... 111

Figure 136 - Showing a larger image of bottom of the ironing board, when it is folded up ..... 111

Figure 137 - Showing larger images of the ironing board when it is folded down..... 112

Figure 138 - Showing the inside decor of the product ..... 113

Figure 139 - Showing the inside of the ironing board when the frame is removed ..... 113

Figure 140 - Showing a larger image of how the ironing board would look like mounted on a wall, when it is folded up ..... 114

Figure 141 - Showing a larger image of how the ironing board would look like mounted on a wall, when it is folded down ..... 114

Figure 142 - Showing larger images of how the ironing board would look when the door hangers are mounted on ..... 115

Figure 143 - Showing larger images of the door hanger from different views..... 116

Figure 144 - Showing a larger image of the door hanger in an exploded view ..... 117

Figure 145- Showing a larger image of how the ironing board would look like hanging over a door, when it is folded up..... 118

Figure 146 - Showing a larger image of how the ironing board would look like hanging over a door, when it is folded down ..... 118

Figure 147 - Showing a larger image of how the ironing board would look like in a room, when hanging over a door and it is folded up ..... 119

Figure 148 - Showing a larger image of how the ironing board would look like in a room, when hanging over a door and it is folded down ..... 119

Figure 149 - Showing a larger image of the black concept with a mirror ..... 120

Figure 150 - Showing a larger image of the with a black board ..... 121

Figure 151 - Showing a larger image of the white concept with a mirror ..... 122

Figure 152 - Showing a larger image of the white concept with a black board..... 123

Figure 153 - Showing a larger image of the finished physical model when it is folded up and mounted on a wall..... 124

Figure 154 - Showing a larger version of the finished physical model when it is folded down and mounted on a wall..... 125

**Table of Tables**

Table 1 - Showing the height when standing straight up ..... 19

Table 2 - Showing the height from the feet to the eyes when standing straight up ..... 20

Table 3 - Showing the elbow height, to bony point with arm straight..... 20

Table 4 - Showing the recommended height of work surface for different types of work21

Table 5 - Showing an example on a functional analysis made for a washing machine ..... 25

Table 6 - Showing the functional analysis created for the User ..... 97

Table 7 - Showing the functional analysis created for the Costumer ..... 97

Table 8 - Showing the functional analysis created for the Producer ..... 97

Table 9 - Showing the functional analysis created for the Reseller..... 98

Table 10 - Showing the functional analysis created for the Assembler..... 98

Table 11 - Showing the functional analysis created for the Sales Company..... 98

Table 12 - Showing the functional analysis created for the Distributor..... 98

Table 13 - Showing the functional analysis created for the Designer..... 98

## Acknowledgements

I would like to say a special thank you the following people for their interest, support and guidance in this thesis.

Kenneth Johansson  
Purchasing Manager at Rörets Industrier AB in Jönköping, Sweden.

Thomas Arnell  
Teacher at Jönköping University in Jönköping, Sweden.

I would also like to say a big thank you to all the other teachers at Jönköping University who have helped me during this thesis and to all the people who were involved in the questionnaire study.

## Abbreviations

- CAD - Computer Aided Design
- CNC - Computer Numerical Control

## Programmes

- CAD-models – SolidWorks 2014 Education Edition
- Renderings – Keyshot 5
- Logo – Adobe CC 2015 - Illustrator

# 1 Introduction

In this chapter, the reader will get a short introduction to the content of this thesis.

## 1.1 Background

Many people are currently living in small apartments, all over the nation. But just because you live in a small apartment, does it not mean that you do not need some of the same things that people who are living in a big houses does. Living in a small space apartment can also be referred to as compact living situation.

There are different ways that you can make your small apartment feel bigger, this can be either by design, smart storage ideas or by using multifunctional furniture's.

When you are living in a one room apartment, you should only have things which are essential or things that you really love, because you are going to be looking at them at all times. So a furniture for compact living should not only have multifunction's, it should also look attractive and have the right appearance to fit your style.

A product that most people have at home is an ironing board. But when you are living in a small apartment there might not be so much space for storing it.

## 1.2 Objectives

The goal with this thesis is to create a multifunctional ironing board for compact living. The ironing board should be easy to access and easy to store after using it. When the ironing board is not in use, it should not look like an ironing board. The ironing board should both be able to be mounted on the wall or hanged over a door.

The target group for the ironing board is single people or couples without children, having a compact living. They should be in the ages between 25-30 years old and they should have their own apartment, either co-operative apartment, rented apartment or apartment rented second hand.

### 1.2.1 Research Questions

The research question for this thesis is:

- How could an ironing board for compact living look so it will fit the stakeholders living environment?

This research question leads to the question

- What functions can you combined with the ironing board
- What are the ongoing design trends?

To accomplish the goal of this thesis and give answers to the research questions, the thesis will go through a design process that includes the steps of Empathizing, Defining, Ideating, Prototyping and Testing.

### **1.3 Company information**

This thesis has been conducted together with the company Rören Industri AB.

Rören Industri AB is a Scandinavian company that belongs to the Finnish SINTUOTE group. They have their own factory in Poland and their main products are ironing boards, covers and airers.

They are the largest manufacturer of ironing boards in Northern Europe and have been a supplier for IKEA in over 30 years. Rören Industri AB is market leader in the Scandinavian countries, Finland, Poland and the Baltic States. During 2012 was over 1 million ironing boards manufactured. [1]

### **1.4 Delimitations**

This thesis does not focus on brand identity for the company Rören Industri AB. This means that the design languages for this product will not go in style with the company's current product line.

The design process will end after the physical model have been made. The last step in the design methodology, where the user will test the physical prototype in its future environment, will not be included in this thesis.

The style for the ironing board will focus on fitting the target group, which are people between 25-30 years old without children, who are living in an apartment that can be classified as a compact living.

### **1.5 Disposition**

Here will the outline of the report for the thesis be presented.

#### **1.5.1 Introduction**

The reader will here get an introduction and some background to the thesis that have been conducted.

#### **1.5.2 Theoretical Background**

In this chapter, will the reader be able to get an understanding for two different design methodology and how they are used.

An introduction to the ergonomic aspects that needs to be taken in to consideration when creating a product like this.

### **I.5.3 Method**

All the methods that were used during this thesis will be presented here.

### **I.5.4 Approach and Implementation**

Here, the reader will get an insight in how this thesis were conducted. There will also be some partial result.

### **I.5.5 Result**

In this chapter is only the final result presented. Here the reader will be able to read about the final CAD-model, final renderings and the physical model that was built.

### **I.5.6 Conclusion and discussion**

In this chapter will mainly focus on the discussion and the conclusions drawn from working on this thesis.

The chapter also contains a comparison between different design methodologies.

### **I.5.7 Attachment**

Here will different result be presented. Some result will be put as attachments to make the report easier to read.

Larger versions of some of the picture from the approach and implementation, and from the result will be presented here.

## 2 Theoretical Background

This chapter includes a definition of overcrowding, design methodology that has been used during this thesis and the important ergonomic aspects that have been taken in to consideration when creating this product.

### 2.1 Overcrowded household

15 % of the Swedish population is living in an overcrowded household. This number has decreased from 20 % during the 1980s, to 15 % during 2012. [2] But the Swedish population have increase during this time as well from 8.3 million [3] to 2012 9.6 million [3]. If these 15 % is calculated on the Swedish population today, there are almost 1.5 million people living in an overcrowded household.

Sweden is still generally classified as to having a low number of overcrowded households. Younger people, people living alone and people living in the big cities are the ones which is most often living in an overcrowded household. [2]

The definition for overcrowded households in Sweden is that a household should have a kitchen, bathroom and a bedroom for each person living in the household. If this is not fulfilled, then the household is classified as overcrowded. One exception is if there is a couple living in the household, then they are expected to share the bedroom.

There are different norms when it comes to overcrowding: [4]

- Norm 1 – More than 2 people/room, where kitchen is counted as a separate room.
- Norm 2 – More than 2 people/room, when the kitchen is not counted as a separate room
- Norm 3 – More than 1 person/room, where the kitchen is counted as a separate room
- Norm 4 – More than 1 person/room, where the kitchen is not counted as a separate room.

Norm 1 and 2 were used during the 1970 and 1975. Norm 3 has been used since 1980 and from 1990 have also norm 4 been used. [5]

According to Boverket, which is an authority for planning, building and housing, 2 out of 3 people living overcrowded household is living alone in a one room apartment. [5]

It is most common for younger people to have an overcrowded household. One of every third person in the ages 16 – 24 years old and one out of every fourth person in the ages 25 – 34 years old are living in an overcrowded household. [2] An explanation for this can be the increasing number of people studying and the problem for younger people to get a job which leads to them choosing a smaller household based on their economics. [5]



Around 70 % of the people who are living in an overcrowded household is living in a rental apartment and around 20 % are living in a cooperative apartment. [5]

## **2.2 Design Science**

Design is art and science combined but Design Science is a relative new discipline within the research community. The reason for creating scientific methods within the design process is because the design should be approached with a combination of analytic and creative sense. [6]

### **2.2.1 Science in design**

Science is built on knowledge and when creating a product it is important to think about the users and get an understanding for human behaviour. By creating a research to get an understanding for this, you will bring out the science in the design process. [6]

Design research should always be at the service of humanity. This is because design is something which is used in everything from everyday products, to products which is used to put people on the moon. [6]

Alongside of the development of new technology, new ways of design science needs to be taken in to consideration. With the help of social media connecting people, products with apps which provides a large amount of data quickly, the designer can get information from the user in a much faster way. This should be taken advantage of and used, both when creating new products or developing already existing product. [6]

But even if it is important to use methods in the design process and create new methods, which we could follow when designing products, it is equally important to respects the creative and non-linear way of thinking when creating designs. If our analytical minds gets involved too early in the design process, it can possible lead to destroying good design ideas. [6]

### **2.2.2 Future of design science**

To increase the knowledge about design science, it is important to get articles about research and similar out to the public. The articles published in the Design Science journal might be the first contact that you have with a specific topic and when reading it, it is important to be able to follow it. The Design Science journal expects a person, who is completely new to the topic, to understand at least 40 % of the articles content. [6]

## **2.3 Approaches when designing**

When designing a product as an industrial designer, there are different approaches you can use during the project to make the products more authentic. [7]

### **2.3.1 User-based approach**

Here the design team involves the user by using their feelings and aspirations as a driving force in the project. The user will be involved in different steps during the project, they can for example be involved in an early idea-generation and/or later in more advance testing of the final concepts. [7]

### **2.3.2 Designer-based approach**

In this type of project, can the designer be seen as an author for his or hers work. Just like a real author wants to get people to feel a certain way when reading their books, the designer have the change to affect people with their design. It is here that the individual designer's vision and principles are shown. [7]

### **2.3.3 Research-based approach**

With this approach, the design team tries to measure the relation between different design decisions and emotional responses. This is a method which can be used when there already are exciting products on the market and the design team are working on a product optimization. This is done by selecting some products variants and let people test them. With the help of a questionnaire study, the design team can get the subjects individual emotional to each of the products. By using statistical techniques can the design team analyse the answers and come to a conclusion. [7]

### **2.3.4 Theory-based approach**

The theory-based approach is used when the design team is creating a product, which does not already exists on the market. With this approach, it's about creating a new relationship between the user and the product. [7]

## 2.4 Bootcamp Bootleg

The design process used during the thesis is called Bootcamp Bootleg. This design process contains five steps, see Figure 1, and it was developed at the Institute of Design at Stanford. During these five steps there are different methods that can be used to gather necessary information to get the project moving forward. The steps are called Empathize, Define, Ideate, Prototype and Test and they will be explained below. [8]

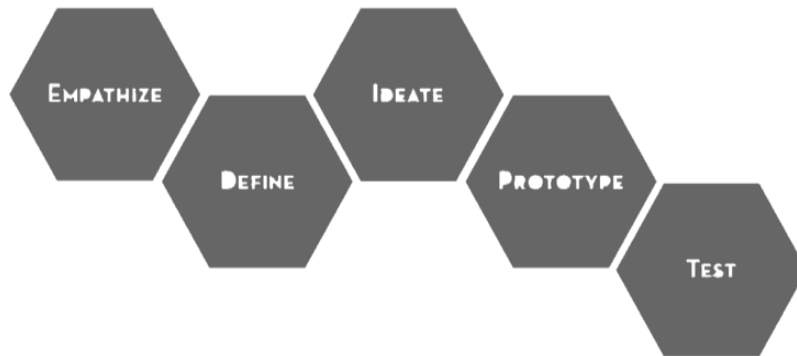


Figure 1 - Showing the different steps in the Bootcamp Bootleg design process [6]

### 2.4.1 Empathize

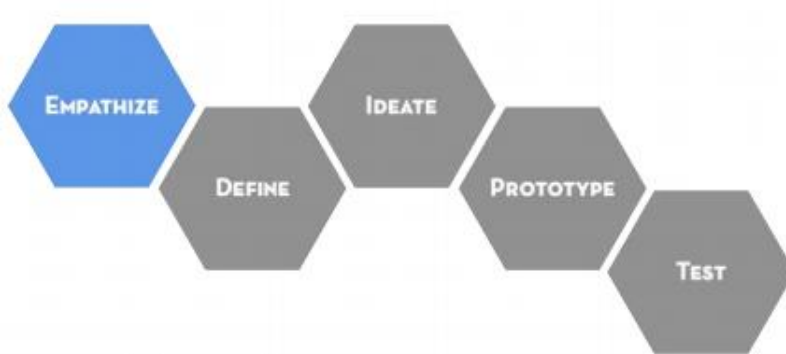


Figure 2 - Showing the first step in the Bootcamp Bootleg design process [8]

The first step in the Bootcamp Bootleg design process is empathize, see Figure 2. It is during this step that the designer gathers the information and get empathy for the user.

Here the design team will study the user with the help of different methods to get an understanding for who they are designing for. [8]

The empathizing stages can be divided in to three steps:

- **Observe** - Observe the users and how they behave in their own environment. To understand the future user is very important since they are the ones that are going to use the product or service in the end.

- **Engage** - Interact with the users and interview them with different methods. By engaging with the users, the design team can learn how the users think and what they value.
- **Immerse** - Experience what the user experiences. This will give the design team a change to view the product or problem in first hand and experience exactly what the user's experiences. [8]

### 2.4.2 Define

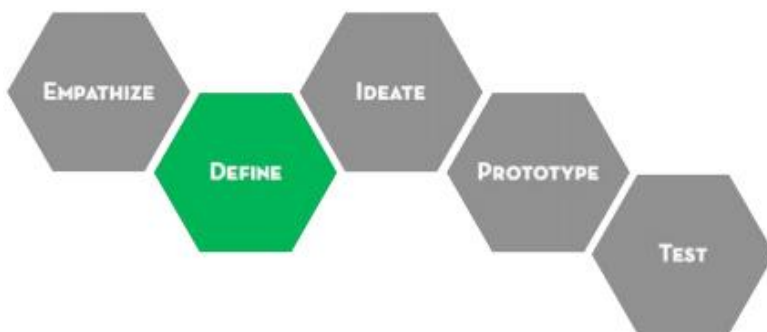


Figure 3 - Showing the second step in the Bootcamp Bootleg design process [8]

The second step in the Bootcamp Bootleg design process is Define, see Figure 3. During this step, the design team will define the problem based on the information that were gathered during the empathize step and create a problem statement. Here will the frame for the project be put up and what the end goal of the project should be is defined. This step is critical to the design process, because it is here that the problem which the design team is striving to address is defined. [8]

### 2.4.3 Ideate

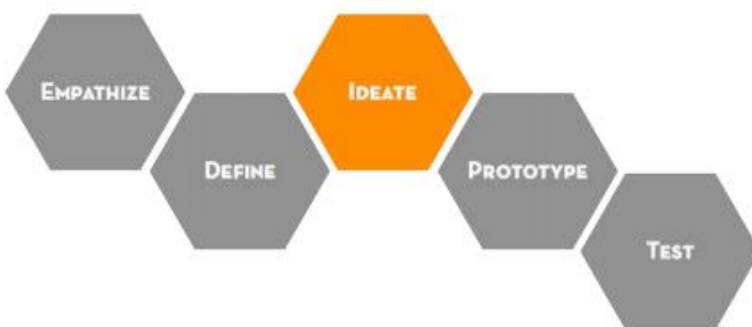


Figure 4 - Showing the third step in the Bootcamp Bootleg design process [8]

The next step in the Bootcamp Bootleg design process is the Ideate step, Figure 4. It is during this step that the design team will focus on idea generation. The design team will go from identifying the problem to creating different solutions for the users.

There are different methods for generating ideas, but the end goal for this step is to create a big volume of concepts to get a wide range of possible solutions for the user. [8]

#### 2.4.4 Prototype

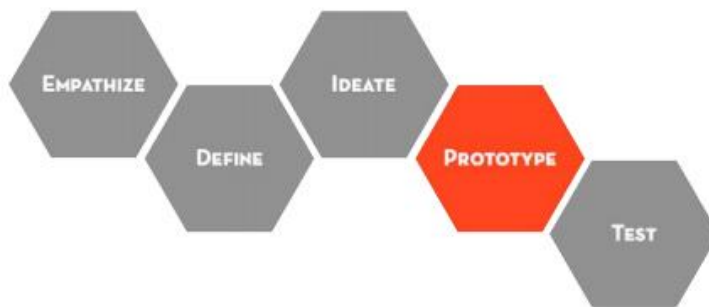


Figure 5 - Showing the fourth step in the Bootcamp Bootleg design process [8]

This step in the design process is called Prototype, see Figure 5. It is here that the concepts goes from sketches on paper to become physical prototypes. The prototypes which are made, should reflect where the design team is in the design process. If the design team is doing prototypes early in the process, then the prototypes should be fast and simple and the further the team gets, the better finish should the prototypes have.

Creating prototypes and letting users try them is the most successful way to get the user to experience and interact with generated concepts. [8]

Prototypes has gone from just testing the concepts functions to evolve into different categories:”

- Empathy gaining - Prototyping is a tool to deepen your understanding of the design space and your user, even at a pre-solution phase of your project.
- Exploration: - Build to think. Develop multiple solution options.
- Testing: - Create prototypes (and develop the context) to test and refine solutions with users.
- Inspiration: - Inspire others (teammates, clients, customers, investors) by showing your vision.

The goals of prototyping is often a bit of all the categories above. Reasons to prototype:

- Learn - If a picture is worth a thousand words, a prototype is worth a thousand pictures.
- Solve disagreements - Prototyping is a powerful tool that can eliminate ambiguity, assist in ideation, and reduce miscommunication.
- Start conversations - A prototype can be a great way to have a different kind of conversation with users.
- Fall quickly and cheaply - Creating quick and dirty prototypes allows you to test a number of ideas without
- Manage the solution-building process - Identifying a variable to explore encourages you to break a large problem down into smaller, testable chunks.” [8]

### 2.4.5 Test

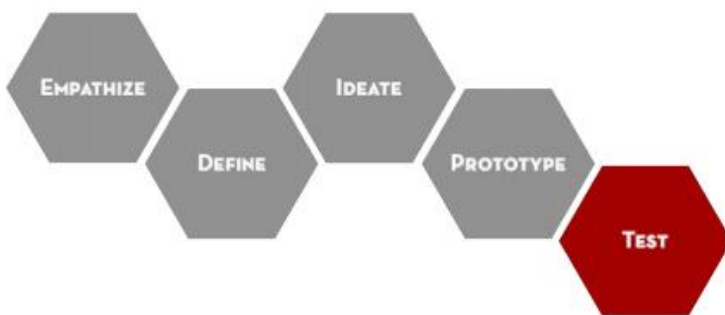


Figure 6 - Showing the fifth step in the Bootcamp Bootleg design process [8]

The last step of the Bootcamp Bootleg design process is Test, see Figure 6. During this step will a low-resolution model be placed in the proper context of a user’s life.

It is important that the design team do this type of testing, both so that the prototype can be refined but also to learn more about the users. [8]

## 2.5 Double Diamond

Another design process model is the Double Diamond. This process is a simple visual way of showing how the design process should work and it has been developed at the Design Council in the United Kingdom. The model is divided in to four stages, Discover, Define, Develop and Deliver, see Figure 7. These stages will be explained below. [9]

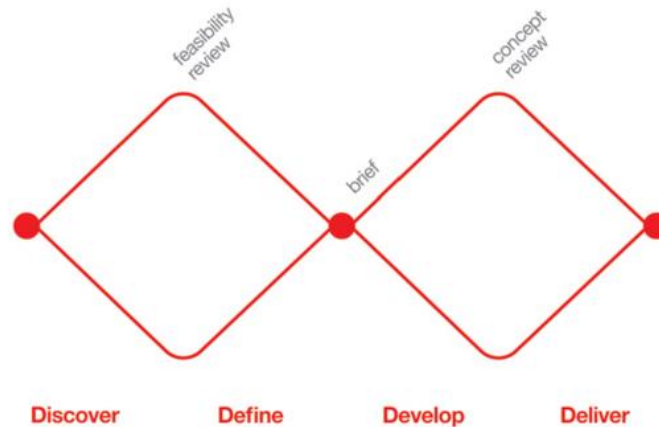


Figure 7 - Showing the design process Double Diamond [7]

### 2.5.1 Discover

The first stage is called “Discover”, see Figure 8. It is here the project starts and where the design team should do different researches for the project like, market-, user- and design research. The goal for this stage is to gather all the information needed for conduction the project. [9]

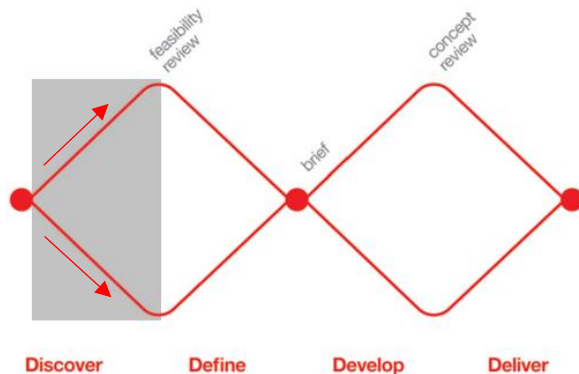


Figure 8 - Showing the first stage in the double diamond design process [9]

### 2.5.2 Define

The next stage of this design process model is “Define”, see Figure 9. The design team will, based on the information gather during the Discover stage, define the project. At the end of the defining stage, is a brief be created. [9]

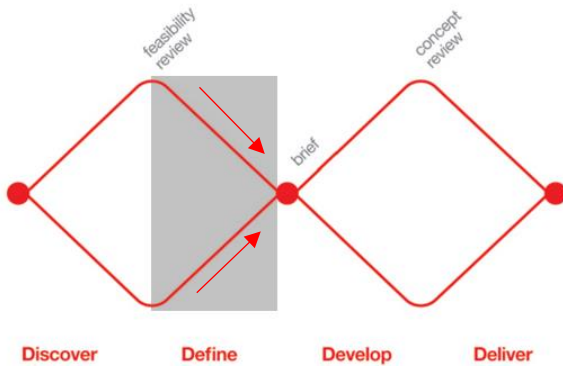


Figure 9 - Showing the second stage in the double diamond design process [9]

### 2.5.3 Develop

The third stage is the “Development” stage, see Figure 10. This is the ideation stage and it is here all the sketches will be developed, iterated and tested. The goal for this stage is to create as many concepts as possible and so that the design team have as much solutions as possible. [9]

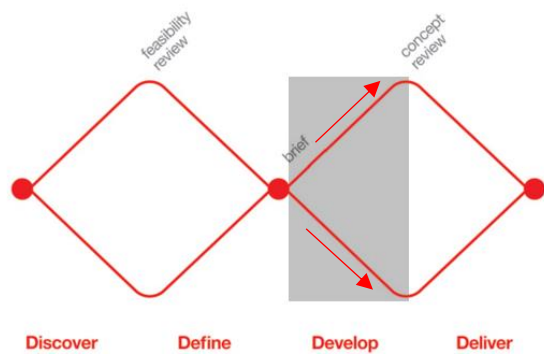


Figure 10 - Showing the third stage in the double diamond design process [9]

### 2.5.4 Deliver

The fourth and final stage of the Double Diamond design process is the “Deliver” stage, see Figure 11. Here will the finalized product be presented and launched on the market. [9]

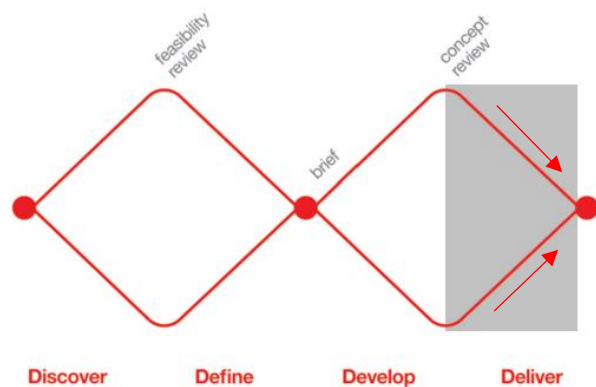


Figure 11 - Showing the fourth stage in the double diamond design process [9]



## 2.6 Appearance

When creating and selling a product, it is important to think about the optical properties of the product. The colour and gloss of the paint is equally important as the choice of material when it comes to the optical properties.

Every human have pre-learned rules which we automatically apply to everything we see. This lets us recognize and interpret the things we see. Walking by a vase of flowers for example. If you walk by it fast, then you might only see that it is a vase of flowers on the table and thereby only apply the pre-learned rules for this. But if something makes you drawn to the flowers and you look more closely at them, then you will apply more rules to be able to interpret what you see. This may lead to you recognizing the type of flower and perhaps evoke memories where this type of flowers have a specific meaning.

Measuring appearance is complicated. When we look at something, we use the response from our visual sense to interpret the light, objects, space, location and movement all working together. Based on what we see, we will make judgements which will lead to us making a specific decision. The light around the product can actually make us buy a product or reject it. When you are buying a car, you might be influenced to buy the car because the surface and glossiness makes us think about high quality and prestige. The visual interpretation can sometimes work against us, since the perception happens fast and automatically. The complete appearance will depend on many different attribute, which occurs when light is shining on the object. [10]

## 2.7 Human Factors

When creating a product, it is important to think about the ergonomics for the user.

When looking at the different dimensions of the human body which is going to have an effect the product, I used the computer program called “PeopleSize Visual Anthropometry Software”. This is a database where you can get information about people’s size based on government surveys.

When searching for people size, you can choose what country you would like to get the people size from. The product that I am creating should be used in Scandinavian homes and thereby based on the sizes of people from Scandinavia. Unfortunately Scandinavia do not have the measurements that I am looking for. Because of this I have chosen to use the information from the country that is geographically closest to us, which is the people size from the German males and females.

Table 1-Table 3 contains different measurement on the body. These numbers represent 99% of the German population in the ages between 25-50 years old. Figure 12 - Figure 14 shows how the measurement has been taken. [11]

Table 1 - Showing the height when standing straight up

Height	Age	Min (mm)	Max (mm)
German male	25-50	1613	1943
German female	25-50	1507	1817

“Measured vertically from the floor to the highest point of the head, compressing the hair. The person stands erect, looking ahead, the arms relaxed at the sides. The shoulder blades (scapulae) and buttocks will ideally be in contact with a vertical surface.” [11]

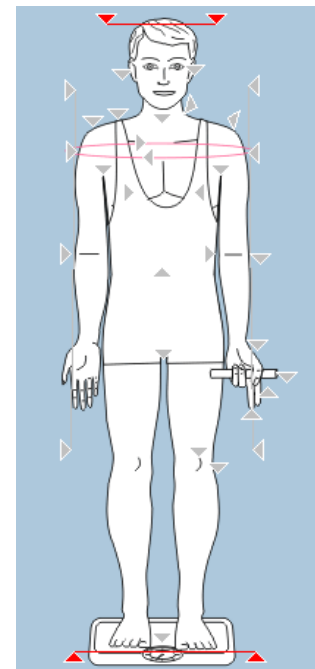


Figure 12 - Showing the height when standing straight up [10]

Table 2 - Showing the height from the feet to the eyes when standing straight up

Height to the eyes	Age	Min (mm)	Max (mm)
German male	25-50	1497	1823
German female	25-50	1406	1702

“Measured vertically from the floor to the outer border of the eye socket. The person stands erect, looking ahead, the arms hanging loosely at the sides. The shoulder blades (scapulae) and buttocks will ideally be in contact with a vertical surface.” [11]

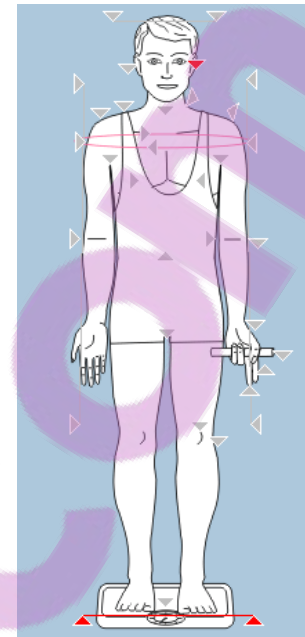


Figure 13 - Showing the height from the feet to the eyes when standing straight up [10]

Table 3 - Showing the elbow height, to bony point with arm straight

Elbow height, to bony point with arm straight	Age	Min (mm)	Max (mm)
German male	25-50	997	1243
German female	25-50	940	1155

“Measured vertically from the floor to the bony prominence on the outer surface of the elbow. The person stands erect, arm hanging straight at the side. This gives a slightly longer measurement than with the elbow bent to 90 degrees.” [11]

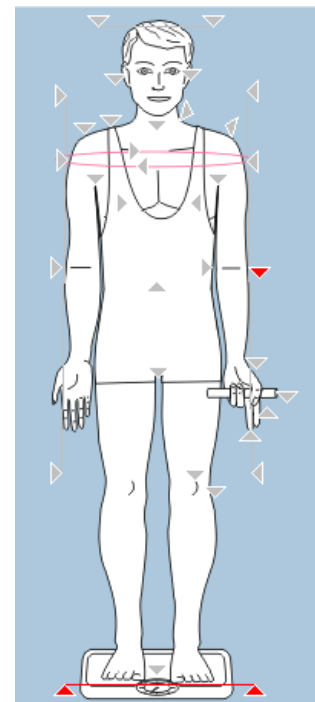


Figure 14 - Showing the elbow height, to bony point with straight arm [10]

The average height of males and females based on country. [12]

Average height based on country	Height (cm)
Swedish Male	177,9
German Male	181

Average height based on country	Height (cm)
Swedish Female	164,6
German Female	165

When working in a standing position, it is important to have the right height on the work surface. This height differs depending on what type of work that will be performed on the work surface, see Table 4 and Figure 15. [13]

Table 4 - Showing the recommended height of work surface for different types of work

Type of work	Example	Height	Height of work surface
Precision Work	Writing, Electronic assembly	5 cm above elbow height. To give support	95 – 120 cm
Light Work	Assembly line, Mechanical work	5 – 10 cm below elbow height	85 – 110 cm
Heavy Work	Work that demands downward forces	20-40 cm below elbow height	65 – 95 cm

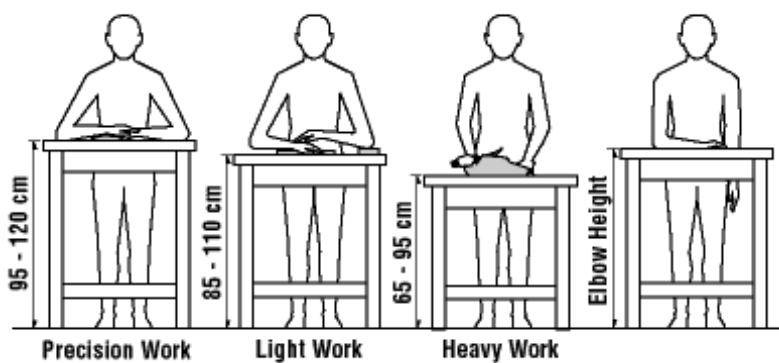


Figure 15 - Showing recommended height of work surface for different types of work [12]

## 3 Method

The methods that were used during this thesis will be described below.

### 3.1 Design Brief

During the design brief will the design team get all the information needed to start the project. The design brief should contain what the project should be about and the information needed to fulfil the expectations. The main focus should be future result and outcomes and not focus on the aesthetics of the design of the product. The design brief should be more of a proposal for the project and not have a clear solution to it. [14]

### 3.2 PERT-Chart

PERT stands for Program Evaluation Review Technique and is a visual tool used in project management. The PERT- Chart consist of nodes and vectors. The nodes can represent milestones or events and the nodes are connected with directional lines called vectors. The nodes can be either parallel or serial. If two nodes are parallel, then it means that the tasks are independent on each other and can be conducted during the same time. If the nodes are serial, that means that the tasks need to be finished in a specific order. [15]

### 3.3 WBS – Work Breakdown Structure

A WBS-Chart (Work Breakdown Structure Chart) gives a visual of all the tasks needed to be done in order for the project to be finished. This chart also consist of nodes and vectors, showing how all the tasks are connected to each other. The difference from the PERT-Chart is that this chart is based on a hierarchy tree. The first nodes are the headlines for the different tasks. Under these headlines, there are several other nodes that symbolizes the tasks. Depending on how detailed the WBS-Chart should be, the design team can continue breaking down the nodes and making them sub-headlines. [16]

### 3.4 Gantt-Schedule

A Gantt-Schedule is a visual schedule put on a time axis. To create a Gantt-schedule the design team have to identify the different activities that is going to be conducted in the project. These activities are then placed on the time axis in the order in which the activities should be carried out. The length of the bars indicates how long time it should take to complete the activity. If two or more bars are overlapping on the time axis, it indicates that these activities should be conducted parallel to each other.

Deciding on how long each activity should be assigned can be difficult if the designer are lacking in experience. A good way to start can be to place out the different deadlines on the time axis and then place out the activities based on if they should be completed before or after the specific deadline. After placing out all the activities, it will be easier for the designer to predict how long time each activity will take. [14]

### **3.5 Stakeholder Analysis**

A stakeholder analysis is a process which the design team uses when trying to identify the different groups that will be affected of the final result of the project. The stakeholders should be organized based on the impact that the project will have on them and the impact that they will have on the project. [17]

### **3.6 Questionnaire Study**

Since the design team is not the end user, it is important to get an understanding of the end user's wants and needs. Collecting information from the end user can be done in many different ways. [14]

The methods used during for this questionnaire study will be explained below.

#### **3.6.1 Observation: Structured**

A structured observation is when a specific type of behaviour is observed. The design team creates an event where people will come and conduct the task that the designer wants to study. This type of method is easily studied but it does not give an explanation for the behaviour. [17]

#### **3.6.2 Interview: Conjoint Analysis**

This type of interviewing method is used to get insight to how people value different features on a product or service. This method is very useful when deciding what features new products should or should not have.

When using this methods, the designer shows some features to the respondent. The respondent will either rate the features or choose the best combination of features. [17]

#### **3.6.3 Interview: Close Ended Questions**

Close ended questions are a questions which the subject can answer with a simple yes or no. This type of answer does not need to be interpreted by the designer. This method is a very fast way to both interview people and analyse the subject's response. [17]

Example of these kind of questions:

Is this a spoon?

Do you like milk?

### **3.7 Brainstorming**

The goal with brainstorming is to generate a large quantity of concepts and ideas. A good way to use brainstorming is to sit in group and try to generate as many ideas as possible. The reason why design team should sit in a group is so that all the team members can build their ideas on the other members' ideas. During a brainstorming session there

should never be any criticism on any of the concepts. It does not matter how crazy the idea might be, another members might get a really good idea by building from the crazy one.

The brainstorming method can be used throughout the whole design process, whenever ideas or solutions are needed. [8]

### 3.8 Target group

Every person is different and like different things. Because of this, it is important that the design team knows who they are designing for. This group is called for the projects target group. The target group is different from the market. The market is everyone that can potentially can buy the product, while the target group is the ones which the design team have in mind when they are designing and who they see as the main buyer for the product, see Figure 16. [14] This group of users shares mutual goals, approach and behaviours when interacting with the specific product or service. [18]

When the design team have established who target group, they can start gathering information about what the buyer appreciates and how that will affect the product that the design team is creating. Another thing that design team should take in to consideration, is that it is not always the user that buys the product, it could be a parent that buys a toy for his or hers child. [14]

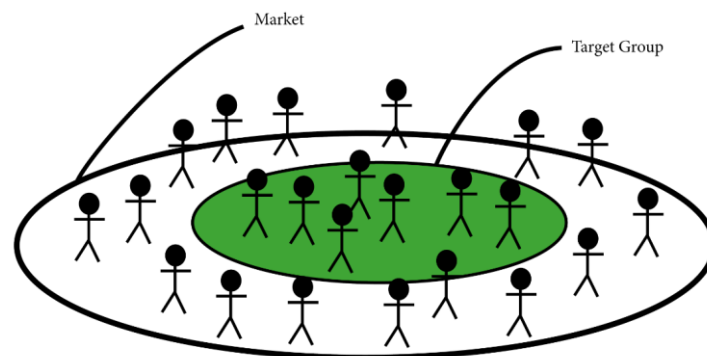


Figure 16 - Showing target group and market

### 3.9 Personas

A persona is a fictional character created by the design team. The personas are not real people but they are based on the target group that the design team is designing for. [18] When gathering information for the personas, the design team can for example look at demographics, habits or a sources of motivation. At last the character is given a name. It is important that everyone in the design team really buys in to the persona and its characteristics. This character should motivate the design team and keep them on track, not make the team confused. [8]

### 3.10 Functional analysis

A functional analysis is a method used to collect data. This data is in the forms of functions that product should have or could have. A functional analysis should only express the function is a verb and a noun and not a description in how the final technical solution should look. A functional analysis will get the best result if it is carried out with all team members during a brainstorming session. This is important since all members should have a chance to contribute to the finished result. [19] [20]

Functional Analysis table contains:

- Feature – The function (verb)
- Noun – A noun that is connected to the feature
- Note – A note about noun
- Type – Classification of the function –  
Main function (MF), Necessary function (NF),  
Desirable function (DF), Unnecessary function (UF)

Description of the classification of the functions:

- Main function – The primary function. If this function is not fulfilled, then the product does not work.
- Necessary function – These functions should be met
- Desirable function – These functions is desirable, but not a priority
- Unnecessary function – These functions are for a various reason is considered unnecessary

*Table 5 - Showing an example on a functional analysis made for a washing machine*

Feature (Verb)	Noun	Note	Type
Clean	Cloth	With a machine	MF
Offering	Refilling of cleaner		NF
Offer	Drying	Centrifuge	NF

There should be one functional analysis for each stakeholder. The reason for this is that some of them have different wants and needs for the product. For example an assembler wants the product to be easy to mount, while this might not be a demand from the user unless the user and the assembler happen to be the same person.



### **3.11 Image Board**

Image Board, also called Mood Board is a picture collage which is used to give inspiration to the design team. The image board can show feelings that the design team wants the target group to feel or it can be to show the environment in which the target group is living or working in. These pictures can be good to make sure that everyone in the design team going in the same direction [14]

### **3.12 Sketching**

Sketching is a good technique when it comes to both visualizing the idea to others and trying out different solutions. A sketch can show things that might be hard to explain. The sketches can be made in both two- and three dimensions, depending on what is important to show. When lots of sketches are done, it is easy to compare and them with each other and choose the best concept. In the beginning, the sketches should be simple and just show the necessary details. When the project then evolves, so should the sketches and they should go more into details the further on in the project that you come. [14]

### **3.13 Design Analysis**

When the design team is designing a product it is important for them to keep track on the ongoing trends and see what might be popular in the future. Design and trend analysing for future trends can be hard to do, because the design team can never really be know what will be popular a year from now. There are two ways to go, either the design team can see what is popular today and maybe make small changes or as few companies dare, create their own trends. [14]

### **3.14 CAD - modelling**

A CAD-model can give the design team an early understanding for how the sketch would look like in real life. This is also a good step to have between sketching and model making, because you can really see the dimensions and the different objects compared in size with each other. It is also good when you fast want to compare different designs with each other. [14]

### **3.15 Rendering**

After a CAD-model is created, the design team can use a rendering program to make the CAD-model more realistic and show how it would look in real life. The design team can create different types of renderings, it can be a rendering representing just the product or the how the product would look like in its future environment. [14]

### **3.16 Physical Model**

After a sketch has been created on a paper and then made in to a CAD-model in the computer, it can be a really good thing to create a physical model. The physical model can be very easy and basic or very advanced and look exactly like it would when it is produced, this is all depending on when in the design process that it is made. When creating a model, the design can really experience how the product would be to use. The design team can also see things with model that had not been noticed during sketching and making of the CAD-model. When the model is rough, it is called a mock up and they could just be tape on the wall or cubes that has been drawn on. When a model is created in end of the product, it can be divided in to two kinds of models, design models and functional models. [14]

#### **3.16.1 Design model and Functional Model**

A design model, looks just like it has been produced. A design model does not work, it only has the same look and use of material as the product while the functional model have them same functions as the real product.

A functional model is a model which works just like the real product would. This could be made in to a smaller scale model, but normally it is in scale of 1:1.

The design model and functional model can sometimes be combined.

A model is normally in the same shape, of the same material and have the same functions as the finish product, the things that can be different is the manufacturing method. The reason for not using the same manufacturing methods is because the machines and tools are usually very expensive. [14]

## 4 Approach and Implementation

This chapter will present the approach of this thesis and also how the methods have been implemented throughout it. The approach for this thesis has been a mixture of designer-based (see Chapter 2.3.2) and research-based (see Chapter 2.3.3) and it will be presented in the stages of design process Bootcamp Bootleg as has been described in Chapter 2.4 at page 12.

### 4.1 Empathizing

The first stage is the empathizing stage. Here will the design brief, planning of the thesis and questionnaire study be presented.

#### 4.1.1 Design brief

The first thing in I did in this thesis was to get a design brief. The company that I worked with, did not give me so much information about what they wanted during the brief. They wanted to see what I could do without giving me any boundaries, but if I had any questions about ironing boards, I could always ask them.

#### 4.1.2 Planning

After the design brief, I started with planning the thesis.

##### PERT-chart

I started with creating a PERT-chart. I began with identifying the different milestones for the thesis. These milestone were written down on post-it notes to make them easier to arrange. The post-it notes were then placed in order of which they were going to be conducted and whether or not they were depending on other milestones to be finished before. When all the post-it notes were arranged in a satisfying way, lines were drawn between the notes to make the critical path visual and to give a clear view of which milestones were depending on others. The PERT-Chart was then put in the computer and printed.

The PERT-chart which was created for this thesis can be seen in Attachment 8.1

##### WBS-chart – Work breakdown structure chart

When the PERT-chart was done, I continued with breaking down the different milestones and thereby creating a WBS-chart. The post-it notes that were used during the creation of the PERT-Chart was used here as well. The milestones were placed in the order, which they were going to be conducted and used as headlines for the WBS-Chart. These headlines where broken down in to tasks and written on post-it notes, one note for each task. These where then placed under each headline. The WBS-Chart was then put in the computer and printed.

The WBS-Chart that was created for this thesis can be seen in Attachment 8.2

## **Gantt-Schedule**

The next part of the planning, was creating a Gantt-schedule which would give me all the tasks on a timeline. The tasks for the Gantt-schedule was based on the tasks that were identified during the creation of the WBS-chart.

The tasks where placed in a column, in the order in which they should be conducted. Before the estimation on how much time each task would take, was the different fixed dates place out on the timeline. These dates were the dates for the mid-presentation, final presentation and the date for when it is time to send the report to the opponent. Based on these dates, it is easier to estimate on how much time each task maximum could take. The time estimations where created from end to beginning.

The Gantt-Schedule that was created for this thesis can be seen in Attachment 8.3

### **4.1.3 Questionnaire Study**

To get valuable information from users of ironing boards, was a questionnaire study conducted. This was a way to get some thoughts from users and information about their wants and needs. The questionnaire study included 20 people that were observed and interviewed separately. The sex ratio was 12 male and 8 female in different ages.

The questions that were asked were divided in to three sections.

The first section was about observing the subjects when they interacted with ironing boards that were brought to the interview. These ironing boards had different styles and shapes, see Figure 17. The ironing board with blue cover is the one which is referred to number 1, the ironing board with pink cover is referred to as number 2 and the blue-green to number 3.



*Figure 17 - Showing the different ironing board which were tested during the first section of the questionnaire study*

The second section of the interview focus on the ironing board that the subject have at home and the usage of it.

The third focused on the future ironing board for the subject. What they value the most when they buy an ironing board and new functions that the user would like to see in the future.

The questions asked during the questionnaire study can be seen in Attachment 8.5.1. The answers given by the subjects can be seen in Attachment 8.5.2.

#### 4.1.4 Design analysis

During this thesis was two design analysis made and compared. The first analysis was made after a visit to the “Furniture and Light Fair” in Stockholm, Sweden. The second design analysis was create after a trip to a store in London, UK called “Skandium”, where they sell Scandinavian design interiors.

Larger images of Figure 18 and Figure 19 can be seen in Attachment 8.6.

#### Furniture and Light Fair, Stockholm

## Design Analysis STHLM



Figure 18 - Showing the design analysis that where made based on Furniture and Light Fair in Stockholm

At the Furniture and Light Fair in Stockholm, you could see soft colours with a lot of natural material like wood and concrete. There were a lot of geometric shapes mixed with each other, either in black and white or in different soft pastel colours.

As shown on Figure 18, there are a lot of furniture's where the designer have taken a natural material like unpainted wood and used it together with material that has been painted in a toned down colour.

Compared to last year, the nature has gotten a larger voice and is now moving from the outside in.

### Skandium, London

## Design Analysis LONDON



Figure 19 - Showing the design analysis that were made based on the visit to "Skandium" in London

In the "Skandium" store in London, you could defiantly see the Scandinavian design. They had the same colour scheme that you could see during the furniture and light fair in Stockholm.

The use of natural material like wood where used a lot with painted surfaces.



## 4.2 Define

After all the information was gathered, I started to define the project by creating a stakeholder analysis and creating a functional analysis on the different stakeholders that have the most impact on the product. I also decided which target group I wanted to design for and made personas within this target group

### 4.2.1 Stakeholder Analysis

The defining stage started with creating a stakeholder analysis. This would give me an overview of who would have an impact on the product and which stakeholders I needed to take in to consideration when creating the functional analysis. To make the analysis more clear, was a stakeholder analysis chart created, see Figure 20.

A larger image of Figure 20 can be seen in Attachment 8.4.

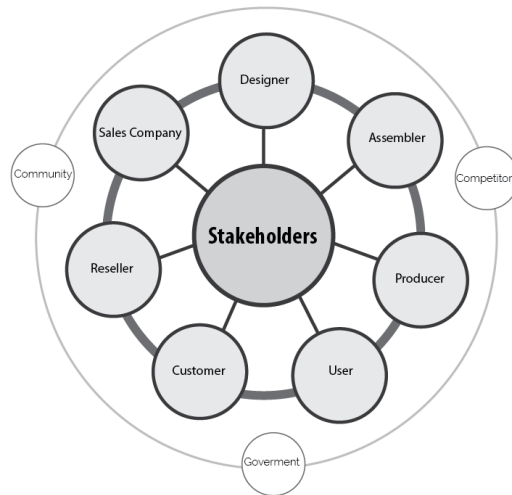


Figure 20 - Showing the a visual image of the Stakeholder Analysis that was created

The stakeholder that were identified were:

- User – The persons who are going to use the product
- Customer – The persons who are going to buy the product
- Reseller – The company who are going to sell the product to the customer
- Sales Company – The company who are going to sell the product to the reseller
- Designer – The person who is designing the product
- Assembler – The company who are going to assemble the product
- Producer – The company who are going to produce the parts for the product
- Government – The government and their laws
- Community – The community around the product
- Competitors – The companies that sell similar products

## 4.2.2 Target group

It is impossible to create a product that everyone is going to like. This means that you as a designer have to choose a target group to design for. I did not get a specific target group to design for during my design brief, so I could choose for whom I wanted to design for myself. When choosing target group, I started brainstorming around what types of target groups I could design for. In the end I choose to create an ironing board for people in the ages between 25-30 years old. They have no children and are either living alone or together with a partner. They have recently started working or they have been working for a couple of years, but they feel that they have an enough income to be able to put some extra money on furniture's and decorations. They are living in a city somewhere in Sweden and their apartment can be considered as a compact living apartment.

## 4.2.3 Image board

To get inspiration when sketching ironing boards for the target group, was an image board created, see Figure 21. This image board was made to represent the environment in which the product could be placed in. When creating the image board, I took in to consideration the design elements that were shown in Stockholm and in London. The reason for doing this is so that the product that I would create was going to fit in to an environment that have the same feeling as the products seen on the furniture and light fair and in the store in London.

A larger version of Figure 21 can be seen in Attachment 8.7.



Figure 21 - Showing the image board that was made to represent the target group



To learn more about ironing boards for compact living, I made an image board with competitor products that exist on the market, see Figure 22.



Figure 22 - Showing image board that was made to represent the competitors' products

#### 4.2.4 Persona

Three personas were created for this thesis. These personas represent the target group that I have chosen to design for. These personas live in different cities around Sweden, they have different marital status and they have different living arrangements but the thing that makes them alike is the fact that they all have a compact living situation. A summary of the different personas will be presented below.

The whole personas that were created for this thesis can be seen in Attachment 8.8.

#### Felix and Amanda

	<b>Name:</b> Felix and Amanda
	<b>Age:</b> Felix is 29 and Amanda is 27 years old
	<b>Marital status:</b> Engaged
	<b>Location:</b> Vasastaden, Stockholm City, SWEDEN
	<b>Income:</b> Felix works as a Key Account Manager has an income of 40 000 kr/month Amanda works as a conference hostess and has an income of 26 000 kr/month
	<b>Activities:</b> Felix is playing tennis twice a week and Amanda enjoys art and decorating

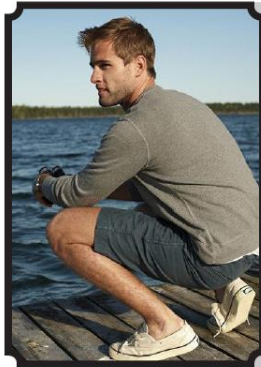
Figure 23 - Showing a summary of the Felix and Amanda persona

The first persona (Figure 23) that was created was an engaged couple, living in Stockholm. They have recently bought a two bedroom apartment and are now looking for furniture that will fit in to their home.

#### Style for the apartment:

Scandinavian style with soft colours and raw materials like wood and concrete.

## Henrik Lundberg



**Name:** Henrik Lundberg  
**Age:** Henrik is 28 years old  
**Marital status:** Single  
**Location:** Redbergsplatsen, Gothenburg, SWEDEN  
**Income:** Henrik is working as a Calculating Engineer at a consulting company and has an income of 33 000 kr/month  
**Activities:** Henrik plays the guitar and enjoys sailing and mountain climbing

*Figure 24 - Showing a summary of the Henrik Lundberg persona*

The second persona (Figure 24) that was created was a single guy living in Gothenburg. He have just moved in to a first-hand contract apartment after renting second-hand for several years. He wants his home to be a place where he can relax after a long day at work.

### Style for the apartment:

Industrial style with a mix of new and antique furniture's.

## Emelie Andersson



**Name:** Emelie Andersson  
**Age:** Emelie is 25 years old  
**Marital status:** Dating  
**Location:** Värnhemstorget, Malmö, SWEDEN  
**Income:** Emelie is working as a Journalist at a traveling magazine and has an income of 25 000 kr/month  
**Activities:** Emelie enjoys traveling and shopping with her girlfriends

*Figure 25 - Showing a summary of the Emelie Andersson persona*

The third and last persona (Figure 25) created for this thesis is a girl whom just move in to a one bedroom apartment that she rents second-hand in Malmö.

### Style for the apartment:

Light colours with a sense of “Less is more” when it comes to decorating.

### **4.2.5 Functional analysis**

To get a greater visual on what functions the different stakeholders want to have on the product was a functional analysis created on each stakeholder closest to the product. When creating the functional analysis, I began with taking the different stakeholders and making them in to headlines. Then I started to brainstorm on what functions the different stakeholders would want to include in the product.

The personas that were created were used as inspiration when creating the functional analysis for the user.

The functional analysis that were made for this thesis can be seen in Attachment 8.9.

## **4.3 Ideate**

After the thesis was define, I started with the ideation stage. During this stage of the thesis I created many sketches and turned some of them in to CAD-model and renderings.

### **4.3.1 Sketching**

Brainstorming sessions where sketches were made was used almost through the whole stage. In the beginning of the ideation stage I made sketches that showed the shape and some large functions, but they did not go in to detail to how everything would be solved.

These sketches can be seen in Attachment 8.10.

### **Four Concepts**

To get feedback from the company, were the four best concepts created in CAD and rendered to give a feeling in how they would look like hanging on a door. The concepts did not have an extensive amount of details, just enough to get an understanding on how the concept would work. The four concepts will be closer explained below.

Larger images of the four concepts can be seen in Attachment 8.11

### **Concept 1**

Concept 1, see Figure 26, is based on an ironing board that you fold up in to a frame that will hide the ironing board. This ironing board can be mounted on over a door with the help of hangers or remove the hangers and mount it on the wall.



Figure 26 - Showing Concept 1

### **Concept 2**

Concept 2, see Figure 27, is based on an ironing board with square metal bars. On Concept 2, the user have the possibility to adjust the height on to ironing board, just to get the perfect height when using it. This concept can be hung over the door with the help of the hangers or used without the hangers and mounted on the wall.



Figure 27 - Showing Concept 2

### **Concept 3**

Concept 3, Figure 28, is based on an ironing board that is mounted to a metal bar. The metal bar is divided in two pieces and will allow the user to change the height of the ironing board slightly. This concept can be both hung over a door and mounted on a wall.



Figure 28 - Showing Concept 3

### **Concept 4**

Concept 4, see Figure 29, has an asymmetric design of metal bars. When the ironing board is folded down, it is held up by the metal bar that is going horizontally. This concept is only made for hanging over the door.



Figure 29 - Showing Concept 4

### **4.3.2 More sketching and CAD-models**

Based on the feedback from the company, I chose to continue with the one that they thought had the most potential, which was concept 1. The sketching sessions became more focused on what functions that could and should be included to give the ironing board as many functions as possible without giving up the feeling of simplicity. The sketches got more and more in to details and some sketches just showed how different parts of the ironing board could look or work.

The sketches that were created during this thesis can be seen in Attachment 8.10.

When I felt satisfied with some parts, I made CAD-models of them and place them on the model. The reason for this was because it is easier to compare different concepts and solutions when you see how they would look in their right context. The CAD-models also gives the right proportions to the parts, something a sketch might not. The CAD-models also makes it easier to present and explain the concept.

The programme that was used to create all the CAD-models for this thesis is called Solid Works 2014, Education Edition.

### **4.3.3 Final CAD- model and Renderings**

The final concept for the thesis was build up over time and parts were added along the way after the sketches had been created and turned into CAD-models. The reason for this is because you start with the big picture which is the shape and then work in to the details step by step. You take one function at the time and try to find the solution to it. There might be many solutions that will create the same function. At times like this, I made CAD-models on several different solutions and place them on the model before I made a decision on which one I should move forward with. If it was hard to choose which between different solutions, I import the model in the renderings program Keyshot 5 and placed the right material and colour on it.

The complete model with the majority of parts, was made in the same model. This was so all the parts would fit together. The model was later split up in to the different parts and adjusted to be able to get the parts milled or 3D-printed. Some of the parts had to be split more times to make it possible to get them milled. The parts that had to be split more times than one time were slightly changed to make them easier to assemble after they had been milled. The model was then assembled in the CAD-program again to make sure that all the parts still fitted together. The final CAD-model can be seen in Chapter 5.2 at page 45.

To make the CAD-model more realistic, several renderings created. The renderings shows a more realistic view of how the product would look with different material and colours, and how it would look like when it is integrated in a room. In the renderings programme, I had opportunity to make an animation of how it would look like when the ironing board is folded up and down. The result for the rendering can be seen in Chapter 5.3 at page 46

#### 4.3.4 Name and Logo

The name I chose to for this product is UNI. UNI is Latin and it means “one”. The name was chosen to highlight that it is many functions in ONE product.

The logo, see Figure 30, which was created is symbolising how the ironing board looks like in different views.



*Figure 30 - Showing the logo that was created for the ironing board*



## 4.4 Prototype

During the prototyping stage was the physical model made.

All the images from the model building can be seen in Attachment 8.14

The result for the physical model can be seen in Chapter 5.4 at page 53.

### 4.4.1 Physical Model

Based on the measurement of the CAD-model, was a physical model built. There have been several material used during the building of the physical model.

I started be milling out the frame, shelves and some parts of the ironing board in hard foam and MDF-board. The machine used for milling the part were a CNC-milling machine. Figure 31 shows all the components that wear milled out for this thesis.



*Figure 31- Showing the components that have been milled*

The other parts that were used to build the model, were bought in different stores, except the hooks for the hangers, which were 3D-printed.



#### 4.4.2 Frame

I began to mount together the outside frame, see Figure 32 - Figure 34 . The model had to be milled on several pieces, because there was not enough room in the CNC-mill to be able to do it in one piece. To get support when mounting the frame together, I used thin pieces of hard foam. These pieces were also used as a guide on where the different parts should be placed.

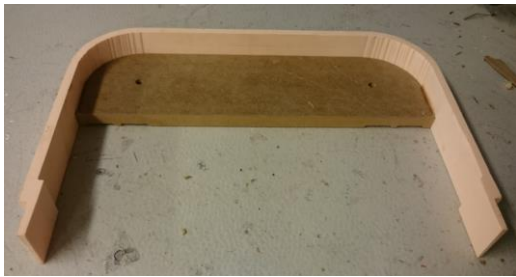


Figure 32- Showing image of mounting the top of the frame (Part 1)

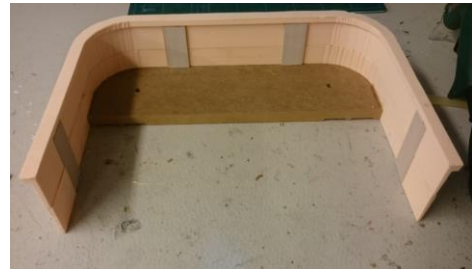


Figure 33 - Showing the steps of mounting the top of the frame together (Part 2)



Figure 34 – Showing the step of mounting the top with the frame legs

#### 4.4.3 Legs

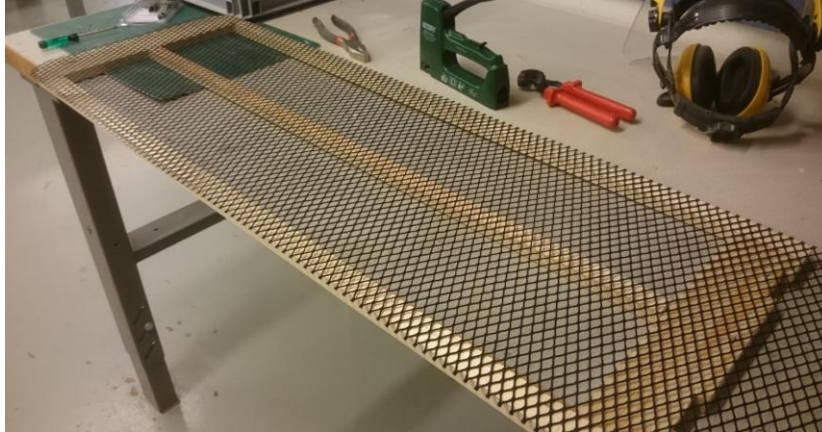
The legs which are going to support the ironing board when it is folded down, was milled out in one piece. To make the legs more stable, was two bent aluminium rails mounted with hot glue. The legs had pockets milled out to make the rails more integrate, but to make them unnoticeable were they spackled and sanded, see Figure 35.



Figure 35 - Showing the legs with the bent metal rails mounted

#### 4.4.4 The board

The skeleton of the board was made out of wood, which I mounted a mesh net on one of the sides, see Figure 36. This net is what is going to be the base of the ironing board and to make it fit exactly to the wood skeleton, I cut off the ends with nippers. On top of the mesh net was wadding placed to make the surface smooth. The wadding was then covered in a fabric.



*Figure 36 - Showing the wood skeleton with a mounted mesh net on*

On the other side of the wood skeleton, was a mirror placed. To hold the mirror up was a frame placed in front of it. On this frame was the legs which was going to be supporting the board mounted and together with the top piece to give the front a smoother surface. These legs and the top piece will act as the mirror frame when the board is folded up.

#### 4.4.5 Hangers for the door

The hangers for the door is made out of two door hangers and a metal rail. The door hangers were sawn in to two pieces and the metal rail was sawn in to two equal lengths which would put the surface board at the right height, when folded down. In the flat aluminium rails were several holes drilled so it would be possible to change the length of the hangers. The metal rail were glued together with the part which is going to be hanged over the door. These pieces were spackled to make it look like they were one piece.

On the part which was going to be holding the ironing board were two holes drilled in to make it possible to mount the hanger together.

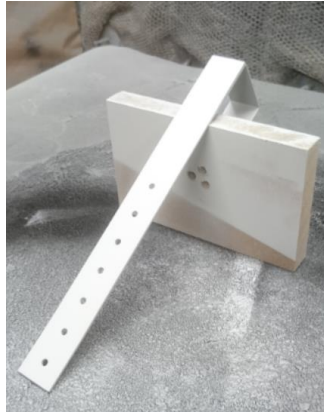


Figure 37 - Showing the hangers for the door

#### 4.4.6 Steps for painting

All the parts which were going to be painted were sanded, spackled, sanded again and sprayed with filler. When you had put a layer of filler on the model, it was easier to see the dimples that needed to be filled with more spackle and the bumps that needed to be sanded down. After putting on more spackle and sanding it with sand paper, was a new layer of filler placed on the piece. The roughness of the sandpaper was chosen based on how large the dimples and bumps where. These steps were repeated multiple times until there was an even, smooth surface, see Figure 38. Next step was to spray a layer of paint on the parts. After a layer of paint had been sprayed on the surface, I sanded it with a very fine sandpaper to contain the smoothness of the surface and then I covered it with a new layer of paint.



Figure 38 - Showing the frame and shelves covered in several layers of filler

The final assembly of all parts occurred after all the sub-assemblies had occurred and all the pieces had been painted and dried.

## 5 Result

Here will the final result for this thesis be presented. The chapter includes a description of the final concept, renderings of the CAD-model that was created and how the model would look like in the environment it should be placed. The chapter also includes pictures of the building and finishing of the physical prototype.

### 5.1 Final Concept

The final concept was chosen because of the multifunctional features and the easy access to the ironing board.

The final concept is named UNI and is a wall-mounted ironing board with storage. When the ironing board is folded-up, it turns in to a stylish mirror and when it is folded down, the backside of the mirror frame will become the surface of the ironing board.

To get stability and prevent the ironing board from breaking, is a part of the mirror frame folded down and acting as a supportive leg. When the user is done with the ironing board, he/she simply fold the ironing board up and fasten it with the leather strap at the top. The legs will automatically swing back to its original position and held there with the help of magnets. The foldable legs have a length that will give the ironing board a height of 900 mm above the ground. This is a measurement that needs to be taken in to consideration when mounting it on the wall.

Even though it is recommended to mount the ironing board on the wall, to get maximum support, so can the user which is living in an apartment where it is not permitted to drill holes in the wall, hang the ironing board over a door. This is possible with the help of removable hangers that you place over the door. The hangers can be adjusted to the doors height and by changing the length of the hangers.

The frame which the ironing board is mounted to in has storage in the form of shelves and hooks. What the storage is used for can be changed, all depending on which room the ironing board is mounted in.

### 5.2 CAD – model

Figure 39 and Figure 40 shows the CAD-model from the front and the back.

The part that is highlighted with blue on Figure 39 is the integrated legs. When the board is folded down, so will they and thereby give stability when ironing.

The parts which are black on Figure 40 is made out of metal. The long metal rail are there give stability to the product and give support to the shelves on the inside. The short ones on the bottom is iron brackets and they are there to give support to the holder of the board. The half long on the top is the hangers that is going to hold the product up, if it is hanged over a door.

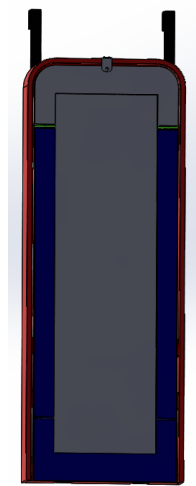


Figure 39 - Showing the front of the CAD-model

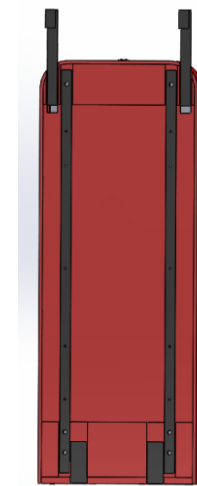


Figure 40 - Showing the back of the CAD-model

### 5.3 Renderings

The renderings were created to get realistic pictures of the ironing board with the right colour and material. The different views of the ironing board will be explained below, both when the ironing board is folded up and when it is folded down. The renderings that were created for in this thesis was done in the rendering programme Keyshot 5.

#### 5.3.1 Main components

The main components for the ironing board is shown in Figure 41.

A larger image of the ironing boards' main components can be seen in Attachment 8.12.1

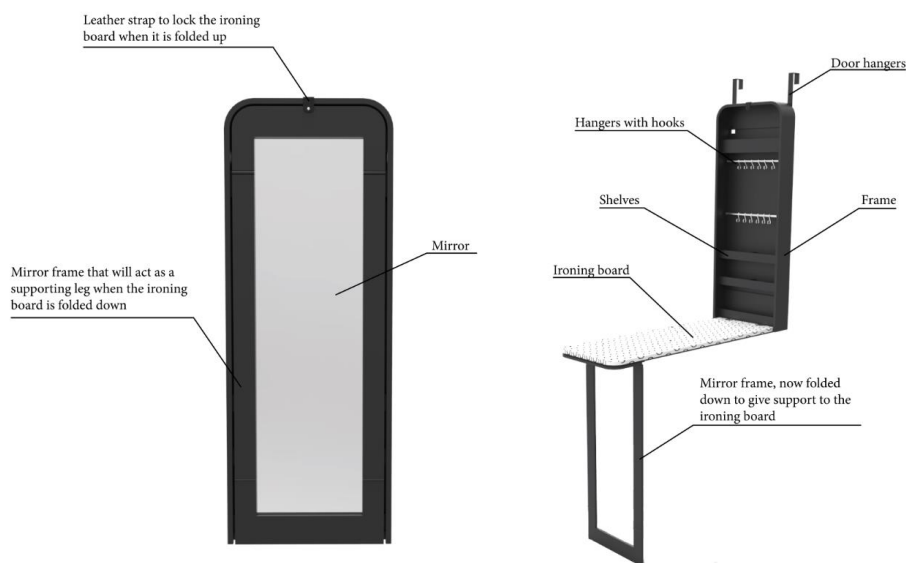


Figure 41 - Showing the ironing boards main components

### 5.3.2 Ironing board folded up

The front of the ironing board consist of a frame that has straight sides and rounded edges in the top corners, see Figure 42. The rounded edge is created to the follow the form of the ironing board.

To make the product as multifunctional as possible is a mirror fasten on the front. The mirror can be changed out to a black board, depending what the user wants.

The frame around the whole product is made out of wood which has been bent to achieve the round edged. The frame for the mirror is also made out of wood to get a strong support for the board.

On the back of the ironing board, is two metal rails fasten. They are placed to give support to the construction when the ironing board is mounted on the wall. They should also give support to the shelves and hangers on the inside.

On the top of the frame is a leather strap fasten with two rivets, see Figure 44. The strap is fasten in front of the ironing board with the help of a rifle button when the ironing board is not in use, see Figure 45.



Figure 42 - Showing the front of the ironing board when it is folded up



Figure 43 - Showing the back of the ironing board when it is folded up



Figure 44 - Showing the top of the ironing board when it is folded up



Figure 45 - Showing the an enlarged image of the leather strap booked on rifle button the front of the ironing board when it is folded up

On the bottom of the ironing board, there are two squares, see Figure 46. These squares are iron brackets which you could see in on the CAD-model in Figure 40. The purpose of them are giving support to the holder, which the board is mounted to.



Figure 46 - Showing the bottom of the ironing board when it is folded up

Larger images of the ironing board when it is folded up can be seen in Attachment 8.12.1.

### 5.3.3 Ironing board folded down

To give support when the ironing board is folded down, see Figure 47 and Figure 48, parts of the mirrors' frame is folded down and becomes a leg. The legs are made out of wood and a bent aluminium rails which have been integrated in the legs to enhance the strength.

Larger images of the ironing board when it is folded down can be seen in Attachment 8.12.3.

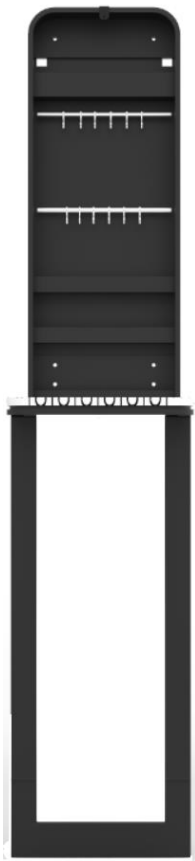


Figure 47 - Showing the front when the ironing board is folded down

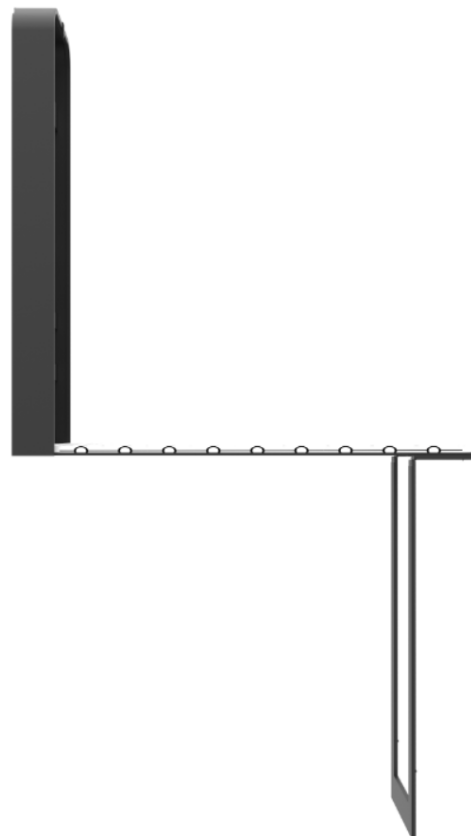


Figure 48 - Showing the ironing board from the side when it is folded down

When the ironing board is folded down, it will get support by the wall. The force (see the red arrow on Figure 49) which is needed to hold the board up will be transported through the plate, which it is mounted to and in to the wall.

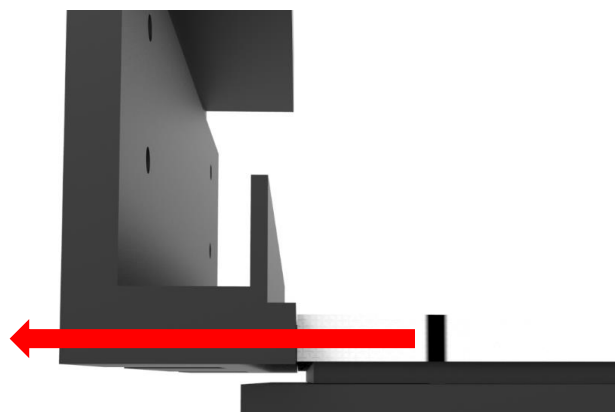


Figure 49 - Showing a zoom view of how the ironing board looks folded down without the frame



### 5.3.4 Inside of the ironing board

When the board is folded down, the user can access the shelves and hangers.

The shelf on the top only has one large compartment, while the other two shelves are split and have two compartments.

On the bottom of the frame is a compartment that can be used as a shelf as well. The main reason for that shelf is to protect things to get stuck in the hinges.

On each hangers is six hooks attached. These hooks are solid s-hooks. This means that the hooks can be moved to left and right but they cannot be removed from the hangers without unscrewing them.

The shelves are made out of MDF-board and the hangers and hooks are made out of extruded aluminium.

Larger images of the inside of the ironing board can be seen in Attachment 8.12.4.



Figure 50 - Showing the metal hook in side view



Figure 51 - Showing the metal hook in front view

Figure 52 - Showing the shelves, hangers and hooks when the frame is removed

### 5.3.5 Cover

The ironing board cover, which was chosen for the ironing board has a pattern of black and white, see Figure 53. The pattern has a white background and ovals of black and white placed in straight lines. The oval shapes are connected with each other with black lines.

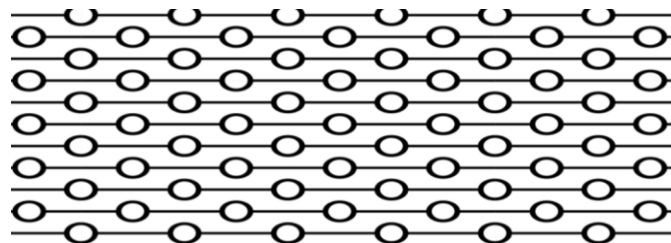


Figure 53 - Showing the pattern chosen for the ironing board

This cover will be mounted in a way that makes it permanent, but when the fabric starts getting old and dull, it can be concealed with a new ironing board cover. The new cover is pulled over the old one and is hold together with a rubber band which you tie together.



### 5.3.6 Hanging over the door

When the ironing board is going to be hung over a door, will the user have to use special door hangers, see Figure 54 - Figure 57. The door hangers are easily mounted to the back of the ironing board. The door hangers are divided in two pieces so they may be adjusted in length depending on how high the door is. The material for the door hangers is steel, which has been bent and drilled holes in to. The length of the hanger is adjusted by changing which holes you put the screws in.

Larger images of the ironing board with the door hangers mounted can be seen in Attachment 8.12.5

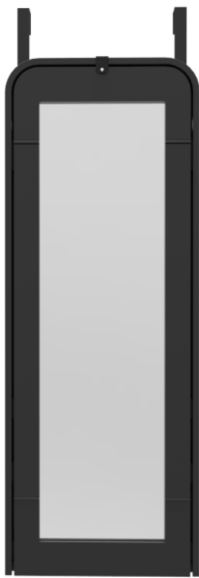


Figure 54 - Showing the front with the door hangers are mounted



Figure 55 - Showing a perspective view of the ironing board when the door hangers are mounted



Figure 56 - Showing the door hanger from the side



Figure 57 - Showing the door hanger from the front

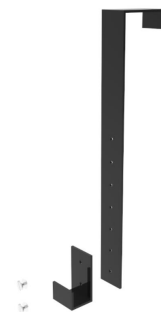


Figure 58 - Showing an exploded view of the door hanger

Figure 59 and Figure 60 is showing how the ironing board would look in its' real context when hanging over a door, both folded up and down.



Figure 59 - Showing the ironing board folded up and hanging over a door



Figure 60 - Showing the ironing board folded down and hanging over a door

### 5.3.7 Different styles

The ironing board comes in two different colours, black and white. And the mirror that comes as a standard, can be changed for a black board.

For this thesis, I have chosen to focus on the ironing board with the colour black and mirror function. Figure 61–Figure 64 shows what the other concepts would have looked like when mounted on the wall but all of these concepts can of course be hanged over a door.

Larger images of the different styles for the concept can be seen in Attachment 8.13.

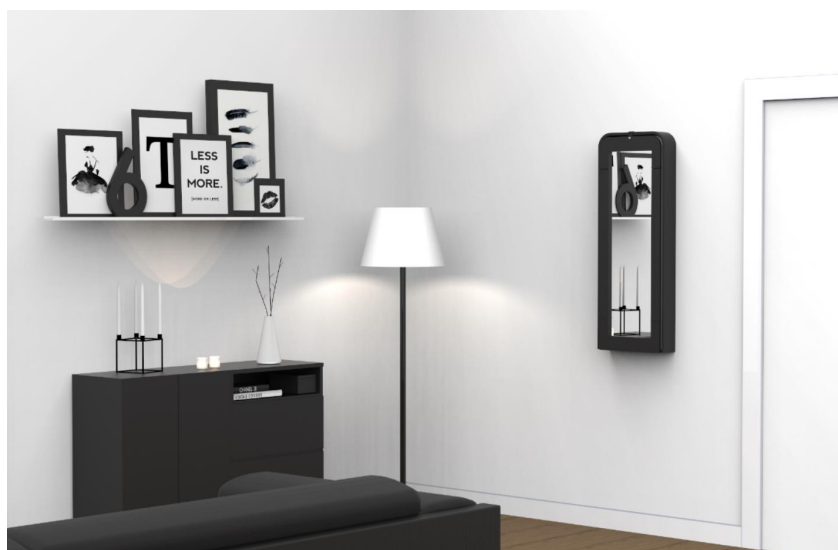


Figure 61 - Showing the black concept with a mirror



Figure 62 - Showing black concept with a black board



Figure 63 - Showing the white concept with a mirror



Figure 64 - Showing the white concept a black board

## 5.4 Main Dimensions

When creating the ironing board, there were some dimensions that were important to look in to. This was both out of an ergonomic aspect and the measurements of the environment it was going to be placed in.

The main dimension was the height of the boards' surface when it is in use. To get the height was the type of work analysed to be somewhere in between light and heavy work. The recommended height for light work is 85 – 110 cm and 65 – 95 cm for heavy work. According to this, the height of the boards' surface should be somewhere between 85 – 95 cm above the floor. The height of the boards' surface was chosen the height in the middle, which was 90 cm. In Sweden this is also the standard height for a kitchen-sink, which also is a height that cannot be change, but people of every length is using.

The second dimension was the length of the ironing board. This dimension is important for two reasons. The first one is that the user should be able to iron the items that he or she have at home. The second reason is because the backside of the ironing board should be acting as a mirror when it is not in use. The mirror should thereby be in a position where an average tall man can look at his reflection. But the ironing board should not be longer than needed, because then it can be hard to find a place with enough room to mount the ironing board.

The average height for a Swedish male is 177.9 cm, which means that when the mirror is folded up it should be in a position where the top of the mirror should be minimum 177.9 cm above the floor.

The work surface does not just have to be in the right height and length, but also have a good enough width. This dimension will also affect how wide the mirror can be. But the ironing board cannot be too wide, if it is going to be hanged over a door.

Another dimension that were important was the height of a door. A doors height can differ quite a lot depending on when it was made and how old the apartment is. If the ironing board is supposed to be hanged over a door and still have the work surface at 90 cm above the floor, then the hangers have to be adjustable in some way.

## 5.5 Mounting the ironing board

To give the ironing board as much stability and support as possible, it is recommended to mount it six M8 screws to the wall. If the user are not able to mount it on the wall, it may be hanged over a door.

### **Mounting on the wall:**

When mounting the ironing board to the wall, it is important to know what type of wall you have and choose the types to screws that suits that type of wall. Ask a professional for help if you do not know what type of wall you have or what screws you should use for your wall.

### **Hanging over the door:**

When hanging the ironing board over a door, it may occur that the ironing board will strike door if the door is closed fast or hard. This can be avoided by fastening the ironing board with two screws to the door. If you are not allowed to drill in the door, you can put double sided tape on the backside, which you can easily remove with the help of heat from a hair dryer.

## 5.6 Physical Model

Here will the final result of the physical model be presented. The physical model has been built in a scale of 1:1.

### 5.6.1 Frame

The frame of the product is made out of hard foam which have been milled out in several pieces and then assembled, see Figure 65.

On the top of the board is a leather strap mounted with two rivets. This leather strap is hooked to a rifle button to keep the board in place when it's not in use, see Figure 66.



Figure 65 - Showing the frame of the physical model



Figure 66 - Showing the leather strap mounted with rivets

### 5.6.2 Board

The board have a wood skeleton where a mesh net have been fasten to give the user a stable surface to iron on. The mesh net is covered in wadding to give a smooth surface to iron on. All this is covered by a fabric which has a white base and a black pattern of ovals and lines, see Figure 67.

On the other side of the board is a mirror mounted. The mirror that is used is made out of acrylic, which means that it is flexible and can follow the rest of the board when it flexes. The mirror is hold in to place by a frame. This frame is divided in two pieces which are both screwed to the wooden skeleton. If the user wishes to exchange the mirror to the black board, he or she only unscrew the bottom part, exchange the mirror for the black board and then screw the bottom part back to the board, see Figure 68.

On the top of the frame which holds the mirror, is a top part glued. On this top is the rifle button screwed on for the leather strap, see Figure 69.



*Figure 67 - Showing the board with the fabric side up*



*Figure 68 - Showing the board with the mirror side up*



*Figure 69 - Showing an enlarged view of top piece, leather strap and the rifle button*

### **5.6.3 Locking the board in place**

A magnet has been placed at the top of the ironing board, to keep the ironing board in place when it is folded up. But to make it easier to get a hold of the ironing board when you are going to use it, have the magnet been fasten on a push lock. By pressing the top of the board inwards, you will hear a click, letting you know that the push lock is activate and you can pull back your hand. The push lock will then push the board out from the frame and thereby making it easier to grab. To make sure that the ironing board will not come falling down if you accidently bump in to it, has a leather strap has been hooked around a rifle button, which you have to unhook first. When you are done with using the board, you simply fold it up and push the top of the board against the push lock until you hear it clicking and then hook the leather strap over the rifle button.

Figure 70 - Figure 71 is showing how the push lock will look activated and inactivated without the board.

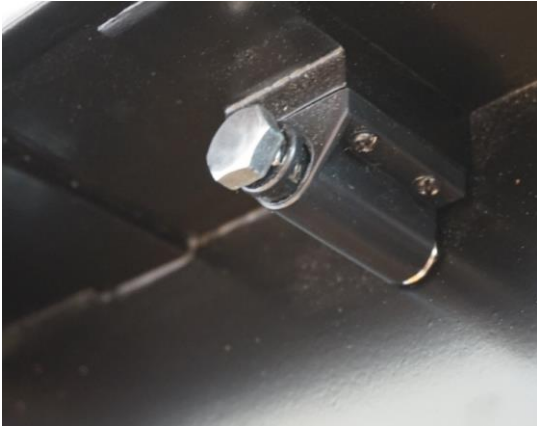


Figure 70 - Showing the push lock inactivated without the board

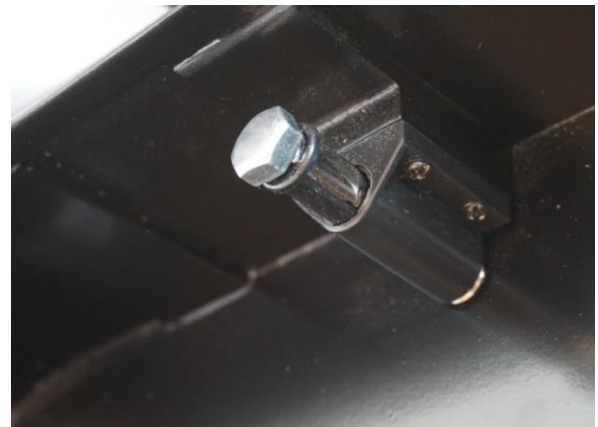


Figure 71 - Showing the push lock activated without the board

#### 5.6.4 Back of the model

The back of the model consist of six parts. Three parts are made out of MDF board which have been milled out, one Masonite board and two aluminium rails. Two of the MDF parts have been both glued and screwed together with two metal brackets. It is to this part the board is fasten. The last MDF part is placed at the top of the frame. In the MDF parts which are placed with its longest side to the wall have holes drilled in to them. These holes are used when mounting the ironing board to the wall.

In between these MDF parts are a Masonite board placed to prevent the frame from moving sideways.

To make the construction more stable are metal rails placed on the back. The screws which are mounting the ironing board to the wall, will first go through the MDF part, then the metal rail and then in to the wall.

Figure 72 and Figure 73 shows how the back looks from the inside where the user should mount the product on the wall.



Figure 72 - Showing the top of the back of the ironing board on the inside



Figure 73 - Showing the bottom of the back of the ironing board on the inside

#### 5.6.5 Inside

The inside consist of four shelves, two hangers and twelve hooks, see Figure 74. The bottom shelf and top shelf have one big compartment, while the two shelves in the middle



are divided in to two compartment. The shelves are all milled out in hard foam. The twelve hooks are 3D-printed and are mounted on hangers of metal. The two hangers are bought from a furniture store.

Both the hangers and the shelves are mounted to the back with screws which goes from the back, through the metal rail and the Masonite and fasten in a nipple on the inside of the shelf.



*Figure 74 - Showing the inside of the ironing board*

### **5.6.6 Hinges**

#### Hinges for the legs:

The hinges for the legs have an L shape and are mounted on the legs and in the frame which holds the mirror in place, see Figure 75.



*Figure 75 - Showing the hinges which fasten the legs to the frame which holds the mirror*

Hinges for the board:

The hinges which are mounted on the holder and on the board is called flap hinges and it will stop when it is folded straight out. This will keep the board from going further than 90 degrees from the big frame, see Figure 76.



*Figure 76 - Showing the hinges which mounts the ironing board to the holder*

**5.6.7 Hangers for the door**

The hangers are divided in to two parts. The big part have several holes drilled in it. This is so it will be possible to change the length of the hanger. The height you want on the hangers in is depending on how high your door is, but it should give you a work surface which is as close to parallel to the floor as possible.

Figure 77 and Figure 78 shows the door hangers from different views



*Figure 77 -Showing the door hangers in a front view*



*Figure 78 - Showing the door hangers in a side view*

### 5.6.8 Legs

The legs are made out of MDF-board which have been milled out in one piece. The legs have been reinforced on the two long outer edges with the help of two bent aluminium rails. When the board is not in use, the legs will be acting like the mirror frame.

Figure 80 and Figure 79 shows what the legs look like when the ironing board is folded up and down.



Figure 80 - Showing the supporting legs for the ironing board when the board is not in use



Figure 79 - Showing the supporting legs for the ironing board when the board is in use

### 5.6.9 Straps for the legs

The legs will stop at a 90 degree angle to the ironing board with the help of two straps, one mounted on each leg, see Figure 81. When the ironing board is not in use will the strap fold in nicely between the leg and the frame holding the mirror. The straps are made out of polyester.

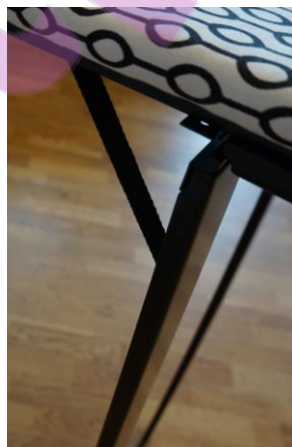


Figure 81 - Showing the straps which are mounted to the leg and frame

### 5.6.10 Style

All the painted parts are spray painted in a black semi-gloss colour except for the hooks, which were spray painted in a silver colour to mimic the look of brushed aluminium.

Figure 82 and Figure 83 shows the two types of colours which were used on the parts.



Figure 82 - Showing some part painted in a black semi-gloss spray paint



Figure 83 - Showing one of the hooks painted in a silver paint

### 5.6.11 Final model

Figure 84 and Figure 85 are showing the finish physical model when it is mounted on a wall.

Larger images of the finished physical model can be seen in Attachment 8.14



Figure 84 - Showing the finished physical model when folded up and mounted on a wall



Figure 85 - Showing the finish physical model when mounted on a wall

## 6 Conclusion and discussion

Here will the conclusions and discussion for this thesis be brought up.

### 6.1 Design process

There are many different design processes which you as a designer can use for a project. These design processes pretty much handles the same thing. You start with gathering information and then define the project and later have the ideation phase and hopefully ends with a final concept and product.

In the theoretical background, I have explained two different design processes or design methodology as it is also called. With the help of different types of pictures they try to explain how you should imagine the design process.

With the Bootleg Bootcamp, they want to convey that there are different stages (see Figure 86) that you can be in, and as long as you keep working in that stage and don't change anything in a previous one, then you can keep on moving forward, but if you change something in a previous one, then you have to go back and do it from that stage.

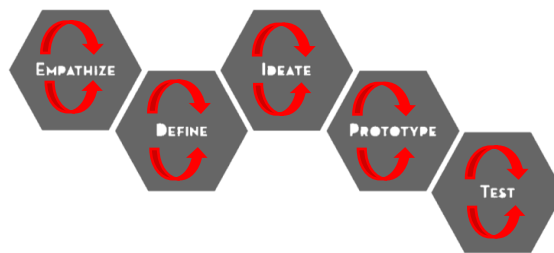


Figure 86 - Showing the different stages of the design process Bootcamp Bootleg [6]

In the design process double diamond does not have as clear stages as the Bootcamp Bootleg does, see Figure 87. Instead their image shows that in the beginning of the project, the design team start with nothing and then they build up information which they are going to need. This information can for example be interviews with users. Then you come to feasibility review, where the design team should think if this project is possible to conduct. After that comes the defining where the design team define all the information they gathered and come to some conclusions. Based on this that they start developing as many sketches and concepts as possible and then comes the concept review and they starts working on the final concept and product.

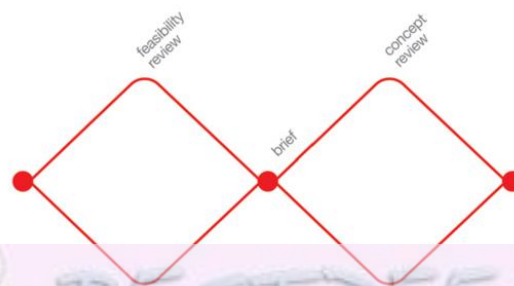


Figure 87 - Showing the double diamond design process

## 6.2 Design brief and direction

Not getting more details and directions for the project during the design brief was both good and bad. The good part was that I was allowed to show what I can create and let the thesis go in the direction that I wanted. On the other hand it can sometimes be good to have some directions to lean on while moving forward. The directions can be there for you and help you make choices.

When I showed the company the four concepts, they really like them and gave me feedback on things that I could do to enhance the product. They told me that they have had an ironing board for compact living, but this had not been a success and it was removed from their product line. Their ironing board was supposed to be hanged over a door, but there was no other functions on the product. So to make this product differ from theirs, I should put as many functions on the product as possible, so it will be more attractive for the customer.

They thought that Concept 1 had the most potential, this was because the user can use the space to store small things. They said that they really believed in my ideas and they encouraged me to continue working with the product after the thesis is done and get it out on the market. But getting the product out on the market was unfortunately not something that they could help me with. The company informed me that this type of product, which is more of a furniture than a normal ironing board, was not in their market.

The question is: Have I missed the target with creating the ironing board that I did? As I have stated before, I did not get any specific direction in which I should go and it was never said that I should create an ironing board for the company, just that they were there for me as information support about the industry.

The company also suggested that the customer might not be out looking for an ironing board, when they end up buying the product. The company thought that the customer probably would be on the look for a mirror, possibly with storage. To see that the product also can be used as an ironing board as well, can be a factor why they choose to buy the product. I believe this statement is true. If the customer do not know that this product exist on the market, then he or she will probably not go out and look for it.

## 6.3 Planning

I was not able to keep up with the Gantt-schedule that I created. Up to the point of the mid-presentation, I felt that I was about as I had planned. The thing that really set me back was the sketching iteration. That is not a bad thing. The more ideas you have, the bigger ideation area you have explored. I might have been a little time optimistic when estimating how long time it would take to create the concepts. The previous projects we have had to plan for, they have been around 8 weeks. During that time we have had another course going parallel, so the amount of time that has allowed to put on the different tasks have been much shorter. A project like this you have much more time, but you also have to go much deeper in every step to make sure that you have explored as

many solutions as possible. To plan for this project was much harder than it has been before, but this is something that you have to learn by doing.

## 6.4 Design process

As I mentioned before, the sketching iteration took much more time than I had anticipated. When reading in different design processes, it looks like it is a straight road. If you follow these steps and methods, then you should be good to go. This is not true when working with design. You as a designer have to spend much time working with different concepts and solutions. It can be a really small part, but it can look so different and that can make the whole design. Every part should be thought of and designed.

The point with the different stages in the design process is that you should iterate within them. As long as you don't change anything in the previous stages, then you can iterate as many times as you like, but when you start making changes in the previous stages, then you have to do the following stages again.

## 6.5 Questionnaire study

The questionnaire study that I made during this thesis was based on the answers for 20 different people, both male and females in different ages and living situations. The questionnaire study gave me the information about their current habits around their ironing board and what they would value when buying a new.

19 out of 20 people had an ironing board at home, which means that 95 % of the subjects had an ironing board. But even though they had one, some of them did not use so frequently. I believe that one explanation for this is that it takes a lot of effort to take out the ironing board from the cleaning closet or where you store it, and only use it for one item and then put it back. If you have the ironing board folded up in your laundry room, then you can use it fast and leave it folded up. Another reason can be that when you are choosing clothes for work or school, then you might not have time to iron the shirt in the morning before your bus leaves, so you just choose another one that does not have as many wrinkles on it. Because of this, you might only iron shirts that you are going to wear to an important meeting or if you are going to an evening event of some sort. Maybe if the ironing board is more easily accessed, it will be used more frequently.

When asking the male subjects if it was them or their partner who ironed the most, it was many who said that they were the person who used the ironing board the most. The answer for what was ironed most was shirts. I believe these two answers are connected. I think that the reason for this is that men use more shirts than women and thereby have more shirts to iron. Their answers on the other hand, does not give any information if the gentlemen in question is living with a partner or if he lives alone. If he lives alone, then it is obviously he who irons the most at home.

This questionnaire study was done before I had chosen what target group I wanted to design for and with that, I did not go in to any questions about compact living. If I would do this thesis again, I would have liked to do another questionnaire study on people that is living in a small apartments. A possibility to interview and maybe observe them in their home.

## **6.6 Design analysis - Stockholm and London**

The reasons for making two design analysis on the same type of design, was to see if we who live in Scandinavia see the Scandinavian design the same way as people from other countries does. It was also a way to see if countries outside Scandinavia are up to date with the latest in Scandinavian design.

The design elements that I saw during the furniture and light fair was the continuous trend with raw material, like unpainted wood and concrete. These could be mixed with each other or together with a painted surface.

One trend that is on the uprising is the inside garden. The use of the colour green had enhanced quite a lot. Not just in the form of plants, but also for example green wallpaper with leafs on. I believe this is a way to get a feeling of garden even though you are living in an apartment in the middle of the city.

Before I visited the Skandium store in London, I thought it would be a store were designers with a Scandinavian aesthetic would sell their products. Compared to what I thought, this was a store that sold interiors made from designers from Scandinavia. Brands that were in the store were for example Iittala, Skagerack, George Jensen and A2, just to mention a few.

The things which were sold in the store really reflected what was shown in Furniture and Light Fair. Everything from the colour scheme to the choice of the materials. This means that the store follows the trends that we have in Scandinavia very closely and can provide their customers products that are up to date.

The only thing that I felt was missing was the green feeling. This have either not yet come to the store in London, or it might also be because they don't work with wallpapers and plants in that way.

I did not choose to do a global design analysis. I think that focusing on one design style is enough for this thesis. The Scandinavian style have so many design elements which you as a designer can use to create a product with.



## 6.7 Stakeholder and functional analysis

I only did a functional analysis on the stakeholders who are the closest to the product and will have a direct contact with it. The stakeholder analysis goes both ways, the impact that they have on the product and the impact that the product have on them. The government and community have laws and regulations that you need to follow when designing and distributing a product. But they will not come in direct contact with the product and they won't have any impact on what functions could or should be included in the product. When it comes to the competitors, they also don't have any saying on what functions could or should be included in your product, but it is good to keep track on the products that already exist on the market and the trends of what is coming.

## 6.8 Image board and Scandinavian style

When creating the image board to have as inspiration, I chose to base it on a style that is referred to as Scandinavian Style. As explained before, this style is very popular right now and it is based on soft colours mixed with each other and patterns of black and white. These colours are often mixed with natural material like unpainted wood and concrete. This style could be seen in both the furniture and light fair and at the store in London. I really like this style because it shows a simplicity and a range in how you can decorate your home. I wanted my ironing board to reflect that simplicity and not take too much space in the room.

## 6.9 Target group and Personas

What compact living is can be very subjective. If you are a family of six living in a three bedroom apartment, which can be seen as compact living because the family is too big for the living area.

In the end I chose to narrow my target group, to people in between 25 to 30 years old. They don't have any children living in the apartment and they are either living alone or together with a partner. When you are in that age, you most likely have just started working or have just been working for a few years, but my target group now have an income which allows them to put some extra money on their furniture's. They are living in a small apartment somewhere in a city in Sweden.

The compact living market was chosen as the target group for two main reasons. The first reason is because the compact living market is the one market that have the least amount of different ironing boards on the market. Compact living is a very interesting area to design for. You as a designer really have to make smart choices and really think about how you can use the space in the most optimized way possible.

The second is that this target group is the one that I feel the closest to. After this thesis I will be in that target group and I can relate to this target group and their needs.

There are of course people in other ages than 25-30 years that are living in a compact living without kids. This can for example be people who weekly commute and have a

small apartment where they work. You can also see a hotel room as compact living, and use people how travel a lot in the target group. But to really be able to focus on my target groups' wants and need, have I decided to place the main target group on people in the ages between 25-30 years that are permanently living in their apartments.

Another form of compact living situation is when you are living on a boat or in a caravan or a camper. These types of compact living has not been taken in to consideration, because those products are created to fit the model of a certain boat or caravan.

## **6.10 Sketching**

It is hard to know when you should stop with creating sketches. The more sketches that you create, the more of the design space are you exploring. But at some point you need to decide which solution you are going to use, so that the project can move forward.

## **6.11 Final design**

Here will conclusions and discussion about the final design be brought up.

### **6.11.1 Styles**

There were several reasons for choosing to only have the ironing board in either black or white. The first main reason was because I think they reflect they reflect the Scandinavian style which are very popular right now. The second main reason is because I think these colours are clean and timeless and will not go out of style just because the styling trend changes. The reason I think that these colours are timeless is because they are very easy to combined with the majority of styles. I don't want the ironing board to take over the style in the room, I just want it to fit in and let the other décors speak for your personal style. I believe this will make the product more attractive and authentic for the customer and the user.

### **6.11.2 Mounted on the wall**

When the ironing board is mounted on the wall, it should be fasten with six M8 screws in the wall. The wall itself needs to be able to carry the weight, which means that you need to have the right screws for the wall. When the ironing board is in use, the legs will help supporting the weight.

### **6.11.3 Hanged over a door**

The ironing board should ideally be parallel to the floor when it is folded down. But the height of a door can differ quite a lot. To make the ironing board able to fit the majority of doors, the hangers are divided into two parts. In these parts, several holes have been drilled. By changing which holes you put the screws in, you will either make them longer or shorter. The ironing board should always be used with the legs completely folded out and touching the floor. This means that when the ironing board is used, the leg should be in a 90 degree angle to the board. This does not guarantee that the ironing board will be exactly parallel to the floor, but be slightly angled upwards.

### **6.11.4 Hooks**

The reason for making the hooks non-removable is to prevent them from falling off the hangers. This could be the question if the ironing board is hanged over a door and the door is somewhat slammed shut.

### **6.11.5 Cover**

The fabric which was used as a cover for the ironing board was bought at a furniture store. The reason for choosing this fabric is because I think it has many elements which you could see on the furniture fair in Stockholm and at the store in London. The fabric has a white base and black pattern based on ovals and lines. The colours will also match all the different styles that you can have on the ironing board.

## **6.12 Name and Logo**

When I create a product, I always want to have a name on it. For me, this makes my products more memorable. When choosing the name for the ironing board, I wanted it to be simple, yet describe my product in a good way.

The name ended up being UNI. UNI is Latin and it means one. I think this is a suitable name for my product because it highlights the fact that it is only one product, but it has many functions.

The design for the logo, see Figure 88, is based on the shape of the product in different positions and views. The 'U' is based on how the ironing board looks from above when it is folded down. The 'N' is based on how the ironing board looks from the front when it is folded up and the 'I' is based on how the ironing board looks from the side when the ironing board is folded up.



*Figure 88 - Showing the logo for the product*

## **6.13 Physical model**

Here will conclusions and discussion about the physical be brought up.

### **6.13.1 Frame**

The frame is currently made out of hard foam, but in real life it should be made out of bendable wood. If all the showing pieces is made out of wood, it would be possible to skip the painting part and just use oil or transparent coating and thereby keep the wood texture showing.

### **6.13.2 Board**

The board was first made out of chipboard, but even when it had been drilled a huge amount of holes with even spacing, was it not enough to bring the weight down. The wood skeleton was then built to keep the weight down. The mesh net used is something which the company uses in their ironing boards, making them much lighter than their predecessor models, which had a board made out of chipboard.

### **6.13.3 Mirror**

The reason for choosing an acrylic mirror is because to prevent the mirror from breaking. When using the ironing board, the board might flex. To make sure that the mirror will follow the board when it is flexing and not breaking in the process, I chose to use an acrylic mirror. The acrylic mirror is easy to work with, you can both saw and drill in it without risking it to break and it will bend nicely with the board without breaking. If the ironing board would for some reason come in contact with situations where a normal mirror would break, for example like falling to the floor, the mirror will not break, it will just get scratched.

#### **6.13.4 Hinges**

##### Hinges for the legs:

The reason for choosing these types of hinges is because they are easier to mount on the legs and on the frame. If I would have chosen normal hinges, I would have had to fasten them on the short side of the legs and on the top piece, which would increase the risk of the material cracking.

##### Hinges for the board:

The hinges are there to hold the board in place. This type of hinge was chosen to prevent the ironing board from going further down than 90 degrees. If the ironing board is hanged over a wall, then the hangers for the door have to be a little bit lower and not a little bit higher. If the ironing board is place to high up, then the supporting legs will hang in the air and not do what they are there for.

#### **6.13.5 Legs**

The legs are there to help supporting the weight from the board when it is in use. To make sure that they are working fully, the legs should be as folded out as much as possible. This means the when the ironing board is in use, the straps which are mounted on the legs should be stretched out as much as possible.

#### **6.13.6 Straps for the legs**

When choosing what type of stop I should have for keeping the legs at a maximum of 90 degrees, I wanted something which would be strong enough to withstand the force, but still take as little space as possible.

These polyester straps are what you use when you want to strap items to your car. I chose the polyester strap because they are very strong and flat which makes them easy to fold.

I thought about having a chain, between the board and the leg, but this would take up more space than the strap and if I would have gone down in dimension on the chain, it might break when the weight is putt on it.

## 7 References

- [1] "Rörets Industrier AB - (Company Presentation)".
- [2] I. Krajewska, "Statistiska Centralbyrån: Trångboddheten i Sverige minskar," Statistiska Centralbyrån, 24 May 2012. [Online]. Available: [http://www.scb.se/sv\\_/Hitta-statistik/Artiklar/Trangboddheten-i-Sverige-minskar/](http://www.scb.se/sv_/Hitta-statistik/Artiklar/Trangboddheten-i-Sverige-minskar/). [Använd 22 May 2016].
- [3] "Statistiska Centralbyrån: Befolkningsstatistik i sammandrag 1960 -2015," SCB, 18 March 2016. [Online]. Available: [http://www.scb.se/sv\\_/Hitta-statistik/Statistik-efter-amne/Befolkning/Befolkningens-sammansattning/Befolkningsstatistik/25788/25795/Helarsstatistik---Riket/26040/#](http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Befolkning/Befolkningens-sammansattning/Befolkningsstatistik/25788/25795/Helarsstatistik---Riket/26040/#). [Använd 22 May 2016].
- [4] "Statistikcentralen: Trångboddhet," Statistikcentralen, [Online]. Available: [http://www.stat.fi/meta/kas/ahda\\_asu\\_sv.html](http://www.stat.fi/meta/kas/ahda_asu_sv.html). [Använd 22 May 2016].
- [5] Boverket, "Trångboddhet - Skillnaderna kvarstår," Boverket, 2004.
- [6] P. Y. Paplambros, "Design Science: Why, What and How," *Design Science Editorial*, vol. 1, nr 1, p. 38, 2015.
- [7] M. A. P. Desmet och P. Hekkert, "Special Issue Editorial: Design & Emotion," *International Journal of Design*, vol. 3, nr 2, p. 6, 2009.
- [8] I. o. D. a. S. Hasslo Plattner, "Dschool Stanford Education," 2014. [Online]. Available: <https://dschool.stanford.edu/wp-content/uploads/2011/03/BootcampBootleg2010v2SLIM.pdf>. [Använd 24 January 2016].
- [9] "Sauder d studio ubc," The University of British Columbia, [Online]. Available: <http://dstudio.ubc.ca/toolkit/processes/>. [Använd 01 May 2016].
- [10] M. R. Pionter, "Measuring visual appearance - Framework for the future," National Physical Laboratory, Middlesex, 2003.
- [11] Open Ergonomics, "People Size Pro (software)," Open Ergonomics, UK, 2008.
- [12] "Average Height," Average Height, [Online]. Available: <http://www.averageheight.co>. [Använd 1 April 2016].
- [13] "Canadian Centre for Occupational Health and Safety," 8 July 2008. [Online]. Available:

[https://www.ccohs.ca/oshanswers/ergonomics/standing/standing\\_basic.html](https://www.ccohs.ca/oshanswers/ergonomics/standing/standing_basic.html).  
[Använd 23 February 2016].

- [14] K. Österlin, *Design i Fokus för produktutveckling*, Malmö, Sweden: Liber AB, 2011.
- [15] M. Rouse, "Search Software Quality," TechTarget, [Online]. Available: <http://searchsoftwarequality.techtarget.com/definition/PERT-chart>. [Använd 22 January 2016].
- [16] D. Lock, *The essentials of project management*, 3. ed, Aldershot, England: Gower Publishing Limited, 2007.
- [17] R. Curedale, *Design Methods 2 : 200 more ways to apply design thinking*, 1 .ed, California: Design Community College Inc., 2013.
- [18] R. Curedale, *Design Metod 1 : 200 ways to apply design thinking*, 1. ed, Topanga, California: Design Community College Inc, 2012.
- [19] L. Eriksson, *Functional analysis 2 (Presentation)*, Jönköping, 2015.
- [20] J. Landqvist, *Vilda idéer och djuplodande analys om designmetodikens grunder*, Stockholm: Carlssons Bokförlag, 2011.

## 8 Attachments

Attachment 1 – PERT-chart

Attachment 2 – WBS-chart

Attachment 3 – Gantt-schedule

Attachment 4 – Stakeholder

Attachment 5 – Questionnaire study

Attachment 6 – Trend analysis

Attachment 7 – Image board

Attachment 8 – Personas

Attachment 9 – Functional analysis

Attachment 10 – Sketch

Attachment 11 – Renderings of the four concepts

Attachment 12 – Renderings of the final concept

Attachment 13 – Different styles

Attachment 14 – Physical model



## 8.1 Attachment I – PERT-chart

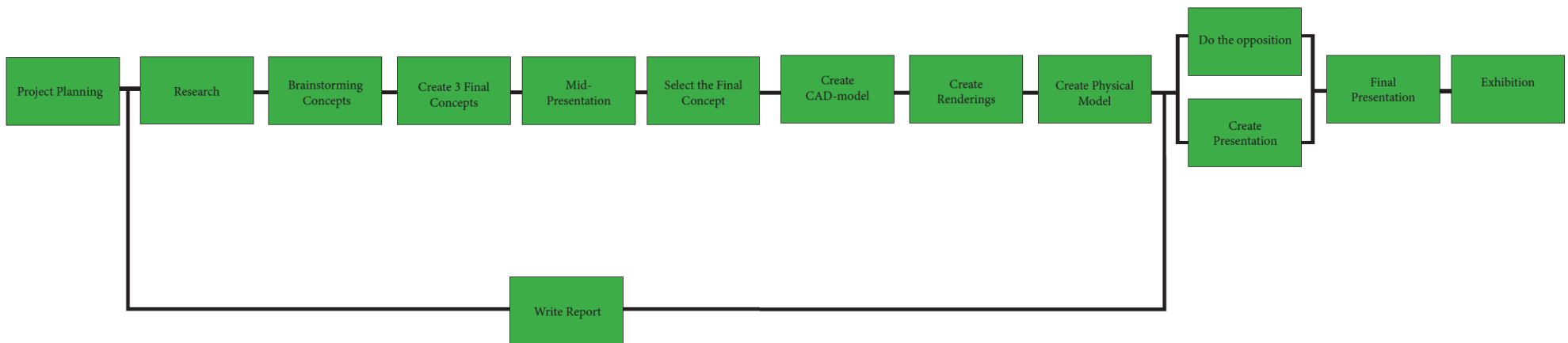


Figure 89 - Showing the PERT-chart that was created for this thesis

## 8.2 Attachment 2 – WBS-chart

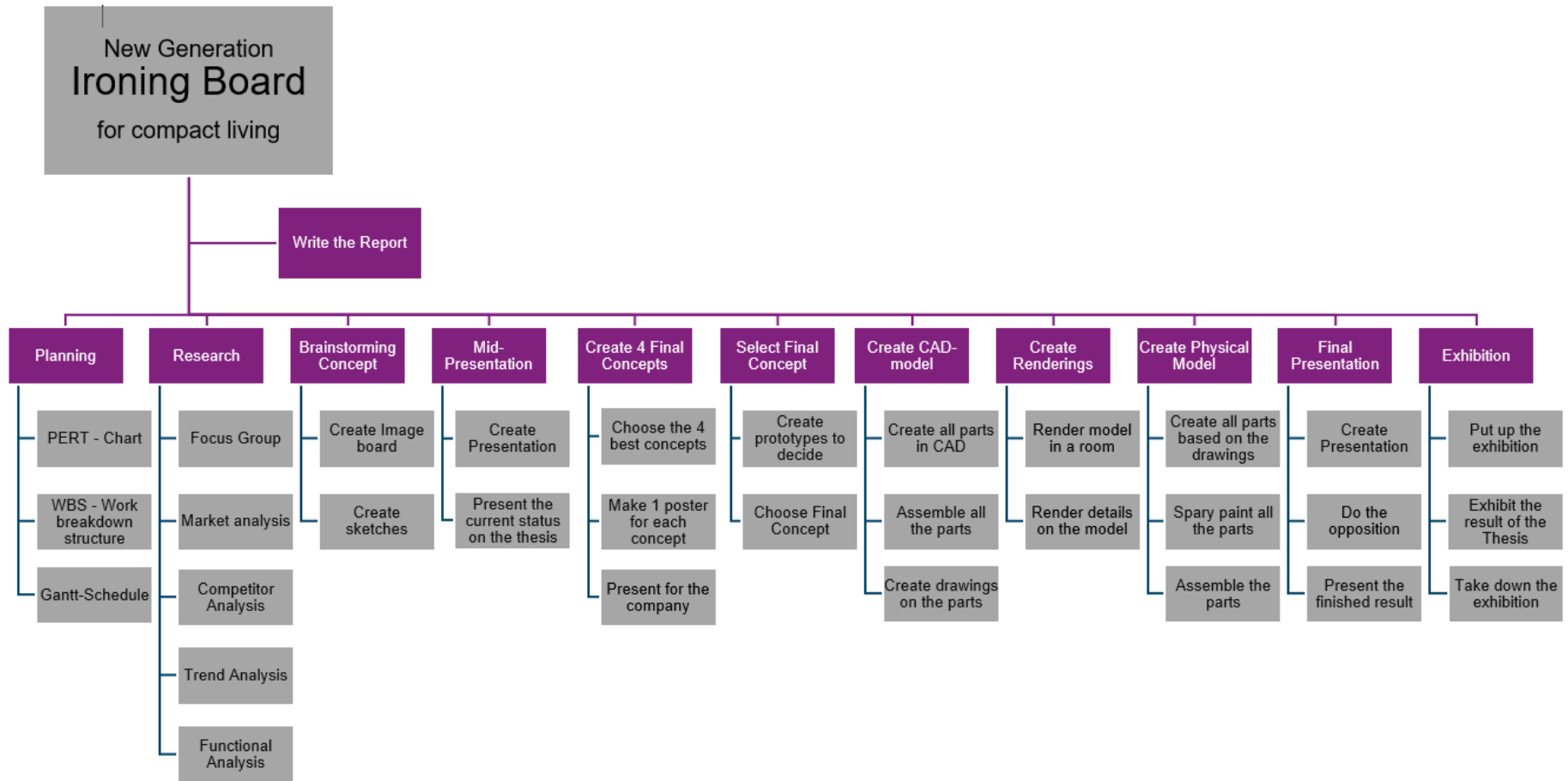


Figure 90 - Showing the WBS - chart created for this thesis

### 8.3 Attachment 3 – Gantt-schedule

Thesis - New generation Ironing Board				2016-01-25	2016-01-26	2016-01-27	2016-01-28	2016-01-29	2016-01-30	2016-01-31	2016-02-01	2016-02-02	2016-02-03	2016-02-04	2016-02-05	2016-02-06	2016-02-07	2016-02-08	2016-02-09
Assignments	Check	Days	Date		v.4							v.5							
			From	To	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M
<b>New generation ironing board</b>		<b>Days</b>																	
Write the report		97	2016-01-25	2016-01-25															
PERT-Chart		1	2016-01-25																
Meeting with the company		1	2016-01-25		X														
Gantt-schedule		5	2016-01-25	2016-01-29															
Project Description		4	2016-01-26	2016-01-29															
WBS		1	2016-01-27																
Focus Group		7	2016-01-28	2016-02-05															
Mood Board		2	2016-02-01	2016-02-02															
Functional analysis		3	2016-02-01	2016-02-03															
TAIDA		2	2016-02-15	2016-02-16															
Brainstroming		5	2016-02-17	2016-02-23															
Concept Sketching		10	2016-02-22	2016-02-04															
Create 3 Final concpets		4	2016-03-07	2016-03-11															
Förberedelse inför Mid-Presentation		2	2016-03-14	2016-03-15															
Mid-Presentation		1	2016-03-16																
Design Changes		3	2016-03-18	2016-03-21															
Create final design		4	2016-03-22	2016-03-25															
Create Cad Model		5	2016-03-23	2016-03-29															
Create Renderings		5	2016-03-28	2016-04-01															
Create physical model		11	2016-04-04	2016-04-22															
Create Posters		6	2016-04-20	2016-04-28															
Give the report to the opponent		1	2016-05-10																
Create Power Point		5	2016-05-10	2016-05-16															
Do the opposition		5	2016-05-10	2016-05-16															
First Final Presentation		1	2016-05-17																
Secon Final presentation		1	2016-06-01																
Exhibition		1	2016-06-02																

Figure 91 - Showing Gantt-schedule part 1 of 5

Attachments

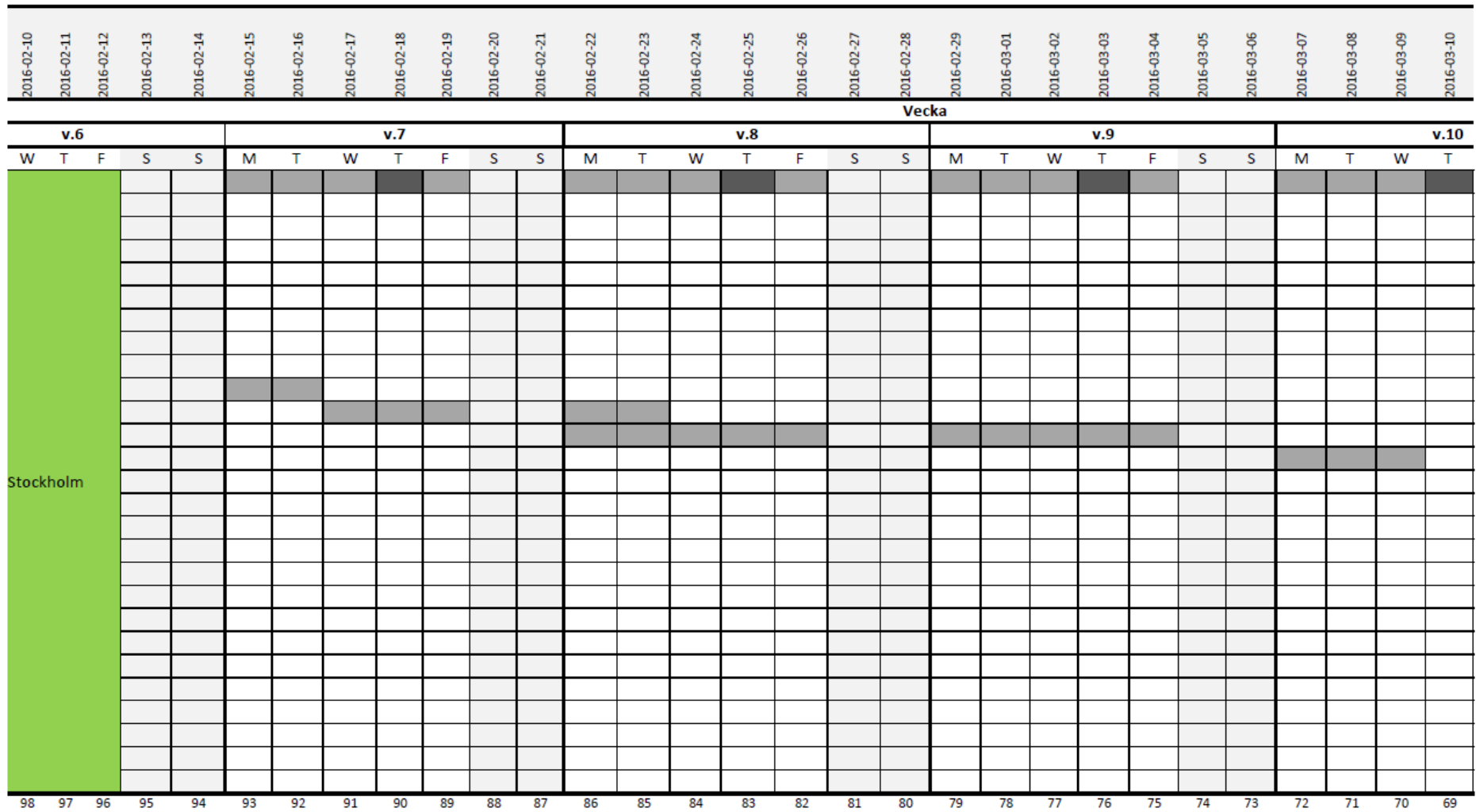


Figure 92 - Showing Gantt-schedule part 2 of 5

Attachments

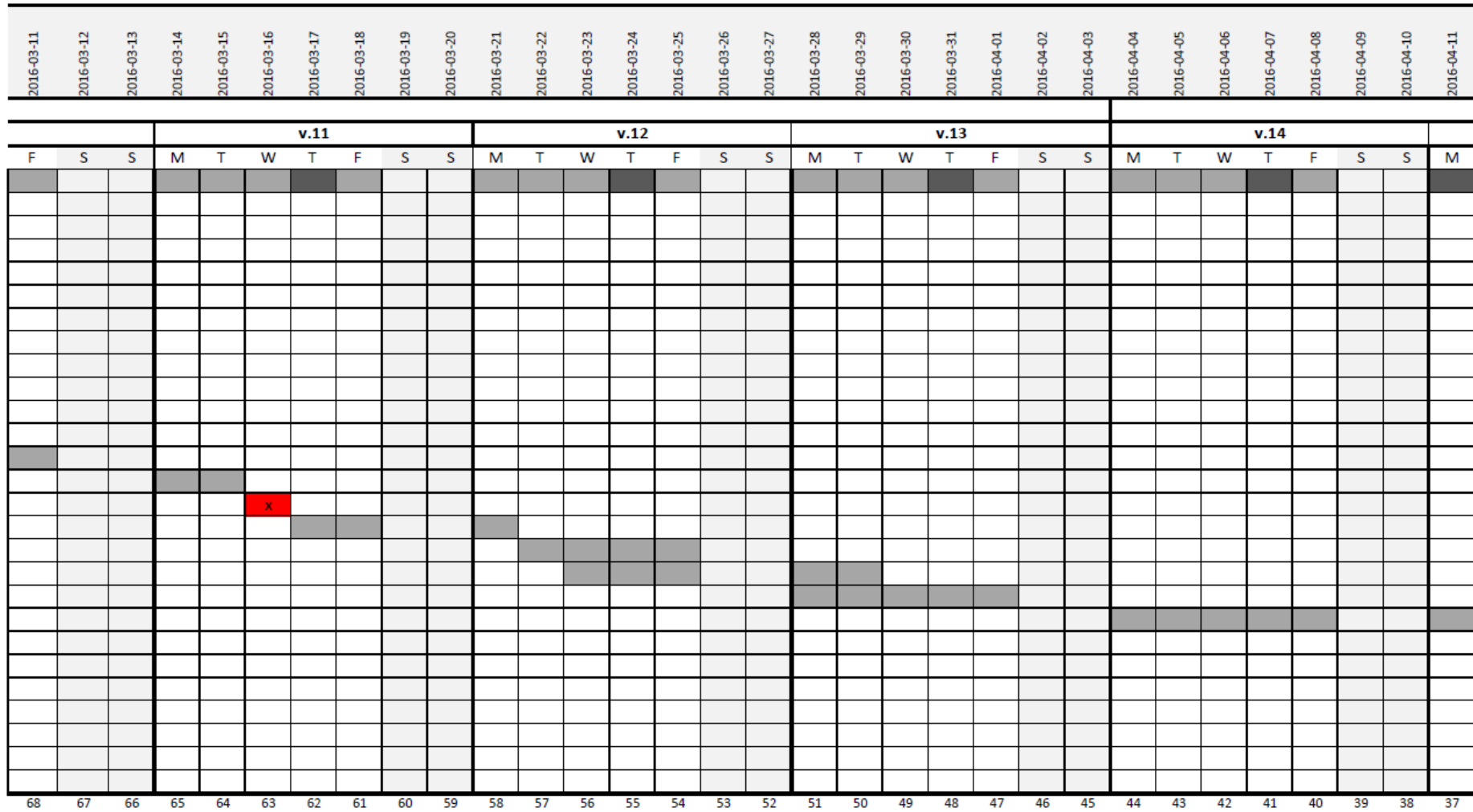


Figure 93 - Showing Gantt-schedule part 3 of 5

Attachments

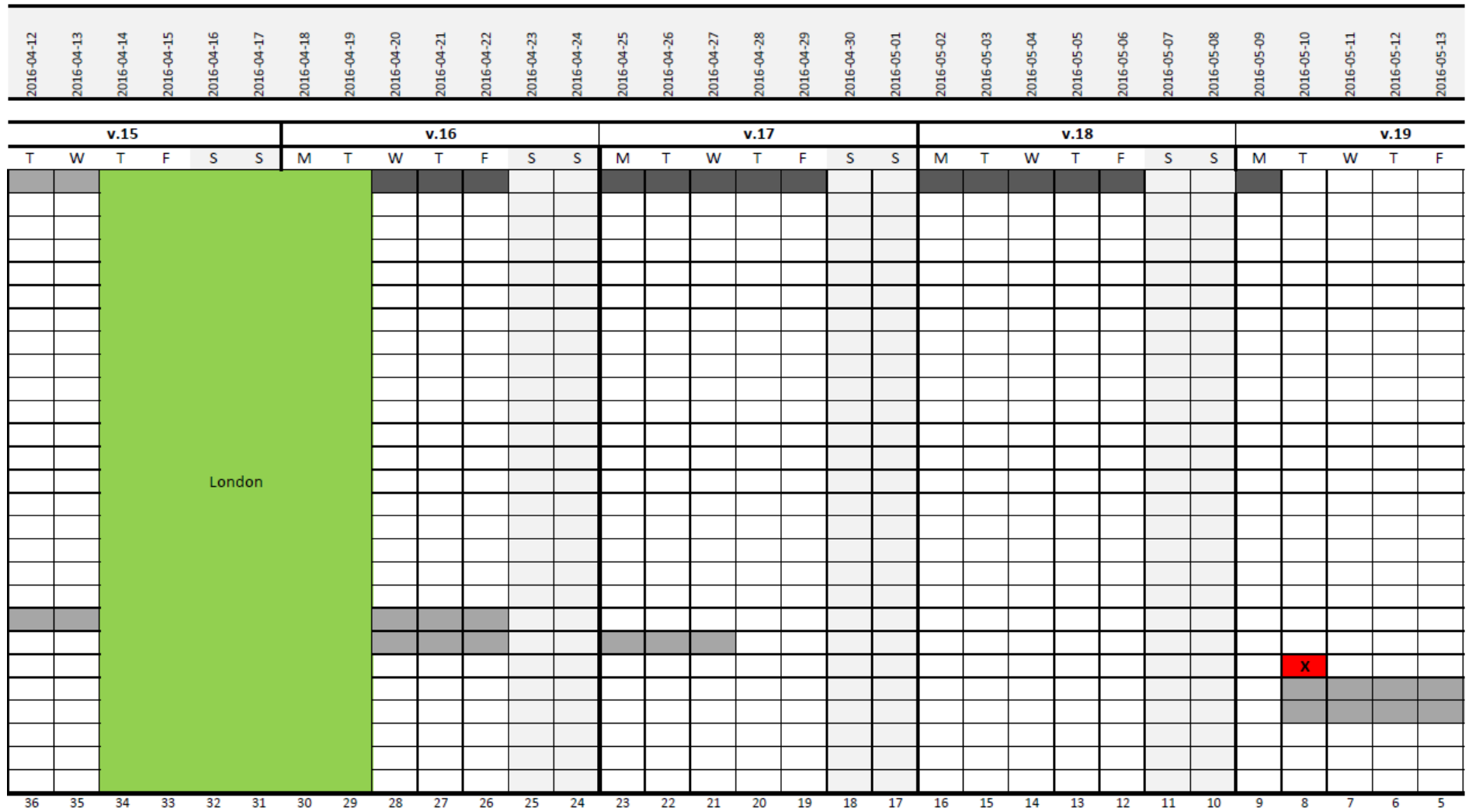


Figure 94 - Showing Gantt-schedule part 4 of 5

Attachments

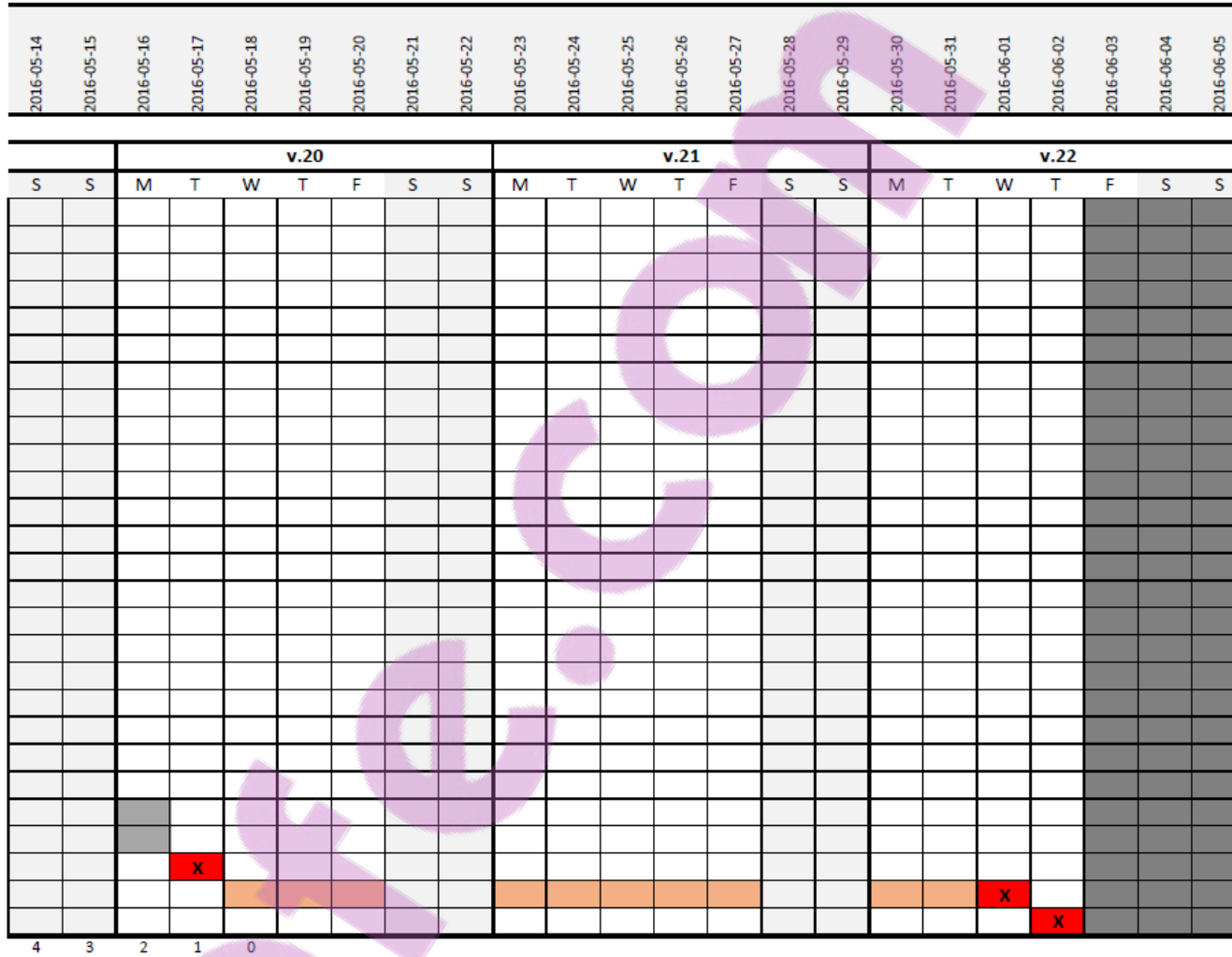
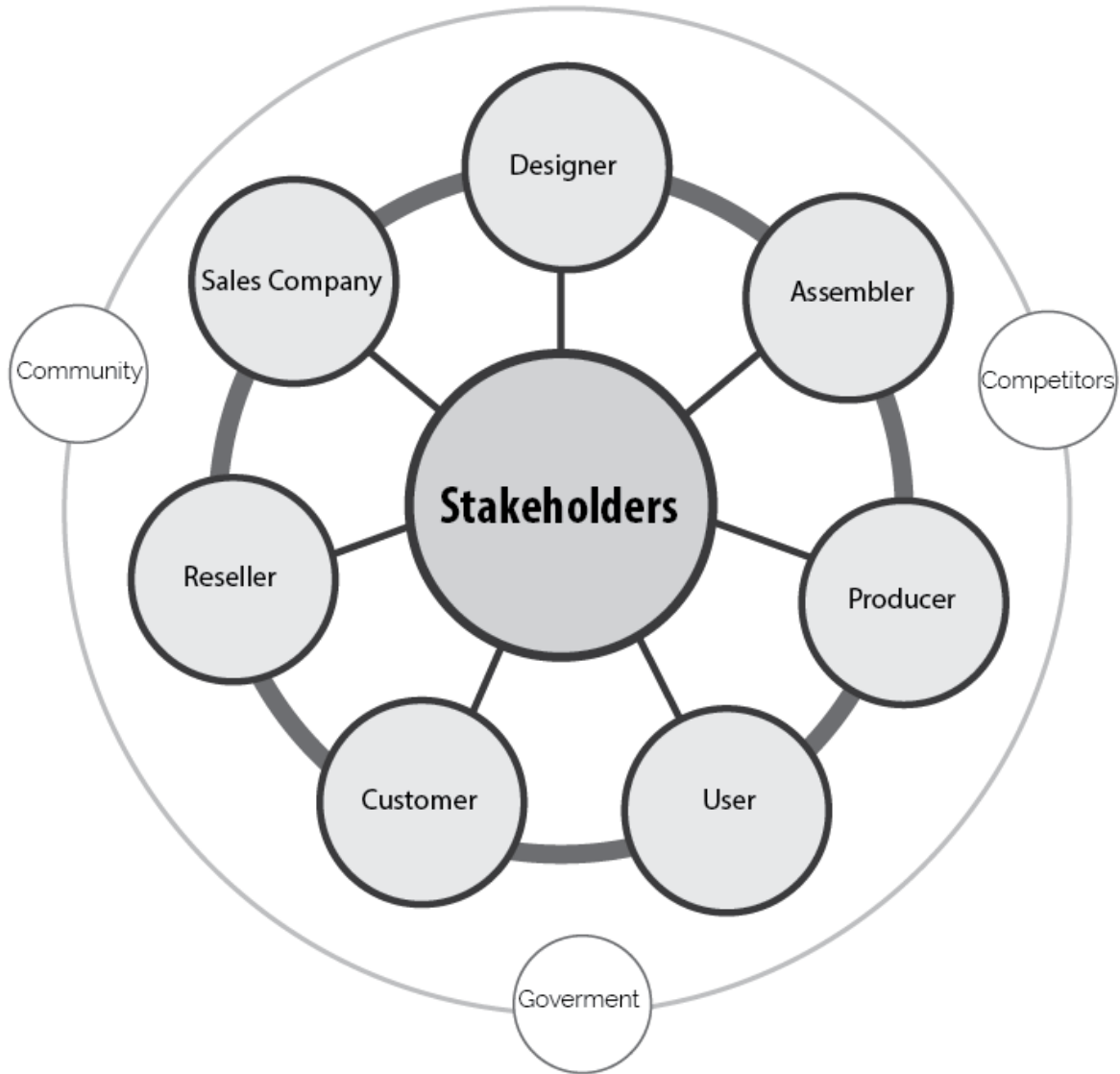


Figure 95 - Showing Gantt-schedule part 5 of 5

## 8.4 Attachment 4 – Stakeholder



*Figure 96 - Larger image of the stakeholder analysis*



## 8.5 Attachment 5 – Questionnaire study

The complete questionnaire study is presented here.

### 8.5.1 Questionnaire

The questions that were asked to the subjects during the questionnaire study can be viewed below. The questionnaire is divided in 3 parts: The ironing boards, your ironing board at home and your future ironing board.

#### Part 1 – The ironing boards

1. Which of the ironing board was the easiest to mount?
  - 1
  - 2
  - 3
  
2. Which of the ironing board do you think is most stable?
  - 1
  - 2
  - 3
  
3. Which front do you like the most?
  - Pointed
  - Blunt
  
4. Which ironing board would you choose to buy if they all have the same price and cover? Motivate
  - 1
  - 2
  - 3

#### Part 2 – The ironing board that you have at home

5. Do you have an ironing board at home?
  - Yes
  - No
  
6. Is it you or your partner that irons the most?
  - Me
  - My partner

7. How often do you iron at home?
  - Each day
  - Once a week
  - Once every other week
  - Once a month
  - Once every other month
  - A couple times a year
8. Do you have your own private laundry room?
  - Yes
  - No
9. Do you put the ironing board away every time after you have used it?
  - Yes
  - No
10. Where do you store the ironing board when it is not in use?
11. What items are mostly ironed?
12. Do you have an iron holder on your ironing board?
  - Yes
  - No
13. Do you use the iron holder? If no, why?
  - Yes
  - No

### **Part 3 – Your future ironing board**

14. What do you priorities the most when you are going to buy an ironing board?
  - Price
  - Function
  - Style
15. What functions are important to you?
16. Any new functions that you would like to have on an ironing board?
17. What would you maximum pay for an ironing board?

### 8.5.2 Answers

How people answered be presented in the form of graphs below, also how many people that answered the specific question.

#### Gender and age division

The graphs below shows the division in gender and age.

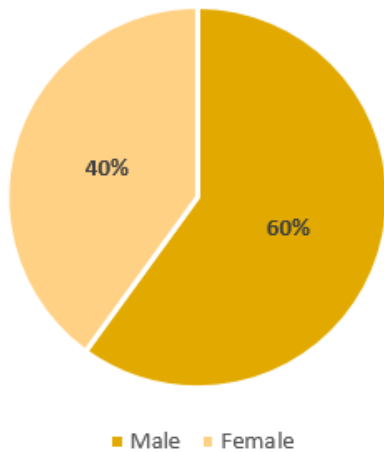


Figure 97 - Graph showing the gender division on the people who took part in the questionnaire study

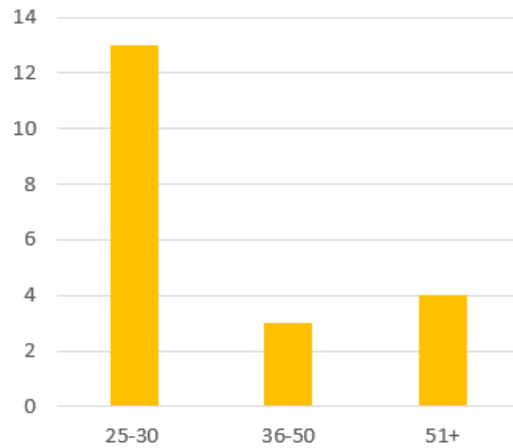


Figure 98 - Graph showing the age division on the people who took part in the questionnaire study

#### Part 1 – The ironing boards

1. Which of the ironing boards was the easiest to mount? (20 of 20)

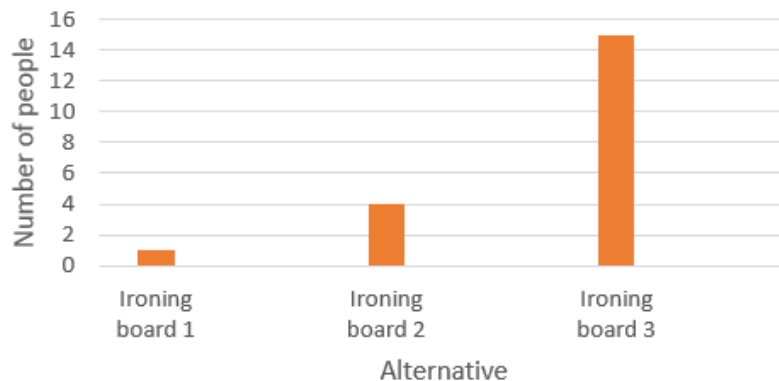


Figure 99 - Graph showing answer for Question 1 in the questionnaire study

2. Which of the ironing board do you think is most stable? (20 of 20)

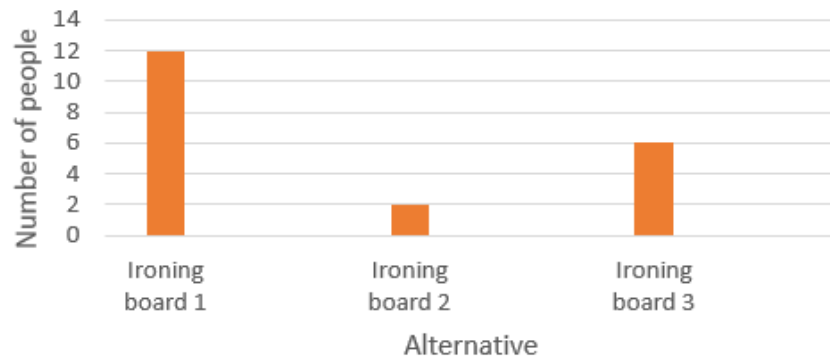


Figure 100 - Graph showing answer for Question 2 in the questionnaire study

3. Which front do you like the most? (20 of 20)

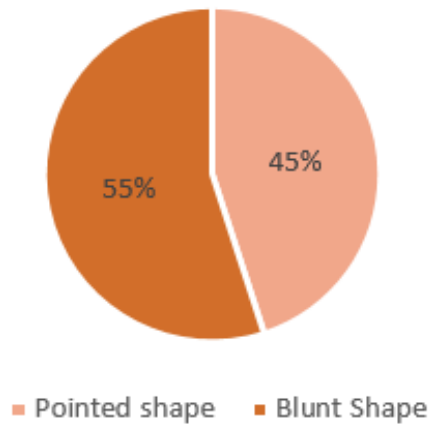


Figure 101 - Graph showing answer for Question 3 in the questionnaire study

4. Which ironing board would you choose to buy if they all have the same price and cover? Motivate! (20 of 20)

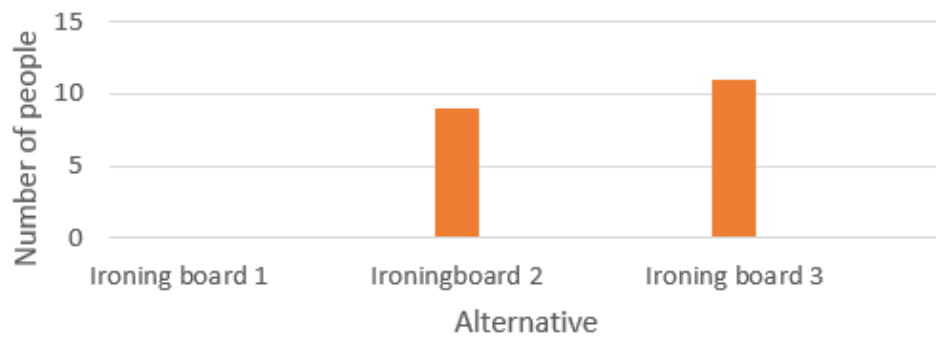


Figure 102 - Graph showing answer for Question 4 in the questionnaire study

**Part 2 – The ironing board that you have at home**

5. Do you have an ironing board at home? (20 of 20)

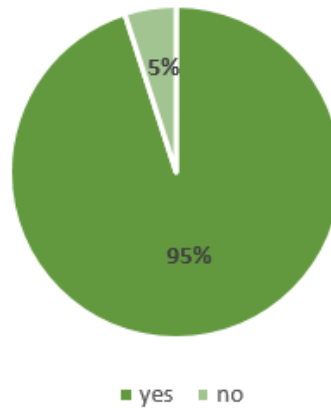


Figure 103 - Graph showing answer for Question 5 in the questionnaire study

6. Is it you or your partner that irons the most? (19 of 20 – The 19 that said yes on question 5)

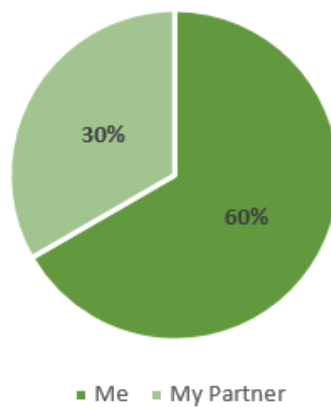


Figure 104 - Graph showing answer for Question 6 in the questionnaire study

7. How often do you iron at home? (19 of 20 – The 19 that said yes on question 5)

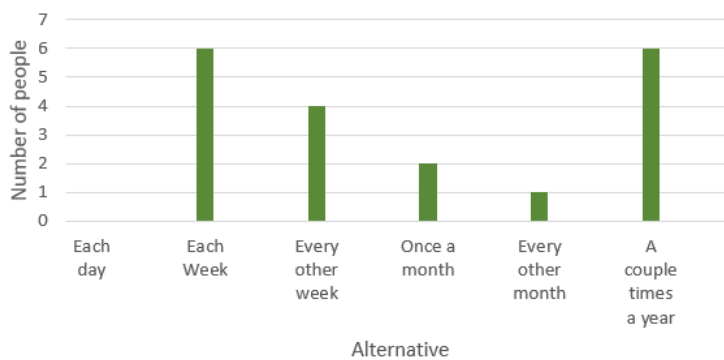


Figure 105 - Graph showing answer for Question 7 in the questionnaire study

8. Do you have your own private laundry room? (19 of 20 – The 19 that said yes on question 5)

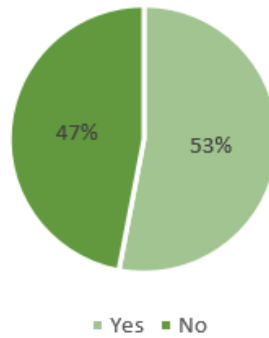


Figure 106 - Graph showing answer for Question 8 in the questionnaire study

9. Do you put the ironing board away every time after you have used it? (19 of 20 – The 19 that said yes on question 5)

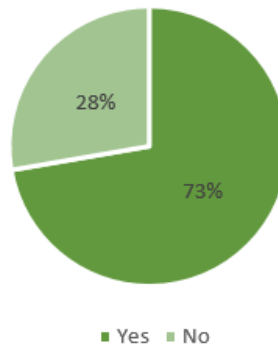


Figure 107 - Graph showing answer for Question 9 in the questionnaire study

10. Where do you store the ironing board when it is not in use? (19 of 20 – The 19 that said yes on question 5)

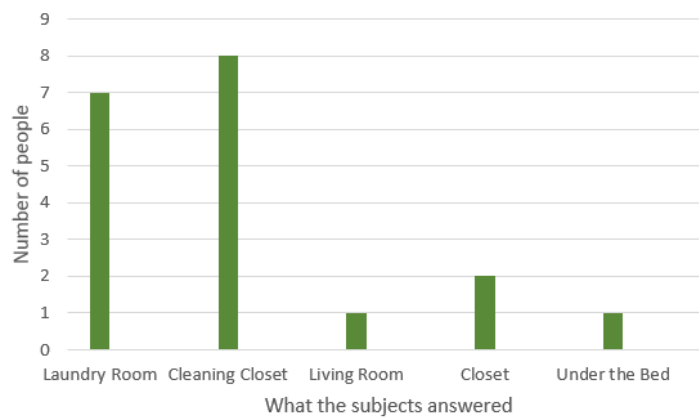


Figure 108 - Graph showing answer for Question 10 in the questionnaire study

11. What items are mostly ironed? (19 of 20 – The 19 that said yes on question 5)

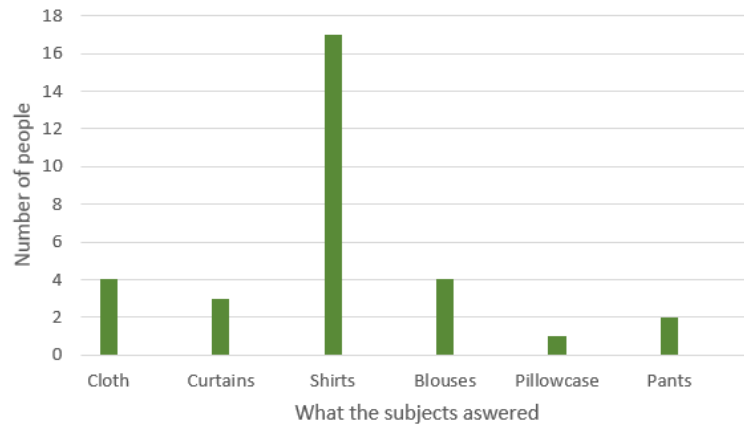


Figure 109 - Graph showing answer for Question 11 in the questionnaire study

12. Do you have an iron holder on your ironing board? (19 of 20 – The 19 that said yes on question 5)

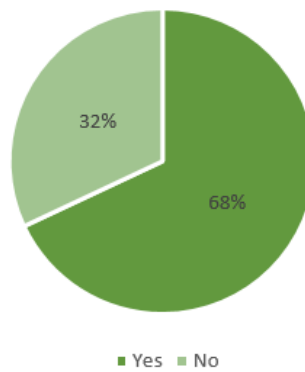


Figure 110 - Graph showing answer for Question 12 in the questionnaire study

13. Do you use the iron holder? If no, why? (13 of 20 – The 13 that said yes on question 12)

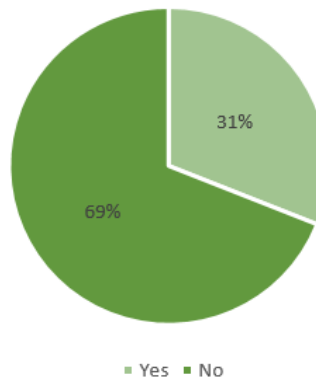


Figure 111 - Graph showing answer for Question 13 in the questionnaire study

**Part 3 – Your future ironing board**

14. What do you priorities the most when you are going to buy an ironing board?  
(20 of 20)

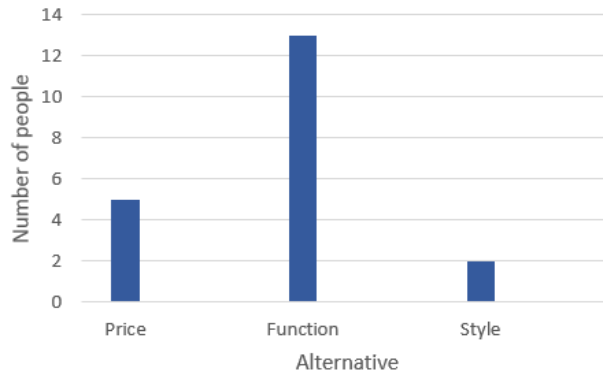


Figure 112 - Graph showing answer for Question 14 in the questionnaire study

15. What functions are important to you? (20 of 20)

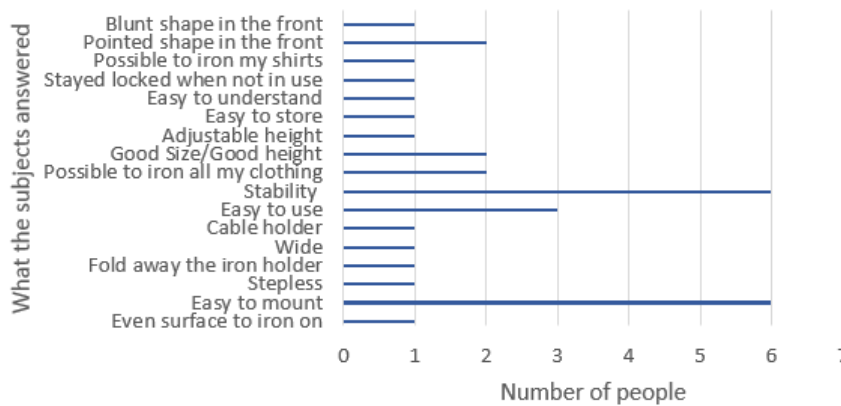


Figure 113 - Graph showing answer for Question 15 in the questionnaire study

16. Any new functions that you would like to have on an ironing board? (20 of 20)

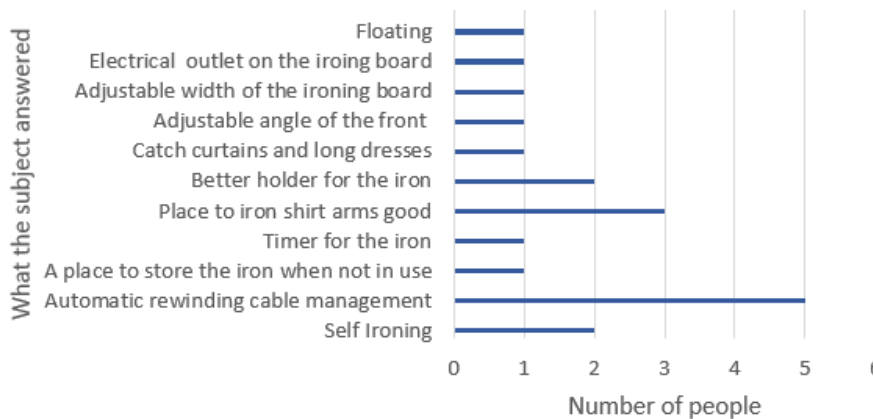


Figure 114 - Graph showing answer for Question 16 in the questionnaire study



17. What would you maximum pay for an ironing board? (20 of 20)

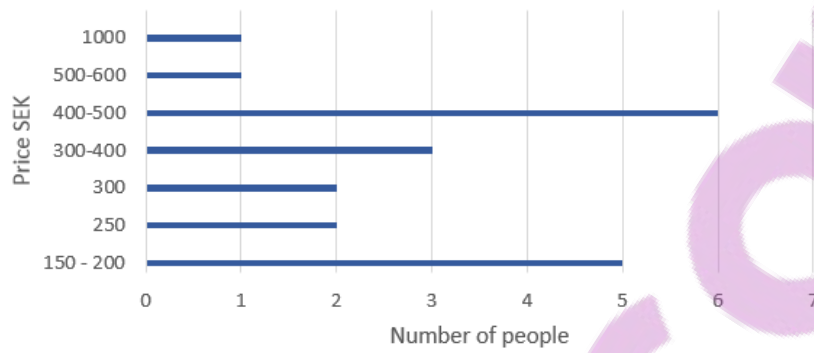


Figure 115 - Graph showing answer for Question 17 in the questionnaire study

## 8.6 Attachment 6 – Trend analysis

### 8.6.1 Furniture and light fair, Stockholm

# Design Analysis STHLM



Figure 116 - Showing a larger image of the trend board from the Furniture and light fair in Stockholm

8.6.2 Skandium, London

# Design Analysis LONDON



Figure 117- Showing a larger image of the trend board from the store Skandium in London



## 8.7 Attachment 7 – Image board



Figure 118 - Showing a larger image of the image board created for compact living

## 8.8 Attachment 8 – Personas

The complete personas created for this thesis is presented here.

### 8.8.1 Felix and Amanda



**Name:** Felix and Amanda  
**Age:** Felix is 29 and Amanda is 27 years old  
**Marital status:** Engaged  
**Location:** Vasastaden, Stockholm City, SWEDEN  
**Income:** Felix works as a Key Account Manager has an income of 40 000 kr/month  
Amanda works as a conference hostess and has an income of 26 000 kr/month  
**Activities:** Felix is playing tennis twice a week and Amanda enjoys art and decorating

#### About Felix and Amanda:

After living in two separate apartments during several years of dating, they have just bought their first apartment together and is now looking to buy new furniture's for the home that they are going to share together.

The apartment that they have bought is a 2 room apartment located in Vasastaden in Stockholm City.

Amanda feel like she is going to have a fun time decorating their new apartment and make it feel like home. She thinks it is important that the furniture's that she buys really looks like they belong in the apartment. She is going for a Scandinavian style, with soft colors and raw materials like light wood and concrete.

#### Goals:

They want to get married within the next two years.

#### Pictures from their apartment:



Figure 119 - Showing detailed information about the persona Felix and Amanda

## 8.8.2 Henrik Lundberg



**Name:** Henrik Lundberg  
**Age:** Henrik is 28 years old  
**Marital status:** Single  
**Location:** Redbergsplatsen, Gothenburg, SWEDEN  
**Income:** Henrik is working as a Calculating Engineer at a consulting company and has an income of 33 000 kr/month  
**Activities:** Henrik plays the guitar and enjoys sailing and mountain climbing

### About Henrik:

Henrik grew up just outside of Gothenburg and studied to Mechanical Engineer at Chalmers University. Since he graduated he has been working as a Calculating Engineer at a consultancy firm located on Lindholmospiren.

During several years he has lived in different apartments that he has rented second hand but has now finally gotten a firsthand contract for an apartment at Redbergsplatsen, Gotheburg.

Henrik loves the industrial style and his apartment has a mix of new and antique furniture's. The most important thing about the apartment according to Henrik is that it should be a place where he could relax after a long day at work.

### Goals:

Win Swedish Ninja Warriors within the next 5 years

### Pictures from his apartment:



Figure 120 - Showing detailed information about the persona Henrik



### 8.8.3 Emelie Andersson



**Name:** Emelie Andersson  
**Age:** Emelie is 25 years old  
**Marital status:** Dating  
**Location:** Värnhemstorget, Malmö, SWEDEN  
**Income:** Emelie is working as a Journalist at a traveling magazine and has an income of 25 000 kr/month  
**Activities:** Emelie enjoys traveling and shopping with her girlfriends

#### About Emelie:

Emelie comes from a town in Sweden called Karlstad. She studied to be a journalist in Lund and moved to Malmö 6 months ago to start working as a reporter at a traveling magazine.

She is currently renting a 1 bedroom apartment second hand, at Värnhemstorget in Malmö.

It is important for Emelie to look her best when she is working and she wants her apartment to reflect her style. Emelie likes to decorate with light colors. She uses the words "Less is More" when she describes her decorating style.

#### Goals:

Emelie would like to go on a trip around the world before she has kids.

#### Pictures from their apartment:



Figure 121 - Showing detailed information about the persona Emelie

## 8.9 Attachment 9 – Functional analysis

Table 6 - Showing the functional analysis created for the User

User			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Withstand	Heat		NF
Withstand	Wetness		NF
Withstand	Steam		NF
Have	cloths	changeable	NF
Have	Stability	High	NF
Facilitate	Use	Easy	NF
Offer	Timer		DF
Offer	Electric outlet		DF
Provide	Storage	Easy	DF
Offer	Storage		DF
Adjust	Hight		DF
Mount	accessories	Easy	DF
Offer	Use	Ergonomic	DF
Contain	Storage	Iron	DF
Contain	Basket		DF
Contain	Shelf		DF
Have	Weight	Light	DF
Express	Design	Long lastning	DF
Express	Design	Trendy	DF
Express	Design	Unique	DF
Express	Function	Unique	DF
Have	Form	Small	DF

Table 7 - Showing the functional analysis created for the Costumer

Customer			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Express	Design	Long lastning	DF
Express	Design	Trendy	DF
Express	Design	Unique	DF
Express	Function	Unique	DF
Fit	Inviroment		DF
Withstand	Heat		NF
Withstand	Wetness		NF
Withstand	Steam		NF
Have	cloths	changeable	NF

Table 8 - Showing the functional analysis created for the Producer

Producer			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Cheap	Manufacturing		
Simple	Manufacturing		
Have	Parts	Few	
Have	Weight	Light	
Have	Manufacturing process	Already owned	



## Attachments

---

Table 9 - Showing the functional analysis created for the Reseller

<b>Reseller</b>			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Sell	Product	Easy	
Have	Product	High value	
Express	Design	Long lastning	
Express	Design	Trendy	
Express	Design	Unique	
Express	Function	Unique	

Table 10 - Showing the functional analysis created for the Assembler

<b>Assembler</b>			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Have	Parts	Few	
Have	Assembly	Simple	
Have	Weight	Light	
Have	Manuverbility	Easy	
Have	Assembly	Idiot Proof	

Table 11 - Showing the functional analysis created for the Sales Company

<b>Sales Company</b>			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Cheap	Manufacturing		
Express	Design	Long lastning	
Express	Design	Trendy	
Express	Design	Unique	
Express	Function	Unique	
Sell	Product	Easy	
Have	Material	Durable	
Have	Max Measurement	119x40 cm	

Table 12 - Showing the functional analysis created for the Distributor

<b>Distributor</b>			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Have	Weight	Light	
Have	Package	Compact	
Have	Package	Easy to manuver	

Table 13 - Showing the functional analysis created for the Designer

<b>Designer</b>			
Features	Noun	Note	Type
Provide	Surface	Ironing friendly	MF
Provide	Value	To User	
Express	Design	Long lastning	
Express	Design	Trendy	
Express	Design	Unique	
Express	Function	Unique	
Sell	Product	Easy	

## 8.10 Attachment 10 – Sketches

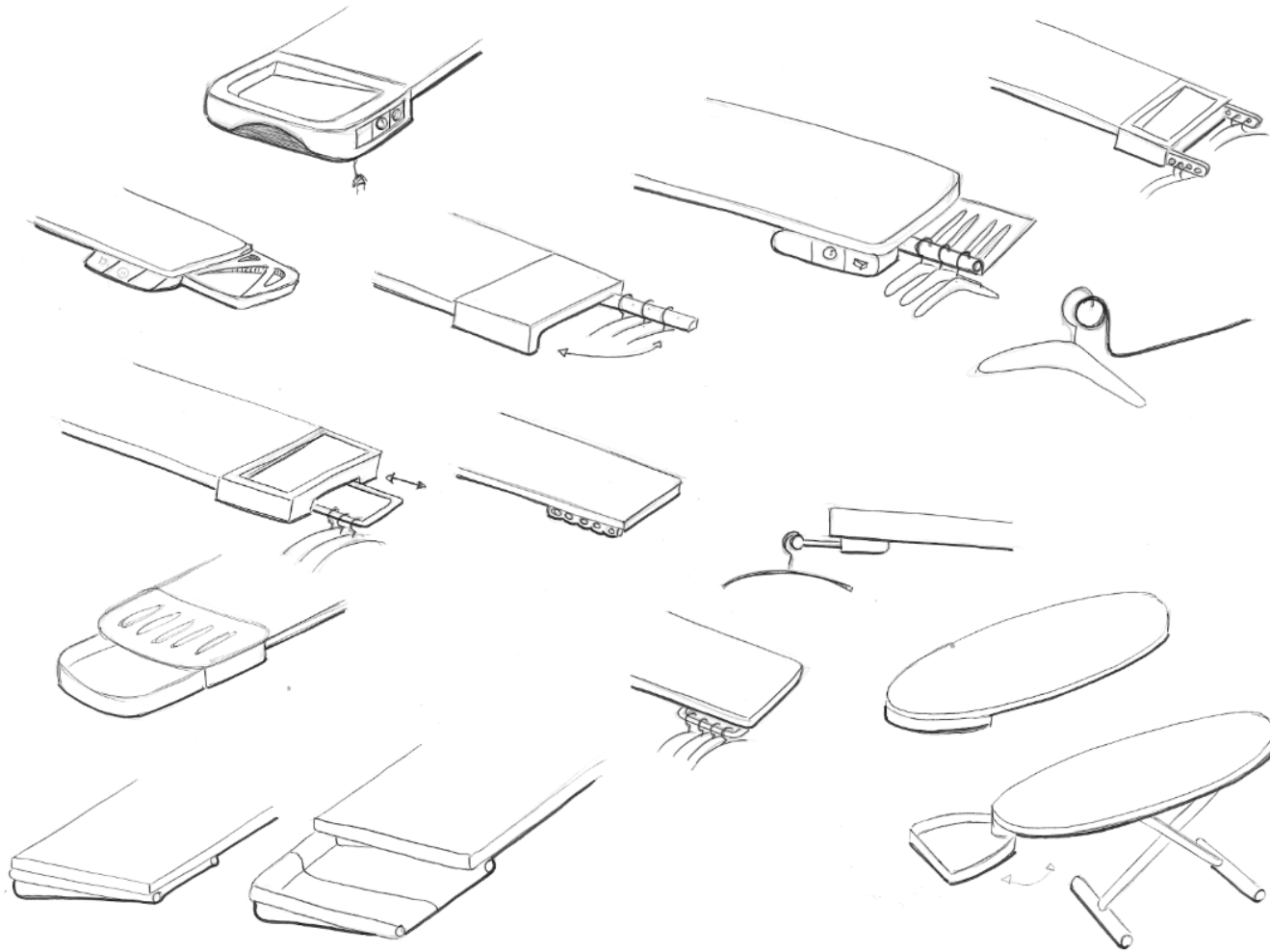


Figure 122 - Showing sketches of iron holders

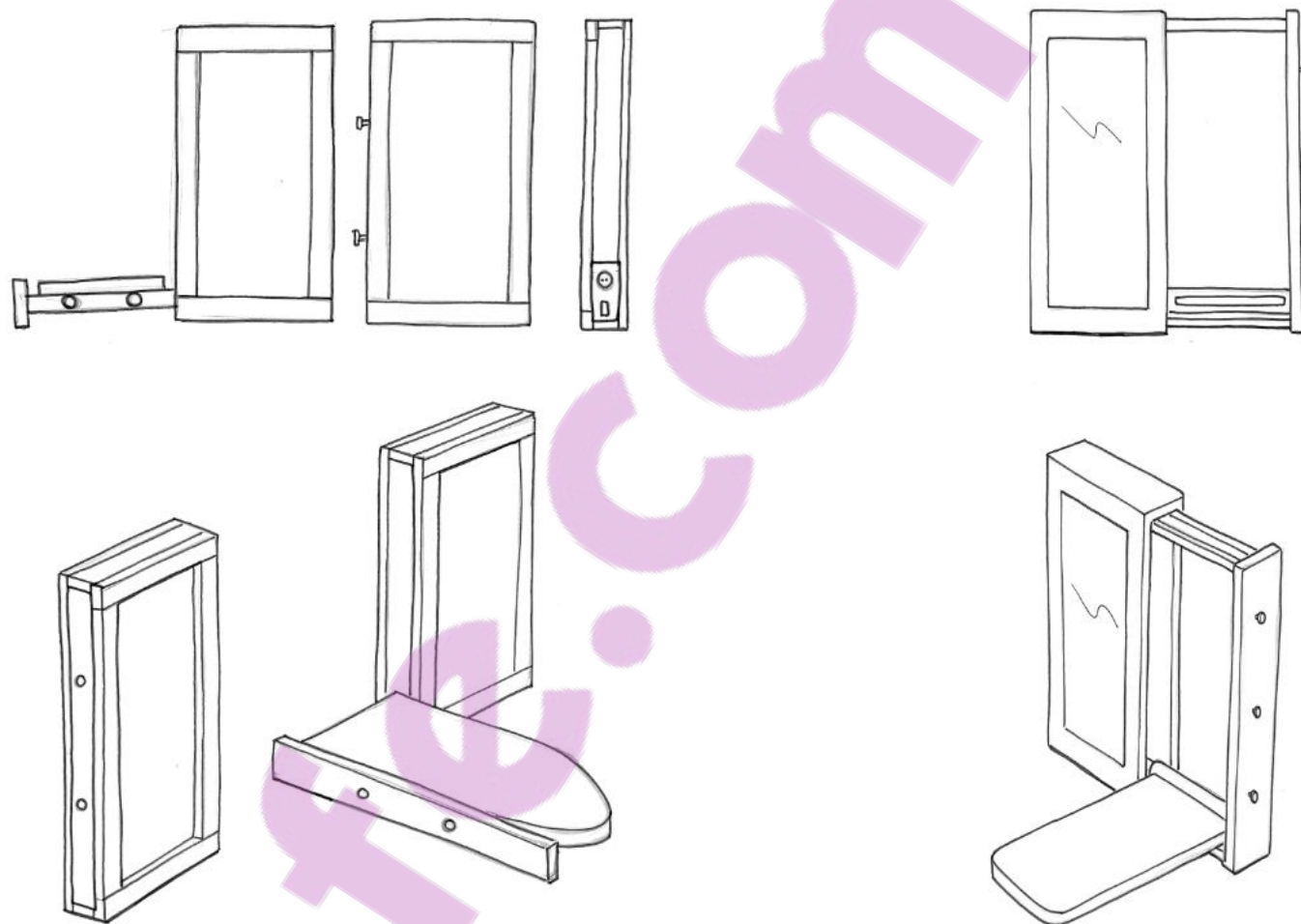


Figure 123 - Showing sketches of ironing boards for compact living (1 of 4)

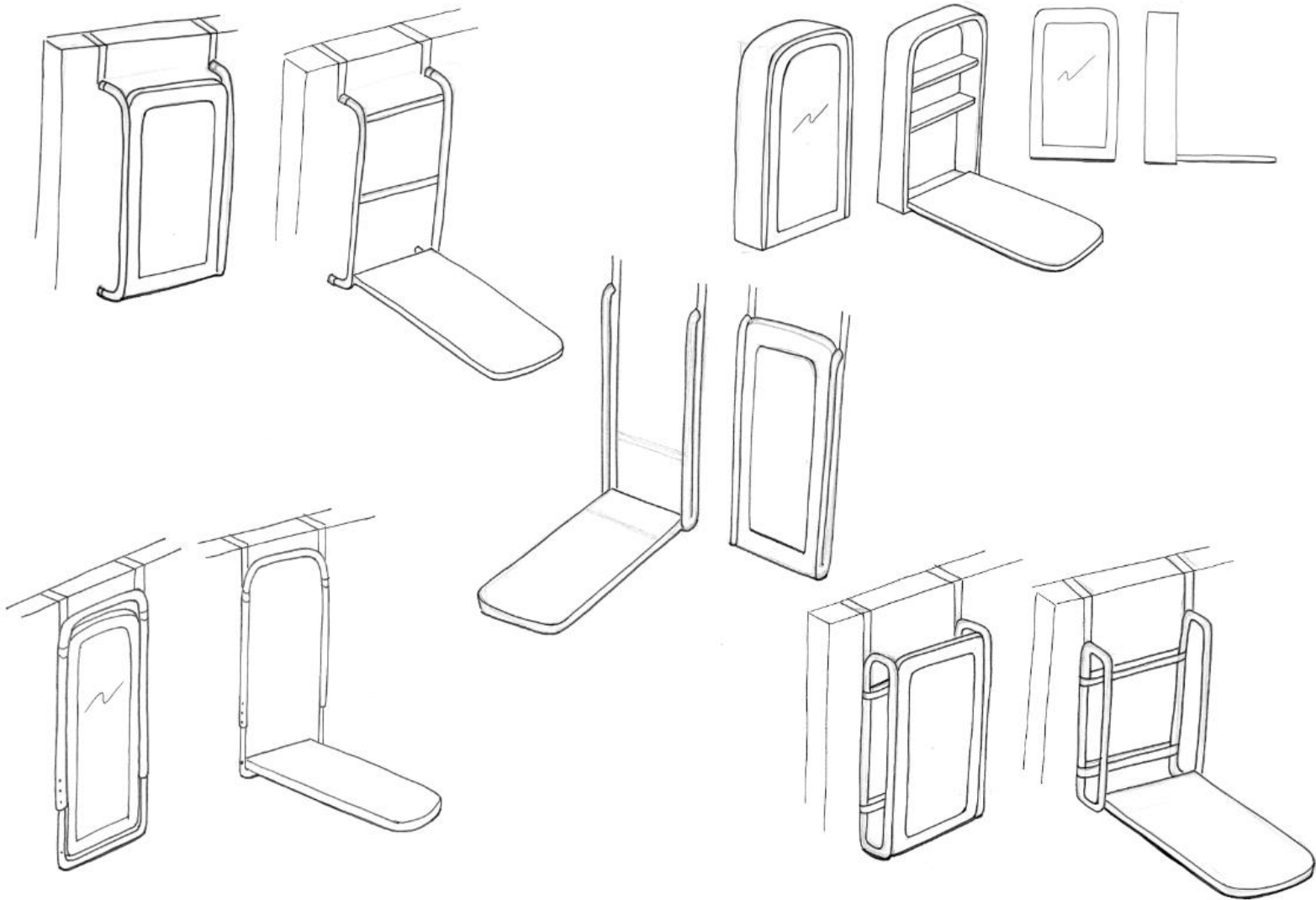


Figure 124 - Showing sketches of ironing board for compact living (2 of 4)

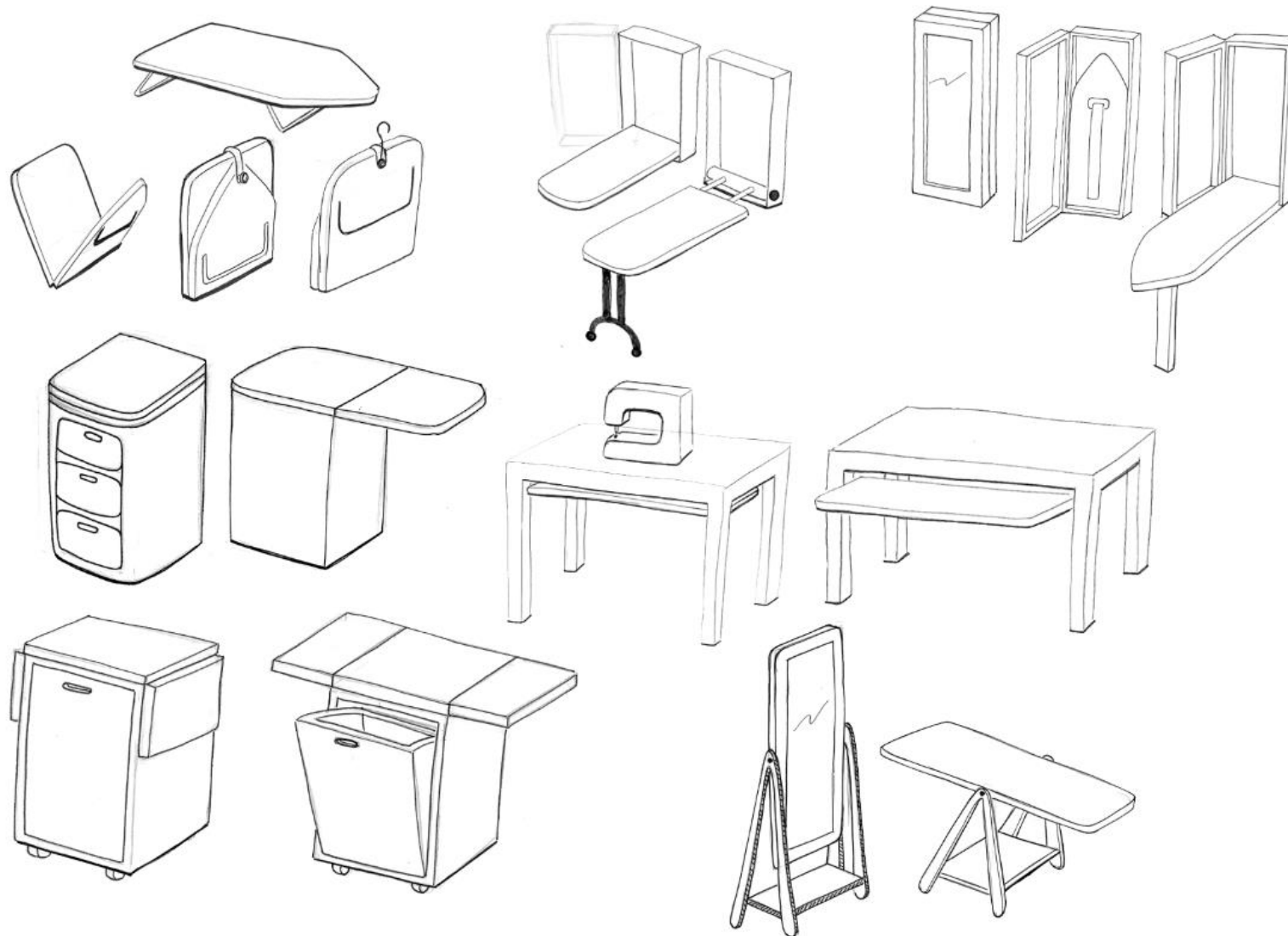


Figure 125 - Showing sketches of ironing boards for compact living (3 of 4)

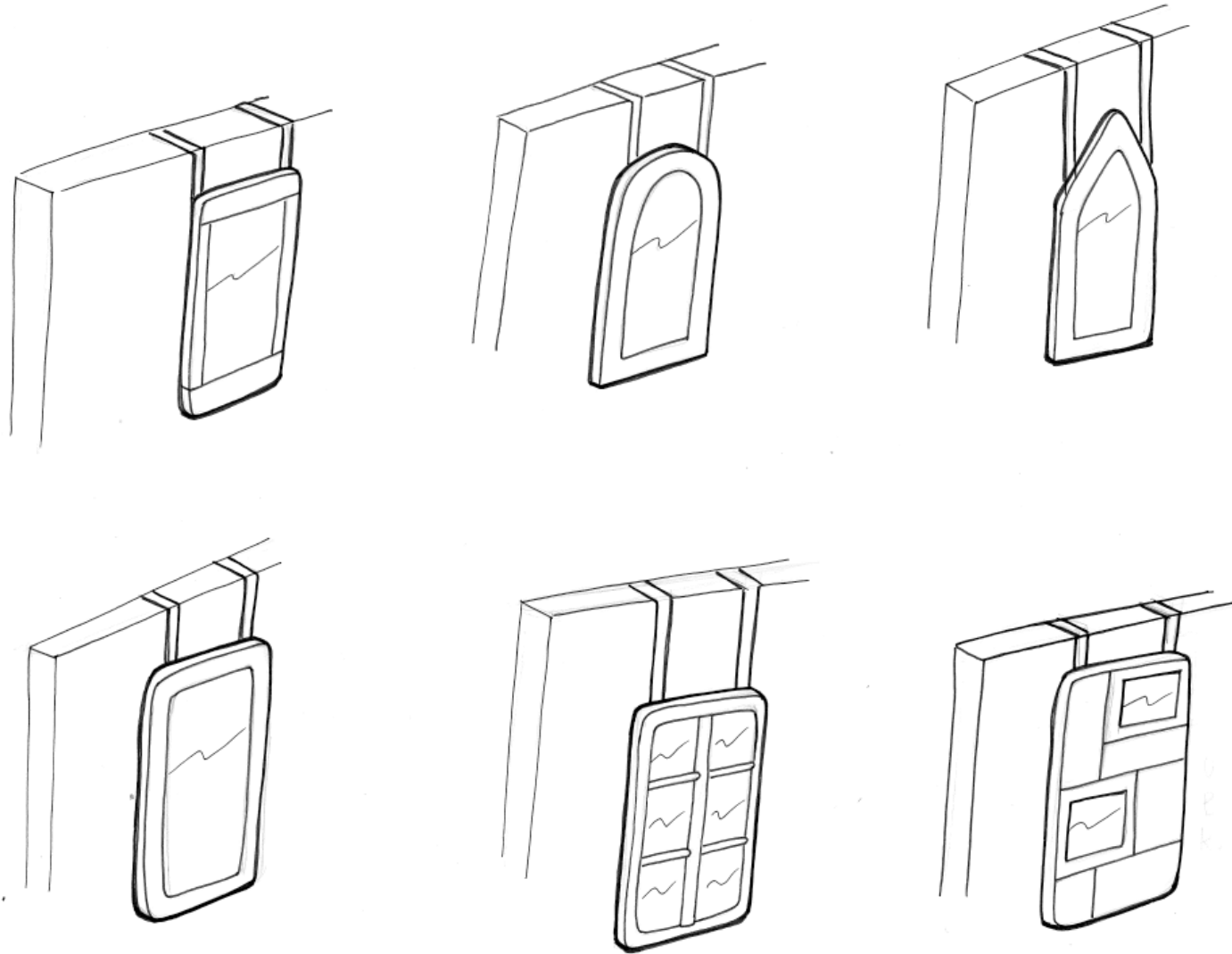


Figure 126 - Showing sketches of ironing boards for compact living (4 of 4)

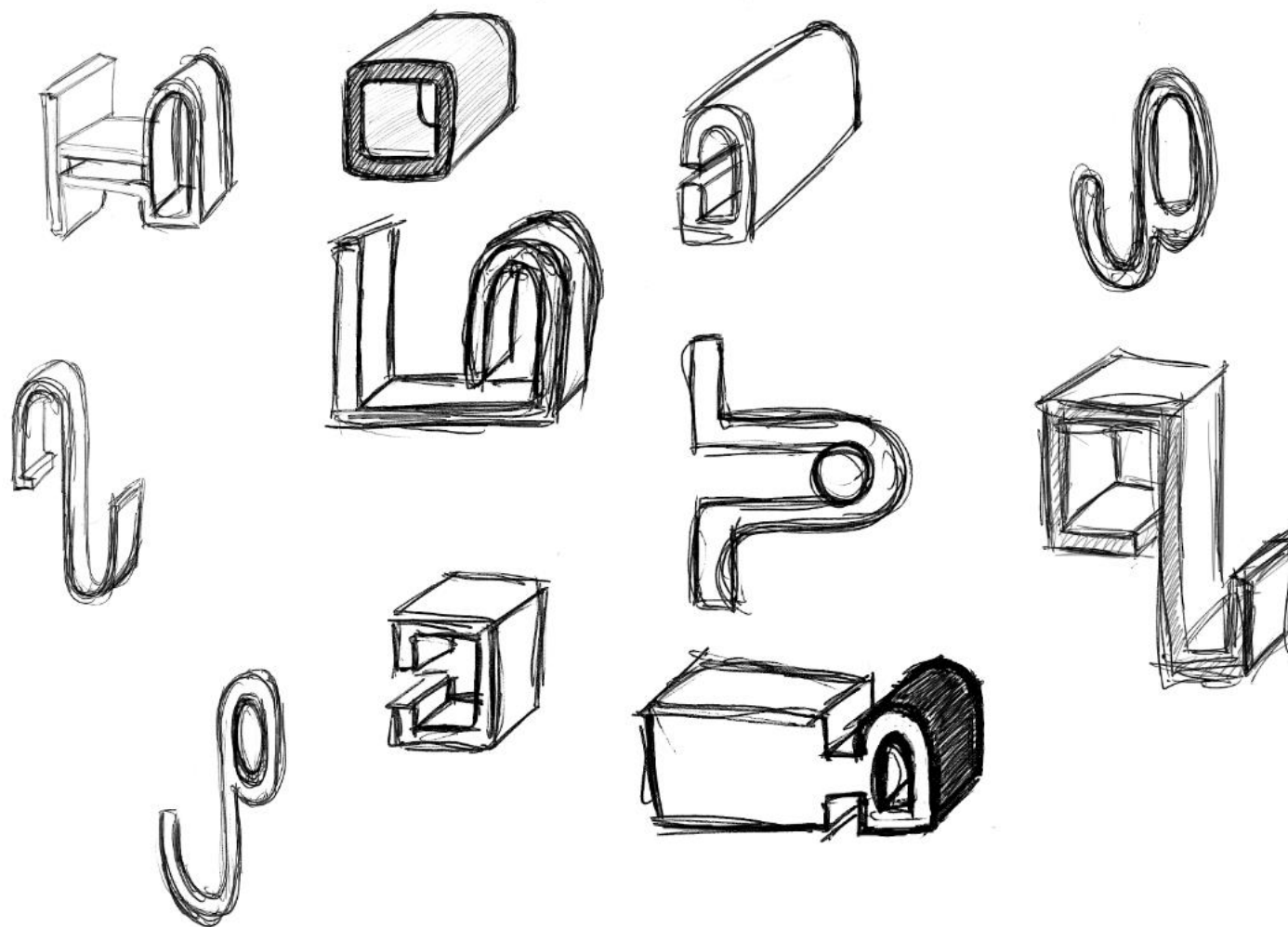


Figure 127 - Showing books and hangers for the interior of the ironing board

## 8.11 Attachment II – Renderings of the four concepts

### Concept 1



Figure 128 - Showing a larger image of Concept 1



# Concept 2



Figure 129- Showing a larger image of Concept 2

Concept 3



Figure 130 - Showing a larger image of Concept 3

Concept 4



Figure 131 - Showing a larger image of Concept 1

## 8.12 Attachment 12 – Renderings of the final concept

Larger images on the final concepts is presented here.

### 8.12.1 Main components

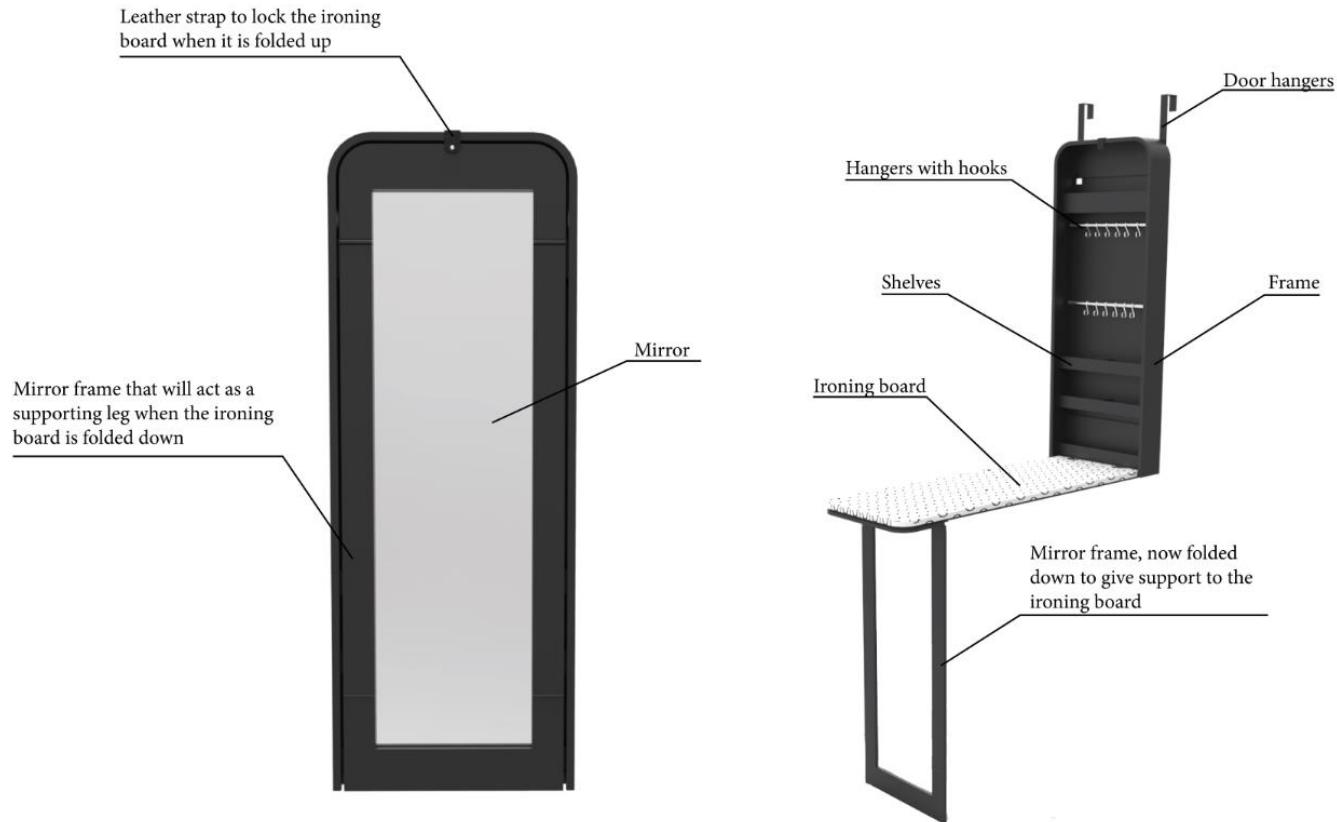


Figure 132 - Showing a larger image of the main components of the ironing board

### 8.12.2 Ironing board folded up



*Figure 133 - Showing larger images of the ironing board when it is folded up*



*Figure 134 – Showing a larger image of the leather strap on the front of the ironing board when it is folded up*

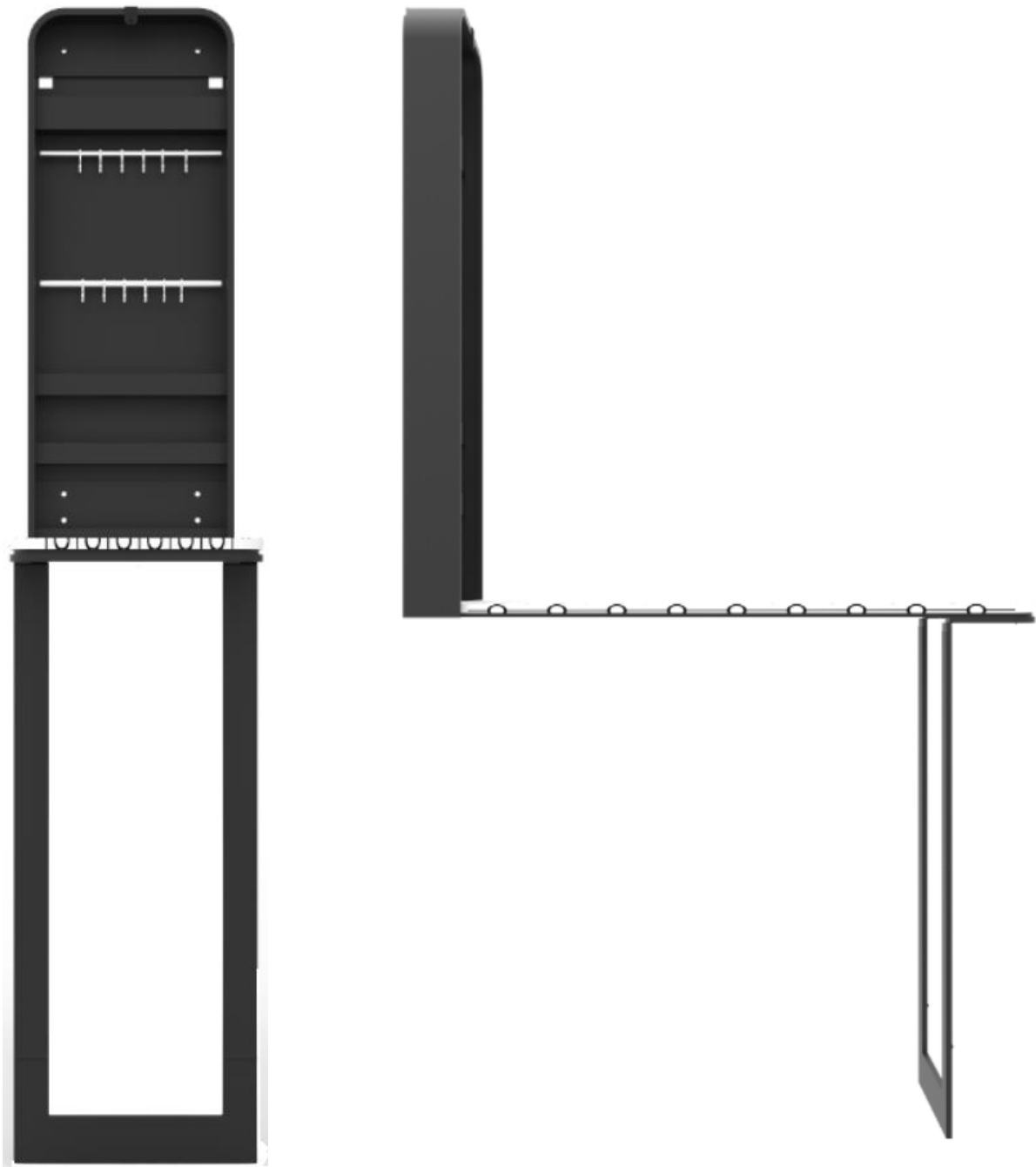


*Figure 135 - Showing a larger image of the top of the ironing board, when it is folded up*



*Figure 136 - Showing a larger image of bottom of the ironing board, when it is folded up*

### 8.12.3 Ironing board folded down



*Figure 137 - Showing larger images of the ironing board when it is folded down*

### 8.12.4 Inside the Ironing board



Figure 138 - Showing the inside decor of the product



Figure 139 - Showing the inside of the ironing board when the frame is removed



### 8.12.5 Mounted on the wall



Figure 140 - Showing a larger image of how the ironing board would look like mounted on a wall, when it is folded up

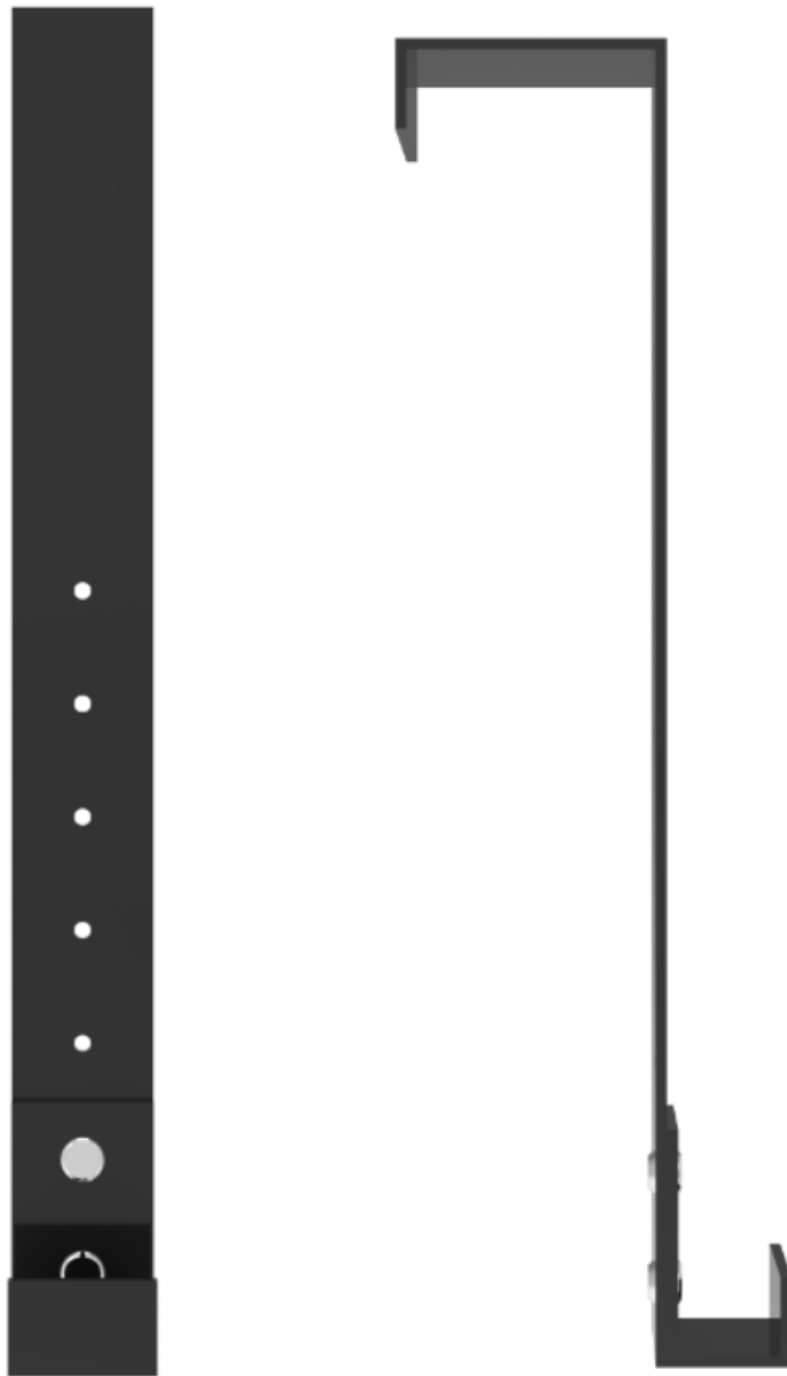


Figure 141 - Showing a larger image of how the ironing board would look like mounted on a wall, when it is folded down

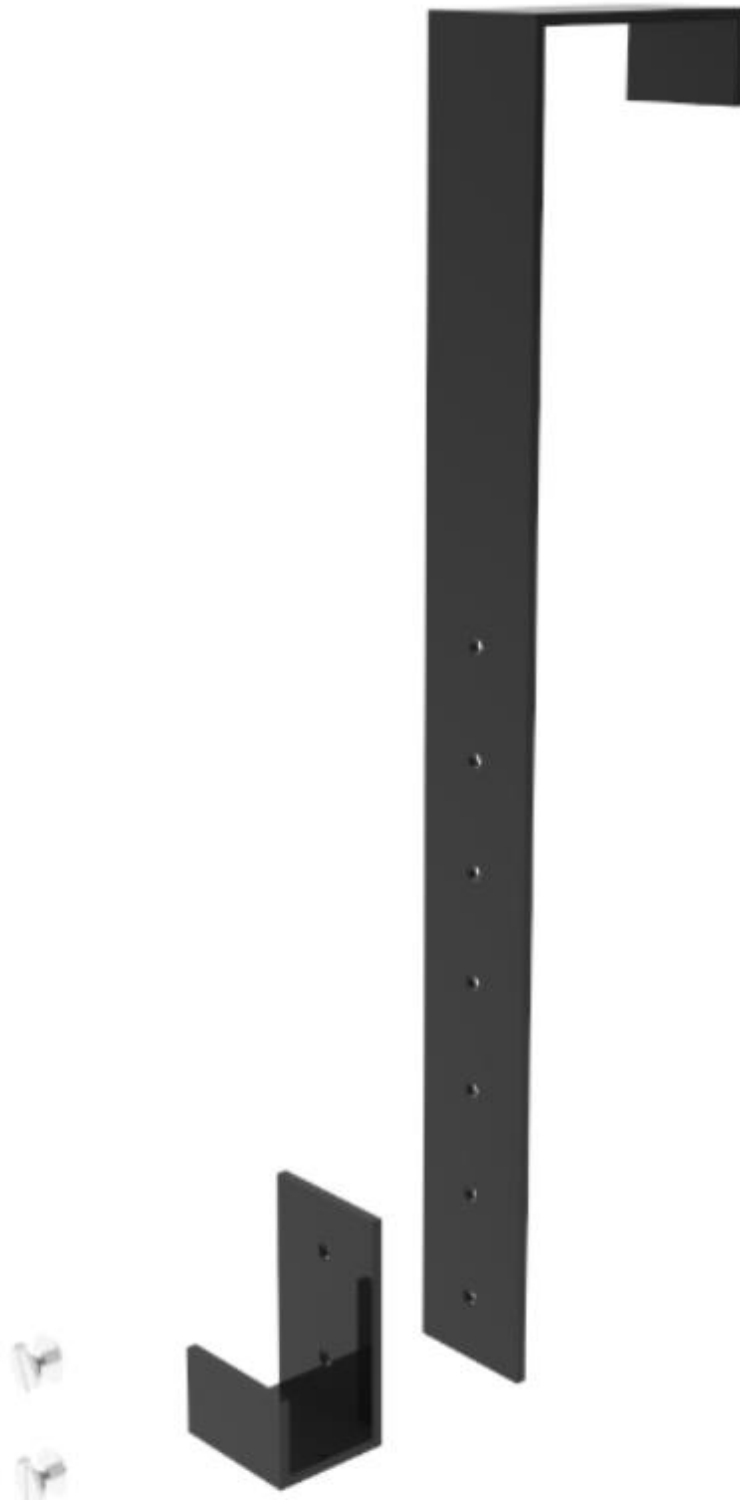
### 8.12.6 Hanging over a door



*Figure 142 - Showing larger images of how the ironing board would look when the door hangers are mounted on*



*Figure 143 - Showing larger images of the door hanger from different views*



*Figure 144 - Showing a larger image of the door hanger in an exploded view*



Figure 145- Showing a larger image of how the ironing board would look like hanging over a door, when it is folded up



Figure 146 - Showing a larger image of how the ironing board would look like hanging over a door, when it is folded down



Figure 147 - Showing a larger image of how the ironing board would look like in a room, when hanging over a door and it is folded up



Figure 148 - Showing a larger image of how the ironing board would look like in a room, when hanging over a door and it is folded down

### 8.13 Attachment 13 – Different styles



Figure 149 - Showing a larger image of the black concept with a mirror



Figure 150 - Showing a larger image of the with a black board





Figure 151 - Showing a larger image of the white concept with a mirror



*Figure 152 - Showing a larger image of the white concept with a black board*

## 8.14 Attachment 14 – Physical model



*Figure 153 - Showing a larger image of the finished physical model when it is folded up and mounted on a wall*



Figure 154 - Showing a larger version of the finished physical model when it is folded down and mounted on a wall