



# ONE LAST WISH

Design for End of Life

Master thesis  
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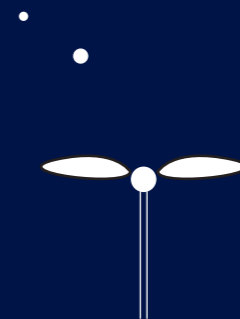
To conclude, I want to thank my friends and family who have supported me on both personal- and professional grounds. Thank you for listening to my complaints, participating in my evaluation sessions, and helping me in many other ways. A special mention to Thomas Mallon, who has supported me throughout the whole project, ranging from emotional support to helping me retain the parts I needed for my prototypes.

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"IEDER MENS HEEFT EEN LAATSTE  
WENS."

- WENSAMBULANCE BRABANT



# ABSTRACT

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Effective and appropriate care for people in their last stage of life has become a priority in nowadays health care delivery. Everyone has a different perspective on what a "good death" would be, but many patients consider a sense of completion important for a good death, attaching value to maintaining their dignity, and to the affirmation of their whole person. Enabling people to make one last wish come true during their final stage in life therefore heavily contributes to their quality of dying. This thesis focussed on optimizing the wish ride experience facilitated by WensAmbulance Brabant, whose aim is to grant the last wish of terminally ill patients (and their loved ones) to visit a special place.

In order to establish an understanding of the complex context of the different stakeholders, literature- and field researches were executed simultaneously. These respectively provided insights regarding aspects to take into account when designing for End of Life, and problems currently occurring during the wish event. This allowed the creation of a comprehensive example of a wish ride and the establishment of a Patient Journey Map. The journey map revealed multiple aspects that could be improved regarding the wish journey. The aim of the design project then became to provide terminally ill patients with a more comfortable and re-assuring experience, without compromising patient- and volunteer safety, in order to increase the likelihood of them meeting their set wish goals.

The concept which was created, the Patient Wrap, decreases the patient's anxiety prior to engaging in the wish ride and when the first goodbyes are being said, is envisioned to improve the patient's ability to rest or even sleep during the wish ride, and provides an accessible solution for WensAmbulance Brabant to ensure patient- and volunteer safety.

To whom it may concern, I hope this thesis will have the ability to inspire you.

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## CHAPTER 1.

**INTRODUCTION**

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This chapter introduces the topic and background of this master thesis project. A brief introduction will be given regarding (design for) End of Life and its prevalence within the current society. In addition, the company, project objective and overview of activities will be presented.



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## 1.1 THE CONTEXT

Overall life expectancy is increasing in European and other developed countries, with more and more people getting to live beyond the age of 65 (WHO, 2004). Improvements in control of trauma and infectious diseases allow greater proportions of the population to live to face more chronic illnesses that require long-term palliative care in combination with acute care (Zorg voor beter, 2017).

Illnesses due to serious chronic conditions cause a wide range of physical, psychological and social problems, in which health care systems must meet the needs of these people by the means of reducing suffering and supporting them in maintaining their quality of life for as long as possible.

Whereas in the 1960's Elisabeth Kübler-Ross had just started to opt her view on treating people at the End of Life with respect, openness and honest communication (Loscalzo, 2008), effective and appropriate care for people in their last stage of life has become a priority in nowadays health care delivery (Veerbeek, 2008).

However, in the end "we all die." Although this reality is as much a part of life as being born, thinking about it is not easy (WHO, 2004). Everyone has a different perspective on what a "good death" would be. For one it could be having an opportunity to say goodbye to their loved ones (NIH, 2018), whilst for another it could be avoiding inappropriate prolongation of dying (Veerbeek, 2008).

Still, many patients consider a sense of completion important for a good death, attaching value to maintaining their dignity, and to the affirmation of their whole person (WHO, 2004). A research conducted by Steinhäuser et al (2000) has identified that a sense of completion and resolving unfinished businesses play a vital role in the patient's perspective and attitude when faced with the final stage of life.

Enabling people to make one last wish come true during their final stage in life could therefore heavily contribute to their quality of dying. Multiple initiatives have been established to make this possible. This report will focus on the organization WensAmbulance Brabant, and their aim to grant someone's last wish to visit a special place.

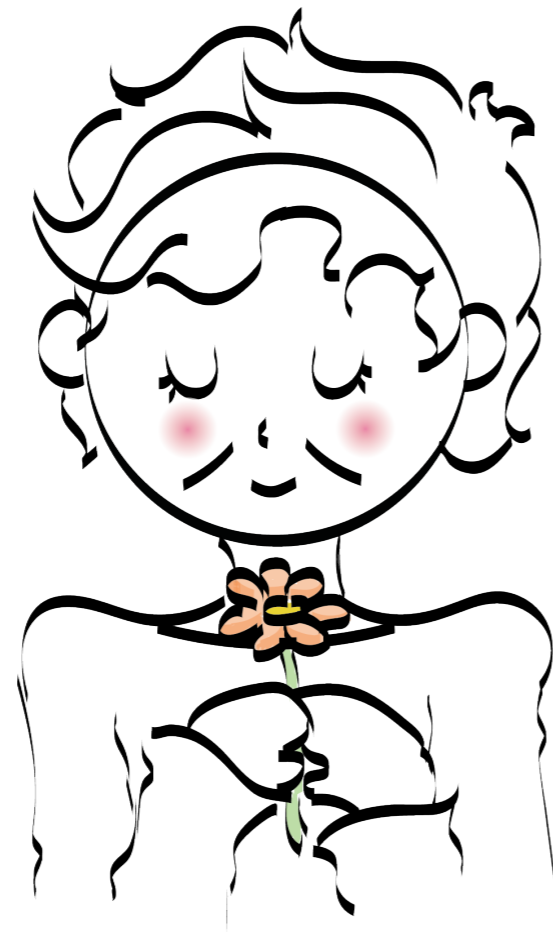


Figure 1.1 Having one last wish

## 1.2 THE PROJECT

WensAmbulance Brabant (WAB) is one of eight organizations who aim to bring terminally ill patients (also, "wish requesters") to a place they want to visit for the last time by providing the possibility of transport whilst lying down (Wensambulance, 2018). In collaboration with the TU Delft, they now aim to improve the experience of the terminally ill patient, the patient's loved ones, and their own volunteers during a wish ride.

### WensAmbulance Brabant

WensAmbulance ("Wish-ambulance") Brabant is a non-profit organization which aims to give terminally ill patients the possibility to make their last wish come true. Supported by professional volunteers (e.g. drivers and nurses) and generous donations of organizations and individuals, they are able to guide patients who can hardly walk or sit to visit a special place for one last time with one of their specialized ambulances. Accompanied by a nurse and a driver, an attempt is made to decrease the burden of disease on both patient and family (caregivers), and enable a journey where one can enjoy the presence of loved ones and the time that is left.

Integrating all stakeholders' needs and wishes in one consistent wish-ambulance design has proven to be a challenge. Although care still plays an important role within the wish-ambulance, the need for the ambulance to be solely clinical is taken away as the accent is placed on providing someone a pleasant wish day on this unique travel journey.

WAB has gotten the possibility to buy new ambulances which can be built to better meet the wishes and needs of the stakeholders involved. Therefore they wanted a designer to thoroughly analyze the current experience of a ride with the wish-ambulance and come up with a fitting design solution which improves the experience of the journey within the boundaries of the (design of the) back-compartment of the wish-ambulance.

### Project objective

The project objective could therefore be stated as:

*"Optimizing the wish ride experience of terminally ill patients, their loved ones, and the WensAmbulance volunteers within the boundaries of (the design of) the back-compartment of the wish-ambulance."*



Figure 1.2 Picture sequence WensAmbulance Brabant



### 1.3 THE PROCES

In order to develop a fitting design solution, an extensive design process has been executed. A visualization of the complete process can be seen in figure 1.2.

#### Front-end analysis

In order to establish an understanding of the complex context of the different stakeholders, literature- and field researches were executed simultaneously to provide answers to the question:

“How to improve the experience of a wish ride for the terminally ill patient, their loved ones and the volunteers of WensAmbulance Brabant within the boundaries of (the design of) the back compartment of the wish ambulance?” (figure 1.1)

The literature research provided insights in aspects to take into account when designing for End of Life, whilst observations (“fly-on-the-wall”) made during attending wish rides, facilitating a generative session with WAB volunteers and analyzing volunteer evaluation forms and patient questionnaire responses provided an overview of problems currently occurring within the field.

The insights which were established through the front-end analysis then resulted in the creation of a Patient Journey Map, which is a visual representation of the process of a wish event from the perspective of the patient.

From the Patient Journey Map, relevant design search areas were extracted in which a design direction was defined in consult with the client and design team.

A design vision was established, and the selected design direction was then explored. Initial design requirements were set up, and a phase of ideation followed.

#### Ideation

Using various ideation techniques, design requirements could be established and vast ideas could be generated. A design metaphor was created in order to define fitting design qualities, a joint brainstorm was conducted to find solutions to “How to” questions, and building blocks for comfort and re-assurance were defined through an exploratory try-out session (“bodystorming”) within the wish-ambulance. This exploration led to the establishment of a program of requirements and promising functionalities and features which needed to be incorporated in the design. Two promising concepts were then created by the means of a morphological chart.

#### Concept refinement

The two concepts were then prototyped in order to execute an user test in which one concept could be selected. Furthermore, new information was gathered by the means of visiting an expert in the domain of ambulance crash safety. Incorporating the new insights extracted from these activities enabled an iterative step, which resulted in the final design.

#### Final design

Sizing of the final design took place by using the DINED database and enabled materialization, detailing of assembly steps and cost estimation. Furthermore, a final use scenario was created in which the use of the design is elaborated and a new Patient Journey was created to explain envisioned benefits of the design.

#### Evaluation

A final prototype was created and used for a final assesment with the IDE students and WAB volunteers. From these evaluation sessions, recommendations could be specified for further research.

#### WHAT

- Which aspects play an important role during the End of Life phase?
- How is the fit of the ambulance regarding facilitation of the wish journey?
- What are the key activities during a wish event and how do they influence the wish ride experience?

#### WHO

- Who are the different stakeholders in the project, and how are they connected to each other?
- What are the needs and wishes of the different stakeholders?

**How to improve the experience of a wish ride for the terminally ill patient, their loved ones and the volunteers of WensAmbulance Brabant within the boundaries of (the design of) the back compartment of the wish ambulance?**

#### WHERE

- When are the stakeholders confronted with the back compartment of the wish ambulance?
- What activities take place in the back compartment?

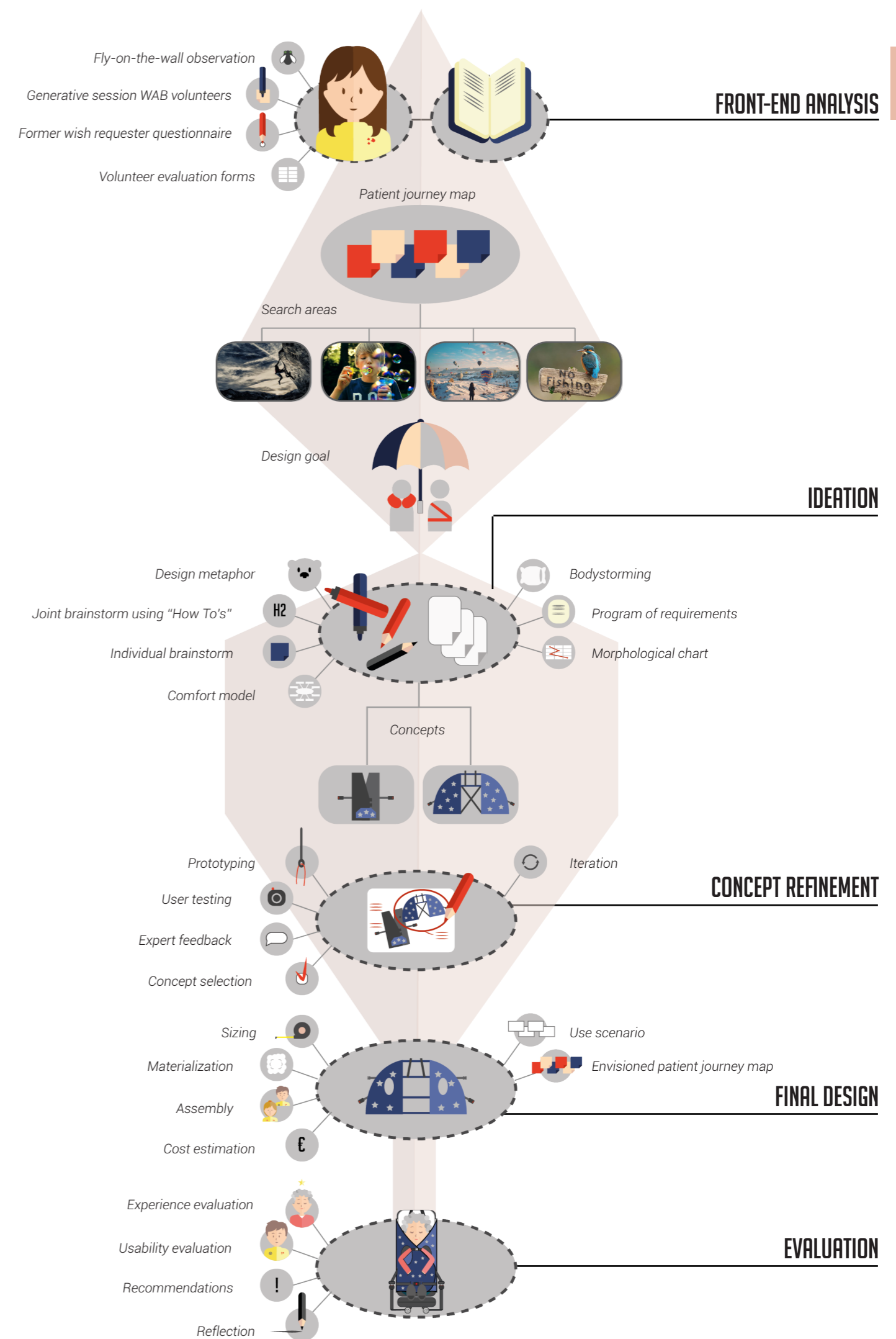


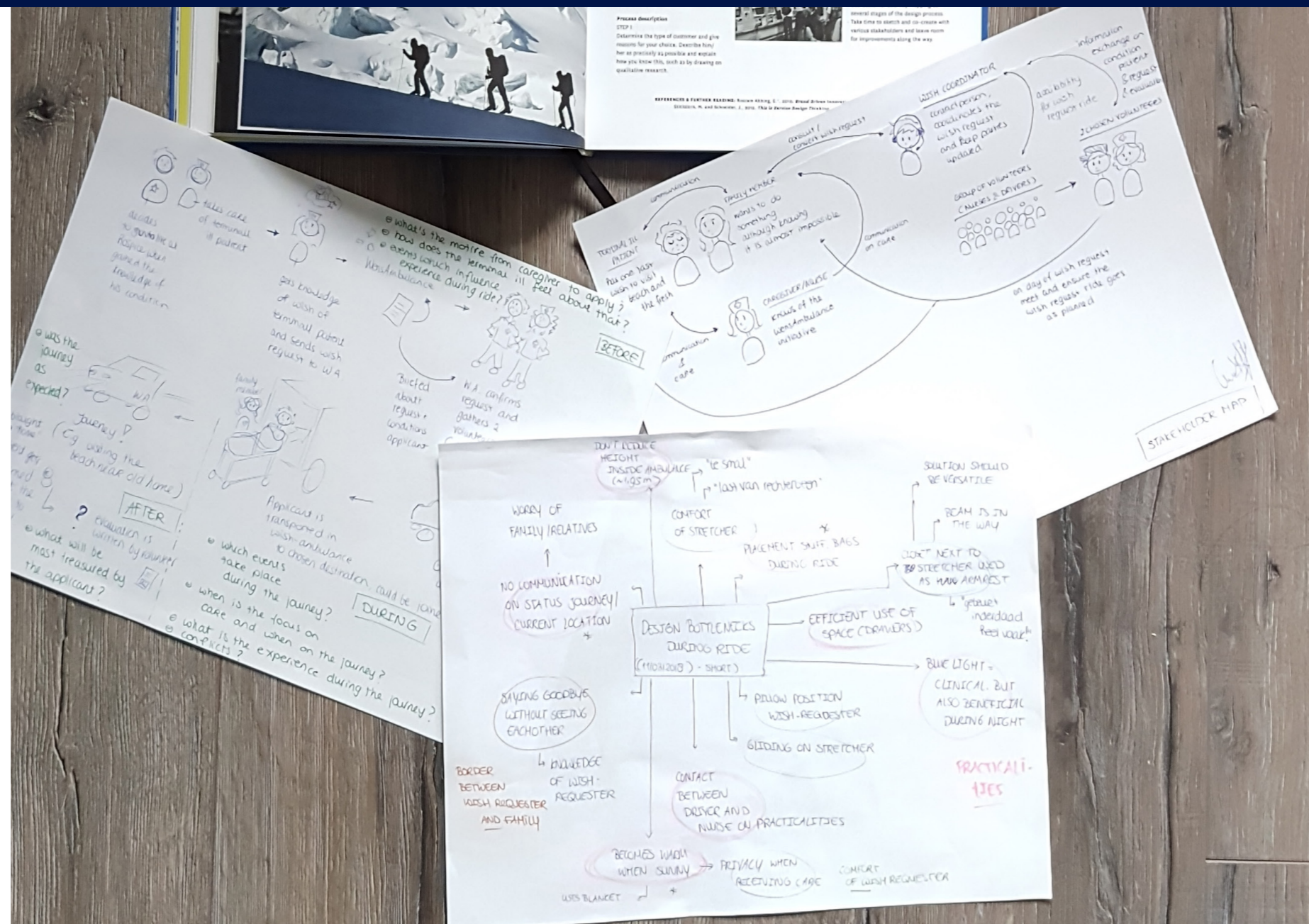
Figure 1.1 Main- and sub questions front-end analysis

Figure 1.2 Process overview

# 2

## CHAPTER 2. ANALYSIS

This chapter concerns the front-end analysis which was executed in order to establish an understanding of the current context of the project, and the users who will be designed for. This analysis led to the establishment of four design search areas. These were then presented and discussed with the client in order to agree on the direction of this design project.



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## 2.1 CHAPTER INTRODUCTION

In order to establish an understanding of the complex context and the user, literature- and field researches were executed simultaneously.

The literature research focused on creating an overview of relevant aspects which come into play during the End of Life phase such as the Kübler-Ross model, patient archetypes and general patient needs and wishes. The field research focused on gaining an understanding of the context to be designed for from the perspective of multiple stakeholders and localizing problems occurring in the current situation.

The field research consisted of observing ("fly on the wall") patients, their loved ones and WAB volunteers during wish rides, facilitating a generative session with WAB volunteers and analyzing volunteer evaluation forms and patient questionnaires responses.

The field- and literature researches both revealed relevant aspects and insights regarding the design context, and enabled the establishment of a Patient Journey Map.

Four design search areas could be defined in which a selection was made in consult with the client and design team.



Figure 2.1 A patient accompanied during a wish ride by one WAB volunteer nurse (front seat) and a loved one (back seat). In the front compartment of the wish ambulance, there is another seat available next to one WAB volunteer driver.

## 2.2 CURRENT WISH EVENT EXPERIENCE

### 2.2.1 Using an ambulance to facilitate the journey

Through history, the ambulance (design) has evolved from a simple wooden cart to the modern motorized vehicle it is today. The aim of the ambulance however has remained the same through time: providing the sick and wounded with the best possible care during transport (Ambulancezorg Nederland, 2018).

WensAmbulance Brabant brings terminally ill people to the place they want to visit last with the use of their four stripped-down ambulances. They provide the transport and, in principle, solely supportive care. The ambulances are equipped with Basic Life Support (BLS) apparatus, and volunteers are advised to contact alarm rooms when Advanced Life Support (ALS) would be needed on the road.

During the journey, the nurse will provide the care as agreed upon with the patient and their family prior to and during the ride, whilst the medical responsibility remains with the patient and their family.

The focus of WensAmbulance Brabant could then be described as the facilitation of transport, in which care has a supporting role to enable a pleasant and comfortable journey to people who are in their final stage of life. However, are ambulances the best means to facilitate this last journey?

To find out, an overview of pros and cons for the wish-ambulance to be an ambulance has been established. The overview is embodied by the knowledge and insights gathered throughout the field analysis (e.g. interviews with WAB volunteers).



Figure 2.2 On the top: Regular hospital ambulance, In the middle: WensAmbulance Brabant, On the bottom: Regiotaxi

### PROS

- **Fitting with the definition:** The wish-ambulance fits the definition of an ambulance which is "providing the sick and wounded with the best possible care" (Ambulancezorg Nederland, 2018).
- **Similar equipment and skills:** The equipment present in the wish-ambulance is similar to BLS-equipped ambulance types, and the volunteers are all able to provide first aid. Therefore no gap between expectations (also, from bystanders) and reality is created.
- **Iconic/recognizable:** The ambulance in general can be regarded as an icon within the health care industry, and using ambulances can in turn make the company recognizable for the public. In addition, the public has adapted the ambulance within the society and has been educated on e.g. behavior in presence of an ambulance. Lastly, the ambulance exterior enables the foundation to profit from a variety of privileges.
- **Professionalism:** An ambulance in general radiates professionalism regarding care. This could contribute to the level that patients and their loved ones feel reassured prior and during the journey.

### CONS

- **Purpose of the wish journey:** The fact that the ambulance radiates professionalism regarding care is supported by its clinical appearance and purposes. However during the wish journey, there could be a need from the patient and family to place the accent on the joy of being together and closure. Potential needed care could therefore play a less prominent role, whilst its availability remains present.
- **Past experiences of patients and their family:** The target group is prone to having an extensive background regarding medical care. Ambulances could therefore be associated as something unpleasant and/or negative depending on the patients and their family's past experience.
- **Closed/secretive design:** The initial design of an ambulance is relatively closed due to privacy regulations coming into play when care is being provided in the vehicle. It has a one-way window on the passenger/nurse's side of the vehicle, whilst the patient side is entirely blocked from the outside. Although adaptations has been made to make the design of the wish-ambulance more open, the design of it remains quite closed when compared with e.g. the regiotaxi (figure 2.2).

### Conclusion

When looking at the overview, it could be concluded that the cons for the wish-ambulance to be an ambulance can be overruled by fitting design adjustments, whilst the pros support the vision WensAmbulance Brabant wants to radiate.

A regular ambulance provides professional transport and care to patients, but is limited to the care-related context- and facilities (e.g. accident site to hospital, hospital to hospital). The wish-ambulance is able to provide similar services, but within an expanded context.

Having an ambulance as a foundation/basis was therefore an appropriate choice. However, the interior design (back compartment) and facilities could be more converged towards the specific target group and the purpose of the wish journey.

## 2.2.2 Project stakeholders and their interrelationships

Within the context of WensAmbulance Brabant, there are five stakeholders: the terminally ill patient, the patient's loved ones, the patient's regular caregiver/nurse, the wish coordinator (WAB) and the volunteers (WAB) as can be seen in figure 2.3.

A wish can be requested by multiple parties, but is most often received from the family and/or friends of the patient. When a wish request is received by WensAmbulance Brabant, one of the wish coordinators will respond within 24 hours. The wish coordinator coordinates further process of a wish request regarding desired care during the wish ride, date, location and time with the one requesting the wish. In addition, he/she checks the availability of the volunteers by sending all of them a short brief.

All volunteers get a time frame in which they can respond to the brief. From the volunteers who responded, two volunteers who fit the wish request details will be selected by the wish coordinator and provided with more elaborate details regarding the wish ride.

On the day of the wish ride, the volunteers, the patient, and his/her loved ones meet for the first time. The volunteer who will provide the care during the wish day will make sure the needed care supplies and information are acquired prior to the wish ride. During the wish day, the volunteers will assist the patient and loved ones to the extent that is desired.

The volunteers are asked to provide a small evaluation of the wish day after the wish ride has passed.

### Conclusion

Each stakeholder has a relevant role to fulfill regarding the wish day, and their actions heavily influence the wish experience, and thus the patient journey. The stakeholders who were defined in the stakeholder map, are therefore also the actors ("a person, product or service contributing to the health process." -Goossens, 2018) within the Patient Journey Map.

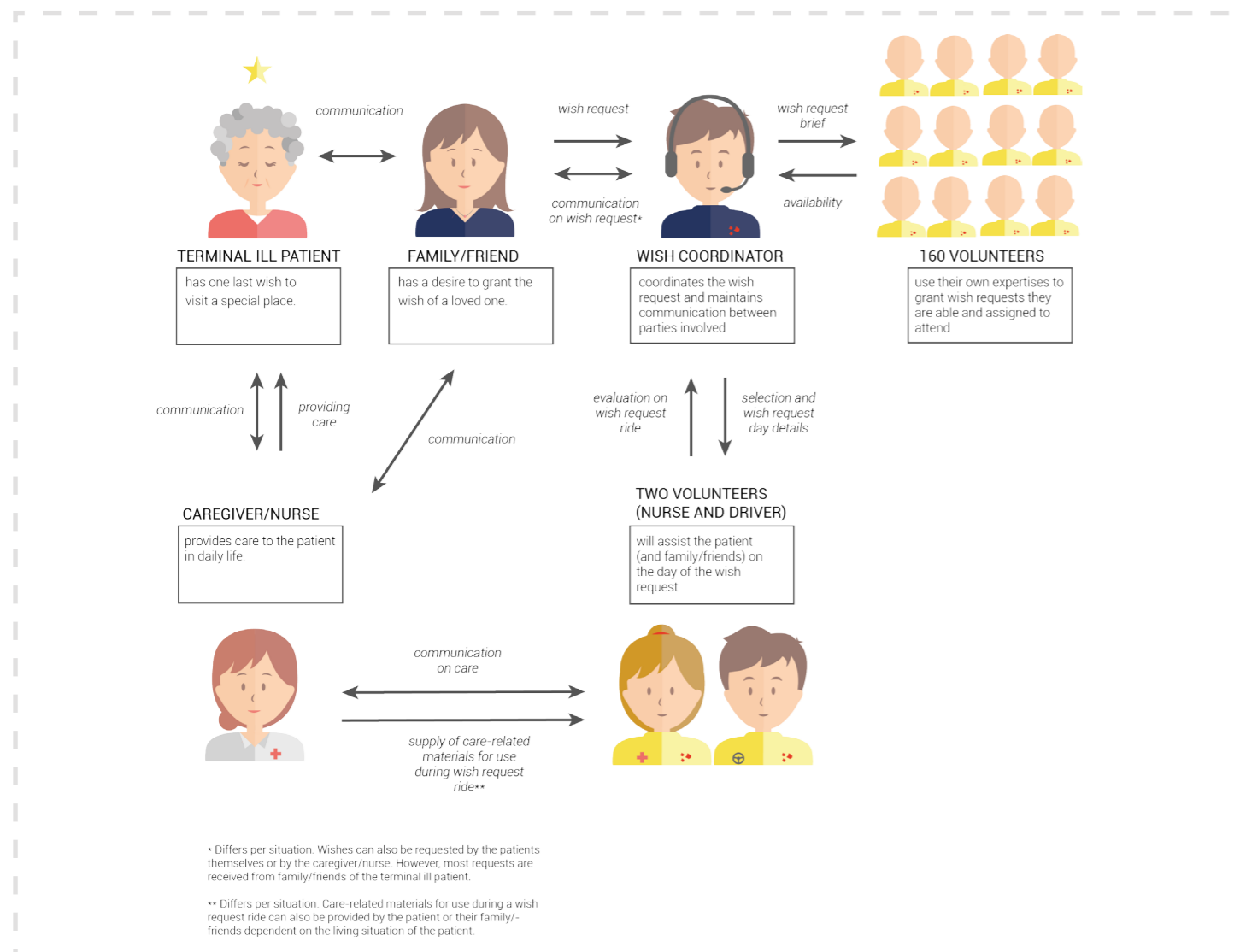


Figure 2.3 Stakeholder map WAB

## 2.2.3 General phases of a wish event

In general, a wish event can be defined in three main phases: before wish day & ride, during wish day & ride, and after wish day & ride. Although the focus of the project is during the ride, within the boundaries of the back-compartment of the wish-ambulance, events prior and after the wish ride could be essential factors regarding the experience during the ride, hence having them included.

Within these main phases, sub-phases could be defined. The events prior to wish day & ride could be extracted from a generative session in which wish coordinators also participated (see Appendix B). The events during the wish day & ride could be extracted from observations done during attending wish rides (see Appendix C) and extracted from a questionnaire which was set-up and sent to former wish requesters and loved ones (see Appendix D).

The events after wish day & ride could be extracted from observations done during attending wish rides, analyzing evaluation forms filled in by WAB volunteers and the set-up questionnaire.

### Conclusion

By combining the insights of different field researches, a comprehensive overview of different phases of a wish event could be defined. These phases were then used to structure the time-axis of the Patient Journey Map (page 36).

## MAIN PHASES

### Before wish day & ride

### During wish day & ride

### After wish day & ride

## SUB PHASES

Getting to know WAB (publicity)

Sending wish request

Waiting for request confirmation

Pre-joy

First meeting

Prepare for journey

Ride to wish location

Arrival at wish location

The wish activity/activities

Prepare for return

First goodbyes

Ride to home

Arrival at home

After-care

Definite goodbyes

Clean-up

Closure

Figure 2.4 Phases of wish event

### 2.2.4 Activities during the wish ride

When attending wish rides, it seldomly happened that the patient was joined (by the designer) in the back-compartment in order to prevent being a disturbing factor on such an important day. Therefore, there was a need to find another way of requiring feedback on the wish ride experience from patients and their loved ones. A questionnaire was therefore created and sent to former wish requesters (being it patients or their loved ones).

Amongst other things, activities taking place during a wish ride were mapped. In figure 2.5-2.6, you can find an overview of the defined activities and their occurrence during the ride towards wish location, and the ride to home.

For the major part, the patients are chitchatting with their loved ones and the volunteers and enjoying the scenery through the ambulance's windows. This was also supported by observations conducted during attending wish rides.

In none of the ten responses nor in the attended wish rides did the patients consume food. Water was sometimes provided to the patient when thirsty during the journey.

Whilst during observations, multiple patients tried to rest and/or sleep, few succeeded in doing so which is also supported by the responses. Furthermore, similar activities were conducted by the family or loved ones.

It is assumed that during the ride home, communication between both parties decreased due to exhaustion of the wish activities. The family/loved ones are more able to rest and/or sleep during the wish journey.

ACTIVITIES	OCCURRENCE DURING THE RIDE TO WISH LOCATION (% OUT OF 100)	OCCURRENCE DURING THE RIDE TO HOME (% OUT OF 100)
Talking with family or loved ones	100	75
Talking with the volunteers	100	75
Looking at scenery (side windows)	50	50
Looking at scenery (back doors)	25	25
Listening to music	25	25
Drinking	25	25
Eating	0	0
Sleeping	25	25

Figure 2.5 Patient activities during wish ride

### Conclusion

An overview of activities undertaken by terminally ill patients and their loved ones during a wish ride could be mapped.

The design should not interfere with desired activities during the wish ride, such as interaction between the different stakeholders, whilst it should optimally facilitate activities which are desired but not able in the current situation such as resting/sleeping.

ACTIVITIES	OCCURRENCE DURING THE RIDE TO WISH LOCATION (% OUT OF 100)	OCCURRENCE DURING THE RIDE TO HOME (% OUT OF 100)
Talking with patient	60	40
Talking with family/loved ones	80	80
Talking with volunteers	60	60
Looking at scenery (side windows)	80	60
Looking at scenery (back doors)	40	40
Listening to music	0	0
Drinking	20	20
Eating	20	20
Sleeping	40	40

Figure 2.6 Family/loved one activities during wish ride

## 2.2.5 Types of wish rides

Although every wish ride is unique, an comprehensive example of a wish ride needed to be created in order to embody the Patient Journey Map.

By interviewing WAB volunteers during wish rides and analyzing what was described within evaluation forms filled in by WAB volunteers, three types of wish rides could be distinguished: taxi-rides, family-oriented rides, and memory-oriented rides (figure 2.7).

Taxi-rides concerns rides in which the focus is mainly on the needed transport, and in which it is often implied by the volunteers that patients could have been able to reach their destination using regular transport. Compared to the other two types of rides, the need of care is least prevalent and there is little interaction between patient, loved ones and volunteers.

Family-oriented rides concerns rides in which the focus is on the opportunity to be together and relaxation from being ill. The patient is often accompanied by multiple family members and the day consists of multiple wish goals.

Memory-oriented rides often embody a small and simple wish, in which the focus is on closure. The total duration of the ride is shortest compared to the other type of rides, and the volunteers often fulfill an active role during the wish activity.

From interviews and the evaluations, it could be extracted that the memory-oriented ride was the most comprehensive type of wish ride in which multiple aspects of the other types of rides are a recurring factor. From the thirty analyzed evaluation forms, they are also the most prevalent types of rides performed by WensAmbulance Brabant (53 %).

### Conclusion

The memory-oriented ride was selected for the embodiment of the Patient Journey Map as it was deemed the most comprehensive of the defined wish ride types.

## 2.2.6 Attitude types within the main target group

A nationwide research conducted by Motivation and commissioned by 'Transmuraal Netwerk Midden Holland' focused on finding the answer to the question:

*"Similar to having their own lifestyle, do people have their own 'die style'?"*

The research aimed to create an overview of people's attitudes regarding the last stage of life (Stichting STEM, 2018). The Mentality Model of Motivation divides the Dutch populations in five types regarding their attitude to life and orientation of values: pro-active, open-minded, trusting, rational and sociable people. These five segments are visualized in figure 2.8.

## TYPES OF WISH-RIDES

### TAXI-RIDE (3/30)



**FOCUS**  
Need of transport - Having fun being together

**GENERAL HEALTH PATIENT**  
Compared to other two types of rides, relatively healthy. Ride could have been provided by non-WAB

**WISH ACTIVITY EXAMPLE**  
Visiting a hotspot within the Netherlands

**DURATION OF WISH**  
Relatively long

**NEED OF CARE**  
WAB volunteers give certainty of having care nearby

**INCLUSION OF WAB VOLUNTEERS ON WISH DAY**  
Little to no inclusion in experience of the wish day

### FAMILY-ORIENTED RIDE (11/30)



**FOCUS**  
Relaxation from being ill - Celebrate being together

**GENERAL HEALTH PATIENT**  
Variable

**WISH ACTIVITY EXAMPLE**  
A day in Scheveningen, visit Sealife, dinner afterwards

**DURATION OF WISH**  
Relatively long - sometimes too much goals at once

**NEED OF CARE**  
WAB volunteers have supporting role

**INCLUSION OF WAB VOLUNTEERS ON WISH DAY**  
Partly included in the experience of the wish day

### MEMORY-ORIENTED RIDE (16/30)



**FOCUS**  
Closure - Memories

**GENERAL HEALTH PATIENT**  
Compared to the other two types of rides, relatively sick. Often in very progressed stadium of End of Life

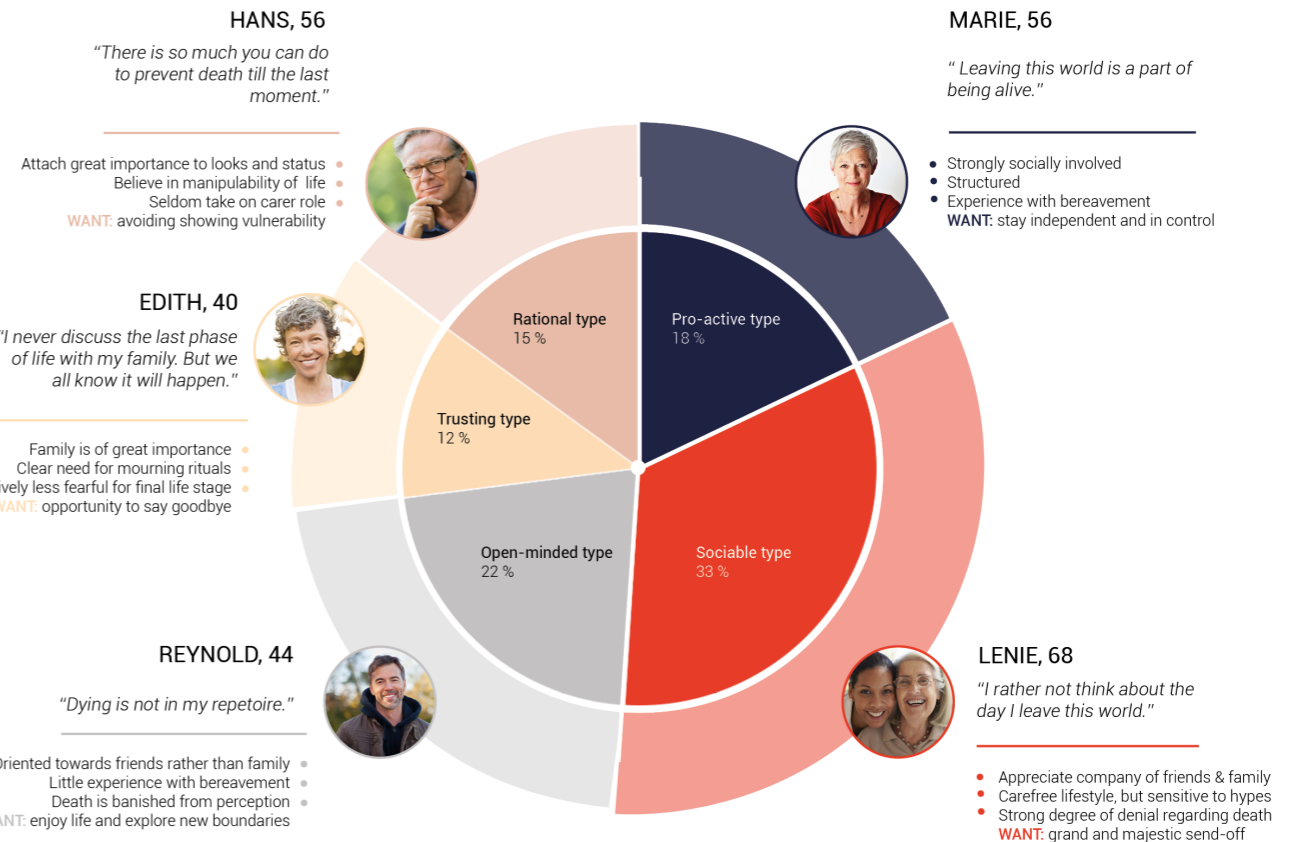
**WISH ACTIVITY EXAMPLE**  
Visiting previous home and see his old companion

**DURATION OF WISH**  
Relatively short - but sometimes patients prolong

**NEED OF CARE**  
WAB volunteers have active role

**INCLUSION OF WAB VOLUNTEERS ON WISH DAY**  
Highly included in the experience of the wish day

**SURPRISE RIDE\*** - Patient does not know on beforehand  
**EMERGENCY RIDE\*** - Less incubation time  
\* PART OF FAMILY-OR MEMORY-ORIENTED RIDE



## IMPLICATIONS FOR THE PROJECT

From the figure could be extracted that there are different kinds of attitudes types present within the target group. These attitudes are however not pragmatic as to one person could possess personality traits from different segments;

- Some people have a strong urge to wanting to stay in control, and would benefit from a sense of independence during the wish event (PRO-ACTIVE)
- Some people have a strong desire for safety and feeling being cared for, and therefore could have more demands during a wish event (SOCIABLE)
- Some people have a strong preference for receiving professional care, where value is attached to adequate care and comfort. The interior design and facilities of the wish ambulance could play an important role regarding this aspect (TRUSTING)
- Some people have little experience with bereavement and are therefore less aware about matters such as potential restrictions and wants and needs during the End of Life phase. This could be a relevant aspect to take into account regarding interaction between volunteers, or patient and volunteer during wish events (OPEN-MINDED)
- Some people attach great value to looks and status, and therefore have difficulty to show vulnerability (RATIONAL).

Having an understanding of the different attitudes segments provides an overview of aspects that need to be taken into account when designing for this project's specific context and exclusion of a significant amount of potential users should be avoided.

For example, the possibility to include family during the wish journey should still be present whilst some people are not family-oriented. The same goes for the possibility to provide people a sense of privacy in the wish-ambulance whilst others prefer a more transparent layout.

### 2.2.7 Persona

For this project, the characteristics of the sociable segment were selected for persona creation (figure 2.9) as there is a strong desire for safety and being cared for (Stichting STEM, 2018). The sociable segment is a segment in which more demands could be present during a wish ride, either known or unknown. Whilst this is not necessarily a need concerning all segments, it does not exclude the patients who do have this need, nor the patients who do not.

The decision to create a sociable segment-based persona does not intend to exclude the other needs and wishes which could concern the other four segments. Potential needs from the perspective of the other segments, were a returning aspect when the design goal was defined and were integrated in the form of design requirements.

# LENIE, 68

*"I rather not think about the day I leave this world."*



<b>NAME</b>	Lenie Janssen-Hoogeveen
<b>AGE</b>	68
<b>GENDER</b>	Female
<b>COUNTRY</b>	the Netherlands
<b>LIVING SITUATION</b>	Hospice, receives daily care
<b>GENERAL HEALTH</b>	Mostly bedridden, receives O2 when desired
<b>DISEASE</b>	Progressed bone cancer, metastases in body
<b>KEY WORDS</b>	

Social

Discrete

Sensitive



### LENIE'S STORY

Lenie is a very kind woman, with a difficult time past and ahead. Lenie's husband who suffered from Alzheimer's past away a year ago.

Lenie started not feeling well and thought this was a backlash of the energy she put in taking care of her beloved husband. A few months ago she found out about her condition, and things went fast from there. The disease became increasingly restricting and Lenie had to leave her home, and memories behind. This was one of the hardest things she ever had to do.

### LENIE'S WISH

Lenie's focus always has been on her family. Therefore she would like to go to the beach one last time, where her husband, their two daughters and herself spend a lot of time during summers when things were still fine. She would love if her three grandchildren could tag along.

She wishes to feel the refreshing ocean breeze one last time, and have a cup of tea in the restaurant where her husband and she celebrated their last anniversary.



## 2.2.8 The role of acceptance during the wish event

Other than attitude, a sense of acceptance of End of Life plays a vital role during the wish event. According to the generative session held with WAB volunteers (Appendix B), patients who did not gain a sense of acceptance yet will most often not apply- nor accept being applied to a wish ride.

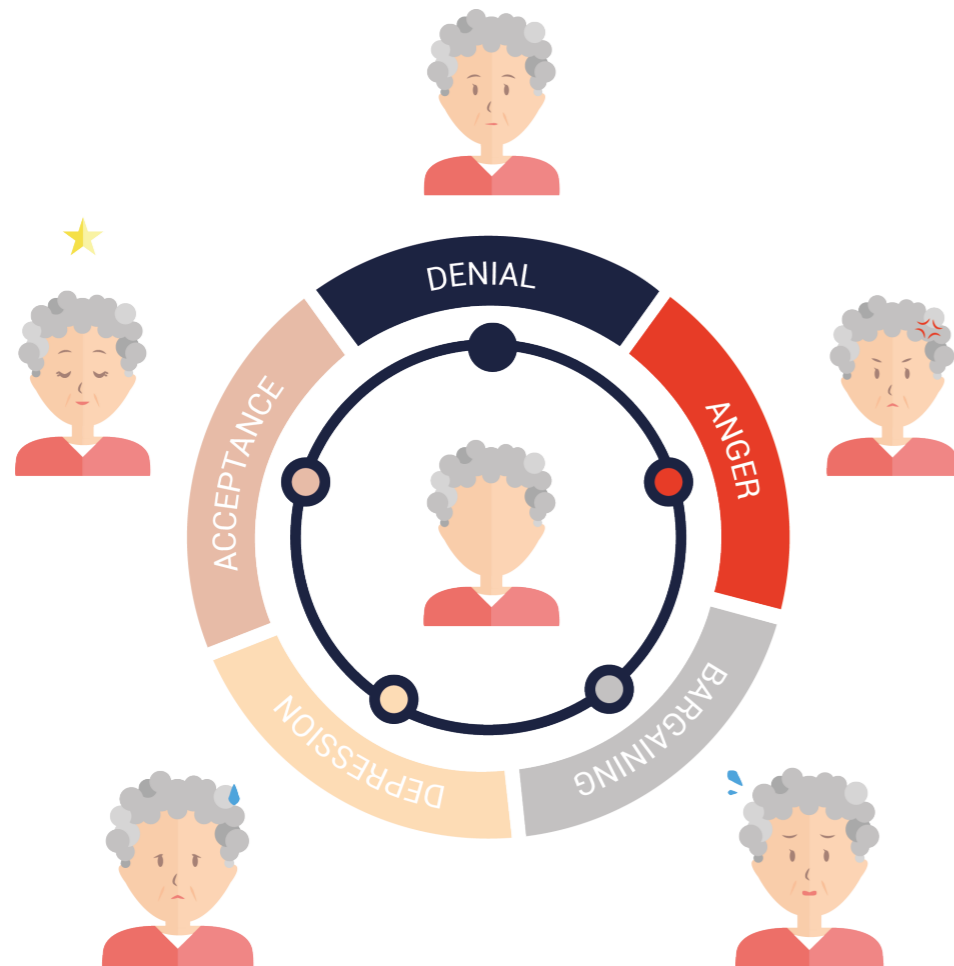
As acceptance of one self being terminally ill can be described as acceptance of the loss of life that soon will be near, it was chosen to analyze the five stages of grief of Kübler-Ross (figure 2.10).

Grief is as unique as every human. No one goes through the five stages in a prescribed order, nor is there a typical response to loss. This model solely provides an overview of responses to loss that many people experience, namely denial, anger, bargaining, depression and acceptance. It implies that these responses are part of the framework that makes up our learning to live with loss (Kessler, 2018).

All these emotions could be present during a wish event, and need to be taken into account whilst designing for this specific target group. It was mentioned however that people who did not reach a sense of acceptance of the nearing End of Life prior to a wish ride, are relatively more disconnected during wish day

*"Meneer geeft aan nog veel hoop te hebben voor de toekomst?"*

- WAB volunteer



## 2.3 STAKEHOLDER WANTS & NEEDS

### 2.3.1 Within the context of WAB

In order to establish an overview of different stakeholder's wants and needs concerning a wish day experience, WAB volunteers were asked to participate in a generative session (figure 2.11). Amongst other things, the participants were asked to generate needs concerning the wish day and place them in a relevance matrix (Appendix B).

From this matrix could be extracted that safety of the patient is regarded important for both patient and their loved ones, as well as for the WAB volunteers.

In addition, comfort, privacy and adequate bedding are regarded important for the patient and their loved ones, whilst internal communication, publicity and information consistency are relevant for the volunteers of WensAmbulance Brabant.

It was also mentioned that the importance of several aspects are highly dependent on the desires of the patient and his/her loved ones during wish day (e.g. presence of loved ones), and that in general the effort is put in providing the ones who requested the wish a pleasant day.

*"Uiteindelijk wil je deze mensen gewoon een fijne dag bezorgen" - WAB volunteer*

#### Conclusion

The generative session provided insights regarding aspects that were deemed important concerning the wish event from the volunteers' point of view and presented initial design challenges.



Figure 2.11 Generative session with WAB volunteers

### 2.3.2 Within the general context

#### Categorization of general patient needs during End of Life phase

It was researched what attributes were considered important in the context of the wish-ambulance, and from the perspective of the volunteers. However, taking a step back and consider the general needs and wishes of someone in their last year of life also provided relevant design implications.

People living with (a range of) serious chronic illnesses face a wide range of problems. Although the symptoms differs per illness, these people often have similar needs and concerns (WHO, 2004). Epidemiological studies have shown that many symptoms and problems in the last year of life are similar (WHO, 2004).

The general needs of people in their last stage of life regarding care can be divided in four areas: physical comfort, mental and emotional needs, spiritual issues, and practical tasks (NIH, 2018). These areas are visualized in figure 2.12. The concerns and interpretation of terms as 'quality of life' and 'a good death' however are highly individual (WHO, 2004). One could be most concerned about physical symptoms such as experienced pain, whilst another is more concerned with the effect an illness has on their daily life and their family.

These areas cover the pillars of palliative care.

*Palliative care is "an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual" (WHO, 2004).*

Palliative care provides relief from pain and other distressing symptoms, affirms life and regards dying as a normal process. It neither intends to hasten nor prolong death, and helps patients to live according to their wishes till the day they leave this world (WHO, 2004). In addition, it provides a support system for family members to cope during the patient's illness and in their own bereavement.

Palliative care can be given together with curative treatment, and may begin at the time of diagnosis. When treatment is no longer helping, the palliative care could transition to hospice care (NIH, 2018). Similar to palliative care, a hospice provides comprehensive comfort care as well as support for the family, however, attempts to cure the illness are stopped.

#### PHYSICAL



Physical discomfort during End of Life can be caused by a variety of problems. Common problems include pain, breathing problems, skin irritation, digestive problems, temperature sensitivity and fatigue (NIH, 2018).

These physical symptoms are present in 32-80 % of patients during their final stage of life (Veerbeek, 2008).

#### MENTAL & EMOTIONAL



Terminally ill people may feel a sense of isolation due to the reactions of family, friends and sometimes even the medical team such as withdrawal from the person who is soon to pass away.

A simple act of physical contact can make a person feel connected to those he or she loves and have a soothing effect, help with relaxation, and lessen pain.

#### SPIRITUAL



Some people nearing the end of life have spiritual needs as important as their physical concerns. This field mostly concerns finding meaning in one's life and finishing unresolved businesses with others.

In addition, it is highly effected by relationships between the patient and their loved ones, and their belief.

#### PRACTICAL TASKS



There are many practical jobs that need to be done during the final stage of life – both to relieve the person who is soon to pass away and the caregiver(s).

Reducing the burden on the parties involved has proven to be a challenge.

Figure 2.12 General patient needs

## Relevance of factors considered important at the End of Life

A research conducted by Steinhauser et al (2000) with the objective to determine attributes considered important at the end of life from the perspective of patients, their family, physicians and other care providers provided an overview of what factors were considered important by which stakeholder, and the relevance of these factors. In figure 2.13, several factors which were considered of high importance are visualized in beige. In addition, factors which were only considered of high importance by the terminally ill patient are added in red.

Not all of these attributes could be influenced by WensAmbulance Brabant. The attributes which therefore were included in the project were:

- Symptoms of personal care
- Sense of completion
- Being treated as a whole person
- Patient's relationships with health care professionals

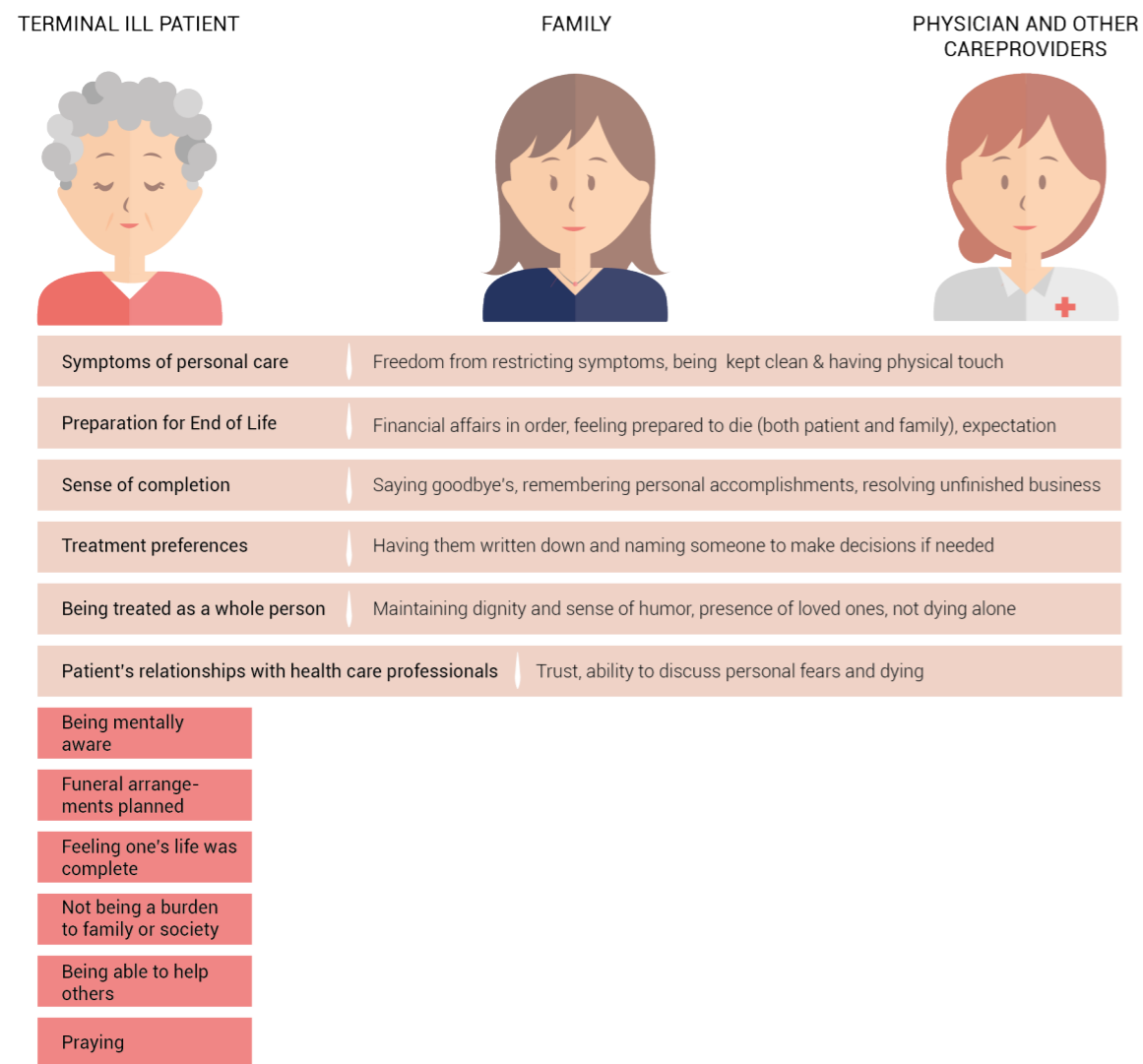


Figure 2.13 Relevant factors EoL

## Dealing with restricting symptoms

Through attending wish rides, talking with volunteers, and by analyzing volunteer evaluation forms, it became prevalent that restricting symptoms play an essential role within the wish ride experience.

According to Giel van Genugten, one of the founders of WensAmbulance Brabant, 1 out of 5 wish rides are cancelled prior to the wish ride due to patient health deterioration. In addition, from the thirty analyzed volunteer evaluation forms, it became prevalent that the main reason for patients not being able to manage getting to their wish goals is due to experienced fatigue.

"Rit was zeer vermoeiend voor de wensvrager. Zij kon niet meer [...]. Familie besloot in overleg met wensvrager om op [...] iets lekkers te halen en dit mee naar de hospice te nemen om daar te nuttigen. Wensvrager ging bij terugkomst gelijk naar bed."

- WAB volunteer

Fatigue, along with other symptoms that lead to restriction in daily activities (also, "restricting symptoms") are common during the last year of life (Chaudhry et al, 2013). In addition, these symptoms increase substantially around the 5th month before death.

RESTRICTING SYMPTOM	PREVALENCE [% OUT OF 100]
Fatigue	32
Musculoskeletal pain	23
Dizziness or unsteadiness	20
Shortness of breath	18
Arm or leg weakness	18
Depression	12
Anxiety	11
Swelling in feet or ankles	10
Nausea, vomiting or diarrhea	9
Memory or thinking problems	9
Urinary problems	9
Difficulty sleeping	8
Chest pain or tightness	7
Cold or influenza symptoms	7
Poor eyesight	3

Figure 2.14 Restricting symptoms during End of Life

To get an overview of symptoms that could be experienced by people applying for a wish ride, the restricting symptoms and their prevalence at the 2nd month before death are visualized in figure 2.14.

Fatigue is one of the most prevalent symptoms in palliative care patients, considerably impairing quality of life (Radbruch et al, 2008). The definition of fatigue is a subjective feeling of tiredness, weakness, and lack of energy. Whilst the prevalence and impact of fatigue often have not been recognized by physicians, it has received more attention in the recent years as quality of life has increasingly been used as an endpoint in trials.

Physical fatigue prevents participation in preferred activities and cause restrictions regarding activities of everyday living, whilst cognitive fatigue complicates leisure activities such as reading or driving a car.

Patients are of opinion that fatigue affected their daily life more than pain, whereas physicians believed that pain affected their patients more than fatigue.

Fatigue is however positively correlated to pain, depression and lower sleep quality (Nicassio et al, 2002). Thus greater pain, greater depression, and lower sleep quality contribute to a higher experience of fatigue.

Fatigue therefore could be minimized by decreasing pain and/or depression, and maximizing sleep quality.

## IMPLICATIONS FOR THE PROJECT

### Needs & Wishes

- The general needs of people during their last stage of life can be divided in the areas of physical comfort, mental and emotional needs, spiritual issues, and practical tasks. The design should address these needs in order to improve the quality of life during the End of Life phase.
- Concerning wish rides, (restrictive) symptoms concerning physical comfort and mental and emotional needs are assumed to be most prevalent.
- When intending to improve physical comfort, the product should intent to minimize fatigue as this is the most common and prevalent restrictive symptom.
- In order to decrease fatigue, the product needs to decrease experienced pain and depression, or increase sleep quality during wish day

## 2.4 PATIENT JOURNEY MAP & DESIGN SEARCH AREAS

### 2.4.1 Patient Journey Map

Relevant insights and observation made during the front-end analysis were summarized and visualized by the means of a Patient Journey Map.

"A Patient Journey Map is a multi-layered visual representation of the process a patient goes through regarding a wish event. It has the ability to present problems occurring during the wish journey and was therefore an appropriate tool to define relevant design search areas."

In figure 2.15, the Patient Journey Map regarding a wish event carried out by WensAmbulance Brabant can be found. Within the Patient Journey Map, the focus is on a memory-oriented ride for Lenie, who embodies multiple characteristics of the sociable segment type, and who has a wish to visit the beach one last time (the persona and wish description can be found on page 29).

The Patient Journey map consists of layers called the phases, the actors and emotions. The phases are steps a patient goes through during a wish event, as defined in paragraph 2.2.3.

The actors are people who contribute to the wish event experience, which in this case were mainly the stakeholders as defined in paragraph 2.2.2. The emotion line was defined by observations done during attending wish rides, and embodied by using the emotion toolkit from prof. Desmet.

The grey squares imply touch points or interaction between the different actors in a certain phase, whilst the other squares provide either an insight concerning a certain phase or a quote stated by patient, loved one or WAB volunteer.

The Patient Journey Map provided an comprehensive overview of a wish event, and revealed various areas in which the wish ride experience could be optimized.

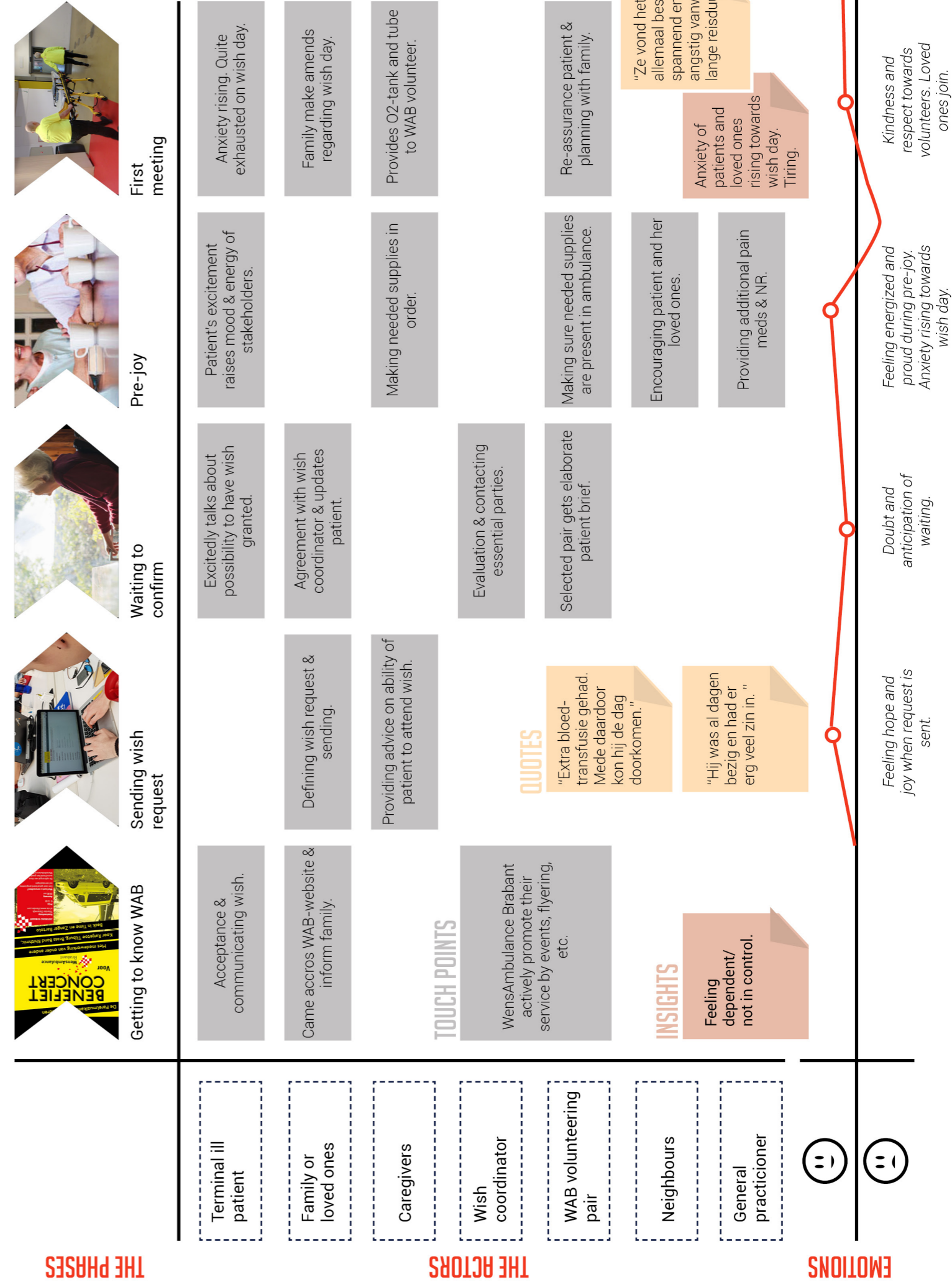
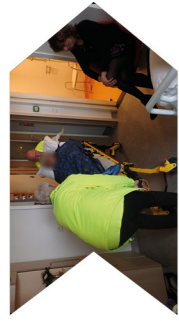


Figure 2.15 Patient Journey Map



### Prepare for journey

Looking forward & Enjoy change of environment.

Patient

Daughter joins in the ambulance, others in own transport.

Family

"Mevr. kan niet liggen door pijnklachten t.g.v. bot ca."

C.G.

"Gezien gezondheids-toestand wensvrager, geplande act. niet haalbaar."

Wish co

Converting patient to stretcher & make her comfortable.

WAB vo

Privacy in back-compartment needed due to deep conversations.

Neighb.

Patient, loved one and WAB volunteer (nurse) cannot hear each other well.

G.P.

Deep conversations & minimizing discomfort.

WAB vo

WAB volunteering pair cannot hear each other well. Conversate through small window.

Neighb.



### Arrival at wish location

Overwhelmed. Enjoys fresh breeze and sun.

Experiencing discomfort & tries to sleep.

Patient

All members join patient. Relief of arrival.

Re-assuring patient & talking about past.

Family

"Later knapte hij op. Hij at goed en genoot buiten op het terras."

C.G.

Converting patient to wheelchair & making arrangements.

Deep conversations & minimizing discomfort.

WAB vo

WAB volunteer nurse not secured during ride. Talking to patient, loved one, and driver.

WAB volunteering pair cannot hear each other well. Conversate through small window.

Neighb.

WAB volunteers "disagree" on use of safety belt of patient. Rules vs. patient's will.

WAB volunteering pair cannot hear each other well. Conversate through small window.

Neighb.



### The activity

Lost in thoughts about memories & decides to want to have lunch.

Overwhelmed. Enjoys fresh breeze and sun.

Patient

Glad to see patient happy. Forget about hardships for a bit.

Re-assuring patient & talking about past.

Family

"Later knapte hij op. Hij at goed en genoot buiten op het terras."

C.G.

Taking a step back & informing family of their presence.

Deep conversations & minimizing discomfort.

WAB vo

Side step of the ambulance not observed by its passengers.

WAB volunteers "disagree" on use of safety belt of patient. Rules vs. patient's will.

Neighb.



### Prepare for return

Fatigue taking over, desire to go home.

Lost in thoughts about memories & decides to want to have lunch.

Patient

Make amends about who will join patient. Reality kicking in.

Glad to see patient happy. Forget about hardships for a bit.

Family

"Heeft nog veel hoop voor de toekomst?"

C.G.

Waiting for patient and family's return & converting to stretcher.

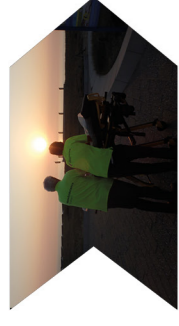
Taking a step back & informing family of their presence.

WAB vo

Losing their control. How to prolongue the peak of joy?

Side step of the ambulance not observed by its passengers.

Neighb.



### First goodbye's

Patient says goodbye's son and (grand)children.

Fatigue taking over, desire to go home.

Patient

Daughter joins ride home.

Make amends about who will join patient. Reality kicking in.

Family

"Heeft nog veel hoop voor de toekomst?"

C.G.

Thanked by family. Making amends for ride home.

Taking a step back & informing family of their presence.

WAB vo

Little space to say goodbye.

Side step of the ambulance not observed by its passengers.

Neighb.

Feeling of loss. Son and grandchildren leave.

G.P.

Anticipation of wish activity.

Feeling distressed due to pain.

Feeling in control.

Euphoria of arrival.

A time of love, relief and relaxation; being with loved ones. Feeling wish is complete.

Through time, exhaustion increases.

Through time, exhaustion increases.



### Ride to home

Very exhausted. Mostly trying to sleep..

Patient

Telling WAB volunteer about their day & sleeps

Family



### Arrival home

Totally exhausted, but glad she's home

Patient

Relieved by arrival.

Family



### After-care

Letting everything go. Overwhelmed by emotions & fatigue.

Patient

Making patient ready for bed.

Wish co



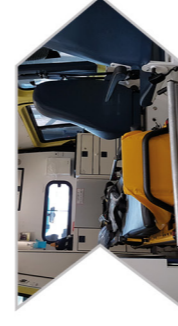
### Definite goodbye's

Giving both volunteers a sincere kiss, thanking them.

Patient

Thanking the volunteers & giving donation envelope.

Family



### Clean up

3 days of re-energizing, proud & thankful. Anticipating End of Life.

Patient

Joyful memories and pictures. Talking about it when visiting.

Family

Throw out blanket, bring ambulance back, practicalities (e.g. fuel).

Wish co

Pictures are the only tactile memory?

C.G.

Re-energizing. Glad & thankful to grant someone's wish.

WAB vo

Providing listening ear.

Neighb.

Experience of sound, touch and light more intense. Little adaptions would contribute.

G.P.

Letting everything go. Loss of control. Relief of lying in own bed.

G.P.

Feeling relieved, quiet. Knows procedure of ride.

G.P.

Relief of arriving home.

G.P.

Sad, but thankful. "Was this the last time?"

G.P.

Re-energizing in the days after. Incubation pride & relief.

G.P.

Satisfaction, closure, "I did it."

G.P.

## 2.4.2 The journey of Lenie

The Patient Journey Map provides a simplified overview of the process our persona Lenie goes through regarding her wish event.

Before Lenie embodies her wish, she has reached a certain sense of acceptance that now is the time to make that wish come true. She communicates her desire to visit the beach to her regular caregivers in the hospice and her loved ones. The caregivers are of knowledge that a request can be sent to WensAmbulance Brabant.

The wish request is then defined, and together with the wish coordinator an agreement is reached. Two suitable volunteers are selected based on their experience and time, and details are communicated.

Lenie receives the good news from either her loved ones or the caregivers, and **the excitement raises the mood** in all parties involved. The caregivers will make sure the needed medical supplies are taken care of and Lenie awaits the day she and her loved ones will go on this unique journey.

Towards the wish day, **anxiety starts to rise**. Worries occur whether Lenie will be able to make this long journey. On the wish day itself, **Lenie is quite exhausted** due to complications with the disease she is facing. Lenie is provided an oxygen tank to relieve her shortness of breath.

When the volunteers come in, Lenie's feels a bit more reassured due to their kindness. Soon her family members join, and Lenie regains some strength.

The volunteers prepare Lenie for her wish journey. She is being converted from her wheelchair to the stretcher, and the volunteers **try to make her comfortable** by providing pillows and positioning the backrest of the stretcher. The patient restraints are applied, and **a blanket is used to cover Lenie**. Then Lenie is positioned into the wish ambulance, and joined by one of her family members and the nurse volunteer.

During the ride, Lenie **re-positions her body multiple times trying to find a comfortable position**. Due to her experienced fatigue, she also **tries to sleep** for a bit prior to arriving to the beach. In the meanwhile, the volunteer and family member engage in **deep conversations** about everything that has happened. Lenie sometimes joins the conversation. The **volunteer gets up a couple of times** to discuss matters with the driver and/or to talk to Lenie and reposition aspects to make her more comfortable.

Coming closer to the wish location, Lenie regains some of her strength. She is **overwhelmed by emotions** and enjoys the fresh breeze and sun on her skin. She cherished the opportunity that she is given to have enjoy this view with her loved ones.

She is **determined to use the wheelchair** and go for a walk together. The **volunteers take a step back**, and find a place to have a drink. They communicate to the family members that they can call when needed.

Lenie is feeling happy and relieved. Her **anxiety has gone away and she feels in control** over her body and mind. A lot of pictures are taken during this journey. Together with her loved ones, she decided to have a little lunch her as well.

A bit later, she feels a bit off... the fatigue is kicking in. Lenie **start to feel uncomfortable, and opts that it is time to go home**. The family members call the volunteers that they are on their way. The volunteers **prepare the stretcher** prior to Lenie's arrival.

Lenie is converted from the wheelchair to the stretcher, **buckled up and tucked in, and positioned in the wish-ambulance**. The **family members go in one by one to say goodbye**. The family members which will return to home, thank the volunteers and say their goodbyes.

One family member will accompany Lenie and the volunteers on their way back to the hospice. During the ride home, both Lenie and her daughter are **exhausted and trying to rest**. Lenie knows the procedure now and is more relaxed compared to the ride towards the beach.

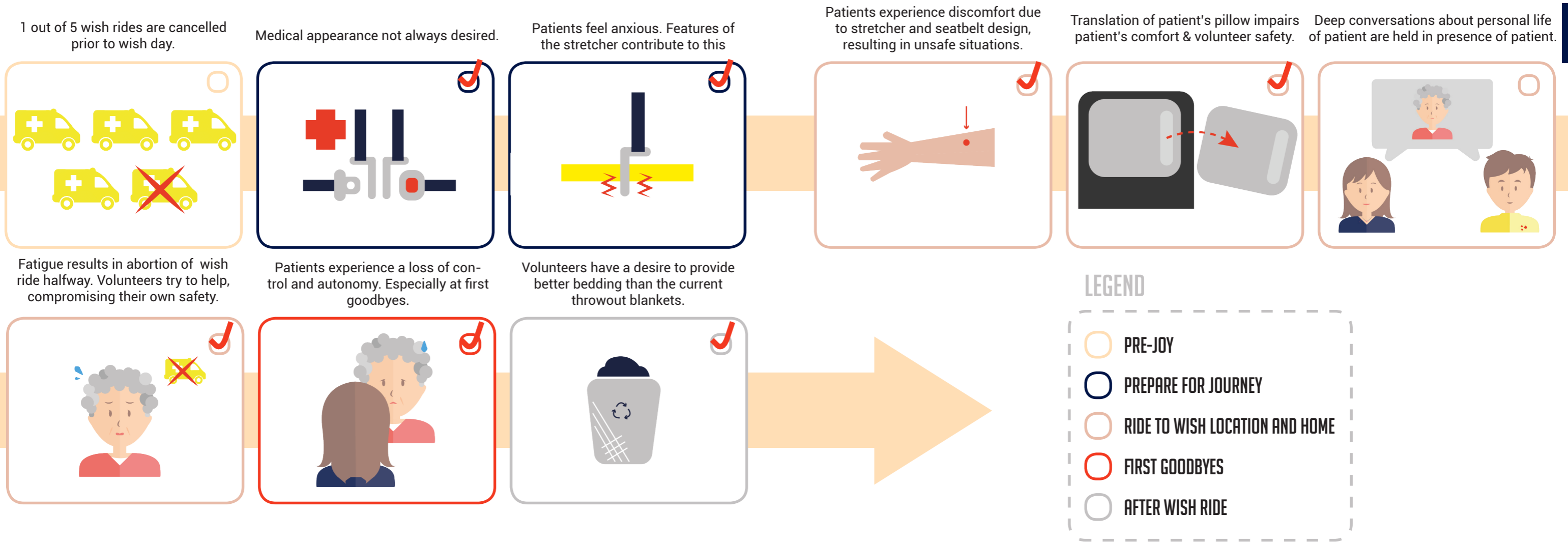
Upon arrival, Lenie is **totally exhausted** and glad she is home. The volunteers and caregivers help Lenie undress and get ready for bed. At this moment, **Lenie lets everything go**. Emotions are taking over, she does not care how she looks anymore. The volunteers communicate that she has been very brave to do this. When Lenie is lying in bed, she takes a deep breath and feels a bit of pride. She sincerely thanks the volunteers for their kindness. The **volunteers are provided an envelope with a donation for their foundation**.

The volunteers then wish Lenie and her family member strength during the last phase, and take their leave. On the way out, **they throw out the (one-time use) blanket** and make sure Lenie and her family have taken all of their stuff. They drive back the wish-ambulance to one of the ambulance depots and **check on practicalities** such as fuel.

The days after the wish ride are used for Lenie to re-energize. She excitedly talks about everything that has happened with the caregivers, friends and loved ones, and can look back on a joyful time. **Pictures are often shown, and words of praise are shared about the foundation that made this possible**.



Figure 2.16 WAB volunteers waiting for patient's return



**Conclusion**

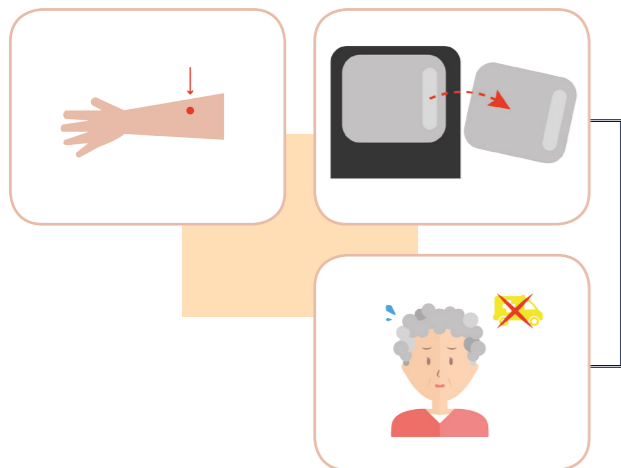
The Patient Journey Map revealed multiple aspects that could be improved upon regarding the wish journey of Lenie (figure 2.17). These were translated into four design search areas (pages 44-47).

The design will focus on improvement within the phases "ride to wish activity" and "ride to home" in order to optimize the wish ride experience, as these are within the boundaries of the back-compartment of the wish ambulance.

Bottlenecks which were defined, but which were not included in the scope were the cancellations prior to wish day due to patient health deterioration and the potential negative effect of deep conversations in presence of the patient. These bottlenecks were deemed inevitable in the context of the project.

### 2.4.4 Design search areas

The user- and context analysis revealed several opportunities to optimize the patient journey of a wish ride. These opportunities were categorized into four design search areas (figure 2.18-2.21) and presented to the design team and company clients.

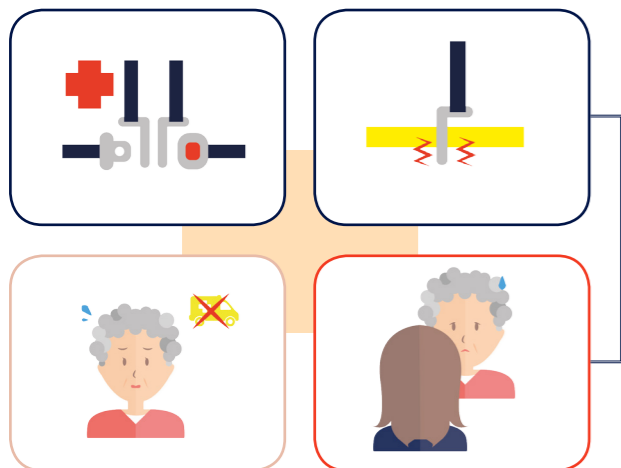


#### Search area 1: Enabling patients to go the extra mile

This search area (figure 2.18) is focused on increasing the physical comfort of the patients in order to enable him to fulfill their wish goals. From the thirty wish ride evaluations by WAB volunteers, four patients were not able to fulfill their wish goal. Within the other 26 evaluations, presence of physical discomfort was mentioned multiple times.

The solutions within this search area would be focused on optimization within the wish-ambulance to minimize experienced fatigue of the patient. This would enable them to fulfill their wish goals, and in addition also provide them a pleasant day.

For example, people within the End of Life phase have a different sensitivity to light, sound and touch. Therefore the fact that the patients, their loved one(s), and the volunteers cannot hear each other well whilst talking in the ambulance, contribute to the experienced fatigue as it requires more effort from the patient to talk.



#### Search area 2: Giving back the feeling of security

This search area (figure 2.19) could be described as focusing more on the emotional aspect on wish day. Instead of dividing the wish day in before-, during- and after the wish day, it could also be divided by the degree of security a patient is experiencing. Prior to wish day, patients and their loved ones are dependent on WensAmbulance Brabant in order to fulfill their wish. In the evaluations by WAB volunteers and during interviews, it is often mentioned that both patient and loved ones are very anxious prior to wish day. This anxiety decreases over the day, in which the patient then can retrieve a sense of control. This feeling of security is then taken away at the phase of first goodbyes.

The solutions within this search area would be focused on decreasing the experienced anxiety, and provide an extended feeling of security. Solution examples could be facilitating a more intimate parting, minimizing anxiety prior to wish day, providing a more home-like interior etc.

### ENABLING PATIENTS TO GO THE EXTRA MILE



### GIVING BACK THE FEELING OF SECURITY



Figure 2.18 Search area 1: Enabling patients to go the extra mile (upper)

Figure 2.19 Search area 2: Giving back the feeling of control (lower)



## FACILITATING A TRAVEL EXPERIENCE



## BREAKING THE RULES TO REACH YOUR GOAL



Figure 2.20 Search area 3:  
Facilitating a travel experience  
(upper)

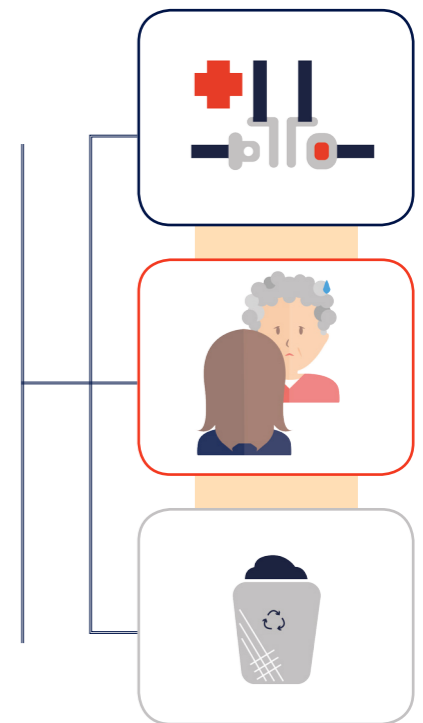
Figure 2.21 Search area 4:  
Breaking the rules to reach your goal  
(lower)

### Search area 3: Facilitating a travel experience

During the front end analysis, it was discovered that the accent of WensAmbulance Brabant is placed on facilitating transport. However from discussions held during the generative session, it could be extracted that there is no clear and consistent identity yet on how to shape this form of transport.

The design of the wish-ambulance is highly based on function, however it was observed that multiple initiatives are taken by WensAmbulance Brabant to optimize this (e.g. interior design by St. Lucas, and self-made arm supports).

This search area (figure 2.20) would be focused on optimizing the unique travel experience WensAmbulance Brabant is providing. Solution examples could be a more joyful interior design, but also the design of a tactile memory of the journey.



### Search area 4: Breaking the rules to reach your goal

This search area (figure 2.21) was created due to one returning aspect throughout the front-end analysis: the safety of patients and WAB volunteers.

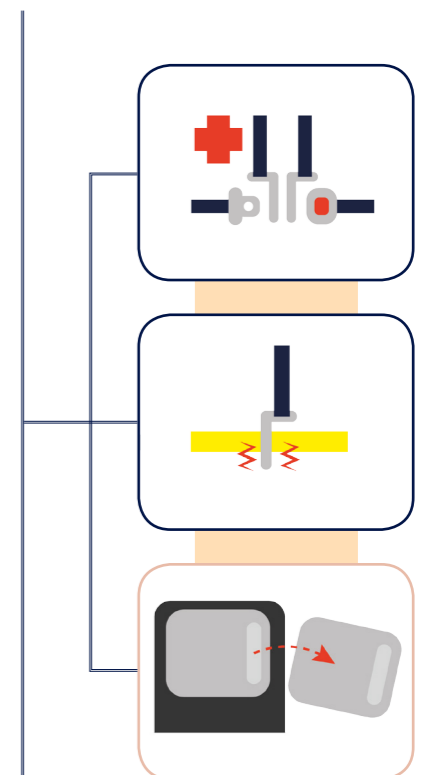
In theory, the patient needs to wear his/her seat belts and the nurse volunteer remains secured and seated during the wish ride. However, due to the design of both the stretcher and the wish-ambulance back-compartment, this turns out differently in practice.

For example, the patient could experience a lot of discomfort when wearing the seat belts due to metastases around the contact area and will request for them to be taken off. Also, when the patient would like to sleep on his side, the use of the seat belt becomes complicated.

In addition, the volunteer in the back compartment has multiple reasons to be on the move during the wish ride (e.g. contact with the front, talking with the patient and loved ones, and re-positioning the patient's pillow) resulting in his/her safety being jeopardized when being unsecured.

Due to the relevance of this aspect to WAB, it was decided to make this a stand-alone search area.

This search area would focus on patient restraint system optimization.



## 2.5 DESIGN OBJECTIVE

The Patient Journey Map and the search areas were presented to the clients and design team, in which during the meeting the search areas were divided in ones focusing on improving physical comfort, and ones focusing on emotion and experience.

Due to the returning aspect of patient- and volunteer safety during the front-end analysis, its relevance to WensAmbulance Brabant, and personal ambitions, it was decided to further explore the field of seatbelt system optimization in combination with physical comfort- and experience improvement.

### 2.5.1 Use scenario

In figure 2.22, the use scenario of the patient safety belt is shown. On wish day, the volunteers prepare the stretcher, place it in hand's reach, and go in to meet with the patient and his/her loved ones. When it is time to leave to the desired wish location, the volunteers go get the stretcher and place it in depressed position enabling the patient to take place on the stretcher (with or without help). The metal parts of the belt hit the frame of the stretcher several times during the process.

When the patient is lying in a comfortable position, the volunteers search and gather the components of the 4-point belt and connect them. In some cases, this took multiple tries as components 1 and 2 kept sliding from component 3.

Then, the lap belt is connected, the patient is provided a blanket and the volunteers place the stretcher in elevated position for transport. During the transport to and within the wish-ambulance, the problems are revealed.

### 2.5.2 Problems occurring in the current scenario

The main problem with the current seat belt system (Rugged-X Restraints | Stryker) is caused by the difference in usage of the stretcher within the ambulance. Due to the motoric limitations of the users and the relatively longer duration of transport, WensAmbulance Brabant put effort in making the journey as pleasant and comfortable as possible by providing an additional mattress and the opportunity for the patients to bring along their own pillow. However, due to these additions the restraints are not able to be positioned correctly, impairing patient safety- and comfort.

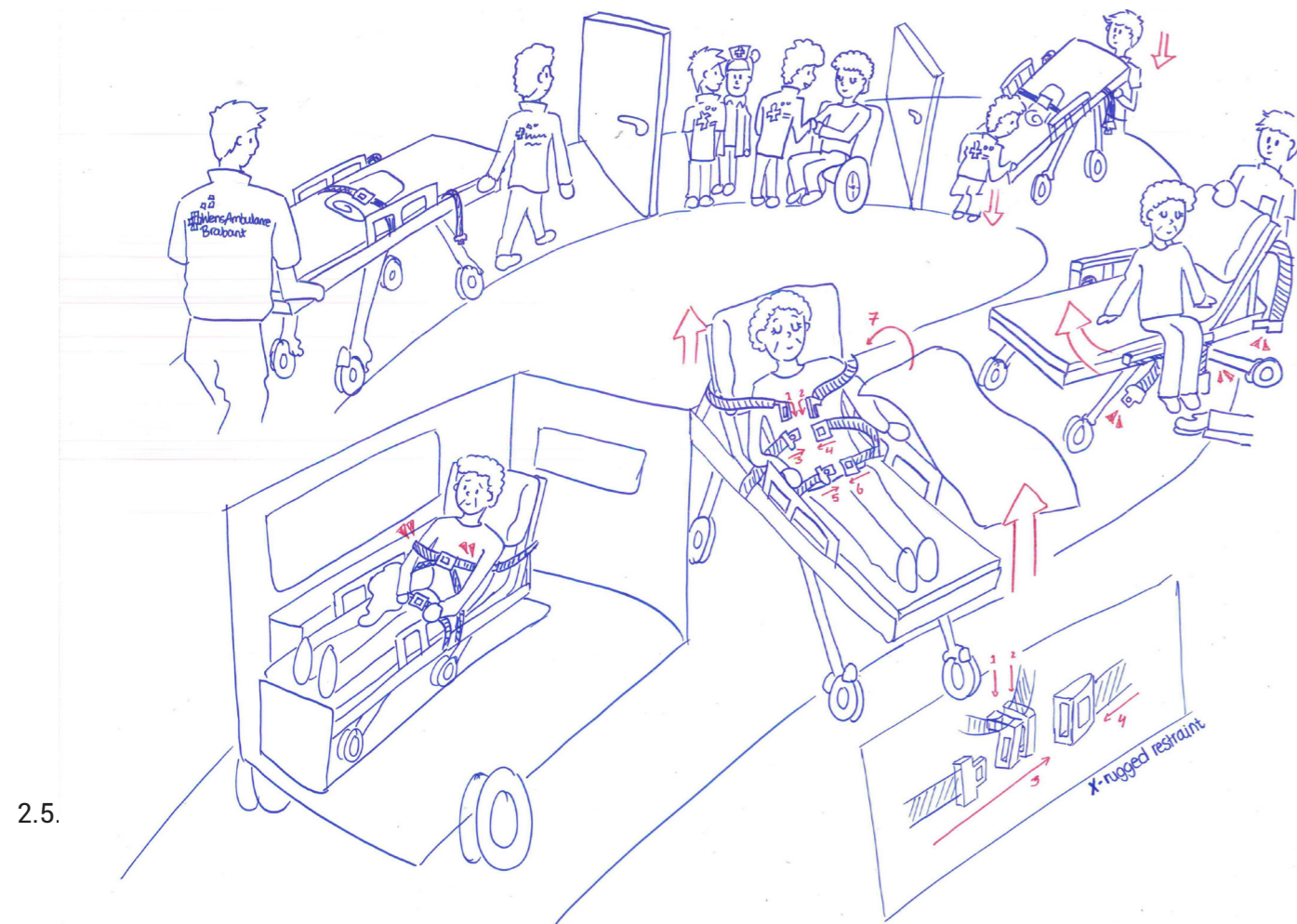
In correct use, the X-restraints are meant to be placed superiorly over the shoulders and form an X-shape over the thorax (figure 2.23). In addition, a lap belt is fastened just below the pelvis.

However, during usage in the wish-ambulance, the X-restraints are translating from shoulders towards the upper arms. As the patients are looking for a comfortable position during the wish ride, they often placed the movement-limiting belts inferior to the arm pits, requested them to be loosened or even entirely removed (figure 2.24).

In addition, in the case of wish rides were multiple family members are accompanying the patient, early good byes are said at the end of the wish activity (see Patient Journey Map, page 37) whilst the patient is already positioned and restrained on the stretcher, preventing the patient to comfortably hug his/her loved ones goodbye.



Figure 2.24 Examples of (no) patient safety belt use during ride



2.5.

Figure 2.22 Using the current patient restraint system

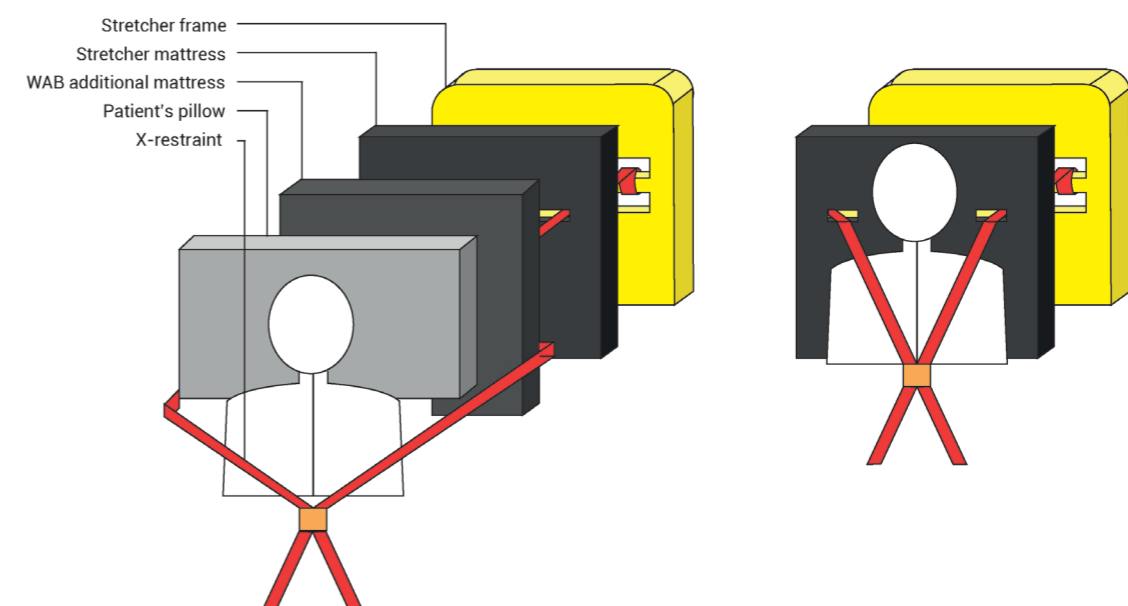


Figure 2.23 Additional mattress and patient's pillow prevent correct positioning of patient safety belt

### 2.5.3 Conclusion

Through analysis it was determined that due to the health deterioration of many patients, one out of five wish rides are cancelled prior to wish day (van Genugten, 2018). On top of that, not all patients are able to have their wish(es) granted even when they managed to attend the wish ride, in which the ride is aborted halfway due to restrictive symptoms such as fatigue.

Being able to provide someone a comfortable and pleasant experience, and make them feel more re-assured during the wish ride so that they can manage to fulfill their wish goals was therefore defined as the aim of the project.

The design goal could therefore be stated as:

*"To design a patient seat belt system that optimizes patient safety- and comfort during a memory-oriented wish ride, whilst simultaneously providing terminally ill patients a feeling of security and re-assurance."*

The core elements of all search areas were integrated in this design goal, in order to tend to patient needs. These needs need to be addressed in order for patients to manage to fulfill their wish goals, and contribute to the facilitation of an unique travel experience which is the core goal of WensAmbulance Brabant (figure 2.25).



## 2.6 CHAPTER CONCLUSION

### WHAT

- Which aspects play an important role during the End of Life phase?
- How is the fit of the ambulance regarding facilitation of the wish journey?
- What are the key activities during a wish event and how do they influence the wish ride experience?

### WHO

- Who are the different stakeholders in the project, and how are they connected to each other?
- What are the needs and wishes of the different stakeholders?

## How to improve the experience of a wish ride for the terminally ill patient, their loved ones and the volunteers of WensAmbulance Brabant within the boundaries of (the design of) the back compartment of the wish ambulance?

### WHERE

- When are the stakeholders confronted with the back compartment of the wish ambulance?
- What activities take place in the back compartment?

### What & Who

During the End of Life phase, there is a variety of patient needs and wishes. To improve the quality of life, or rather quality of dying, not only physical comfort should be provided, but psychosocial- and spiritual need to be tended for as well. In addition, the family caregivers spend time and effort to tend to many practical tasks revolving around the loved one who is soon to pass away.

Removing the burden on all parties involved has been proven a challenge, but being provided an opportunity by WensAmbulance Brabant to go on this unique travel experience adds value to the quality of life of the patient, and relieves the burden of disease for both patient and loved ones.

A wish ride can be divided in three different categories, in which the memory-oriented ride was depicted as most comprehensive for the patients, their loved ones, and the WAB volunteers. Observations made during attended wish rides also hinted that patients being subjected to major restrictive symptoms, most often have small wishes such as visiting an old home.

Whether the patient is able to succeed in the desired wish goal(s), is dependent on multiple factors. However, from thirty evaluations forms which were filled in by WAB volunteers, it could be concluded that physical discomfort caused by restrictive symptoms of the disease is the most prevalent cause for a patient, loved one and/or volunteer to abort the wish ride prior to granting the desired wish goal(s).

Fatigue is one of the most prevalent symptoms in palliative care patients, considerably impairing quality of life, and in this case the major contributor to the extent a wish goal can be granted. Therefore, minimizing pain and depression-, and maximizing quality of sleep contribute to the overall experience of the wish journey.

### Where

Aspects within the wish-ambulance influence the experience of discomfort and fatigue. The moment of contact between the patient and the back-compartment of the wish-ambulance is during the wish-ride on wish day, in which the wish-ride can be divided in two parts: the ride towards wish location, and the ride towards home.

As the patient remains seated on the stretcher throughout the ride, the aspects of the stretcher are the main focus points to be changed to increase physical comfort. The seat belt system has proven to cause the most problems due to incorrect positioning. Due to this, pressure is exerted on sensitive body parts and movement of the patient is limited. These aspects affect the likelihood of the patients reaching their set wish goals. To counter this, the nurse volunteer often has to provide some kind of support, e.g. repositioning or removing the seat belt.

### Project objective

Therefore, the design objective is to design a seat belt system which optimizes patient safety- and comfort during a memory-oriented wish ride, whilst simultaneously providing terminally ill patients with a feeling of security and re-assurance during this unique travel experience.



Figure 2.26 Field research



1



2



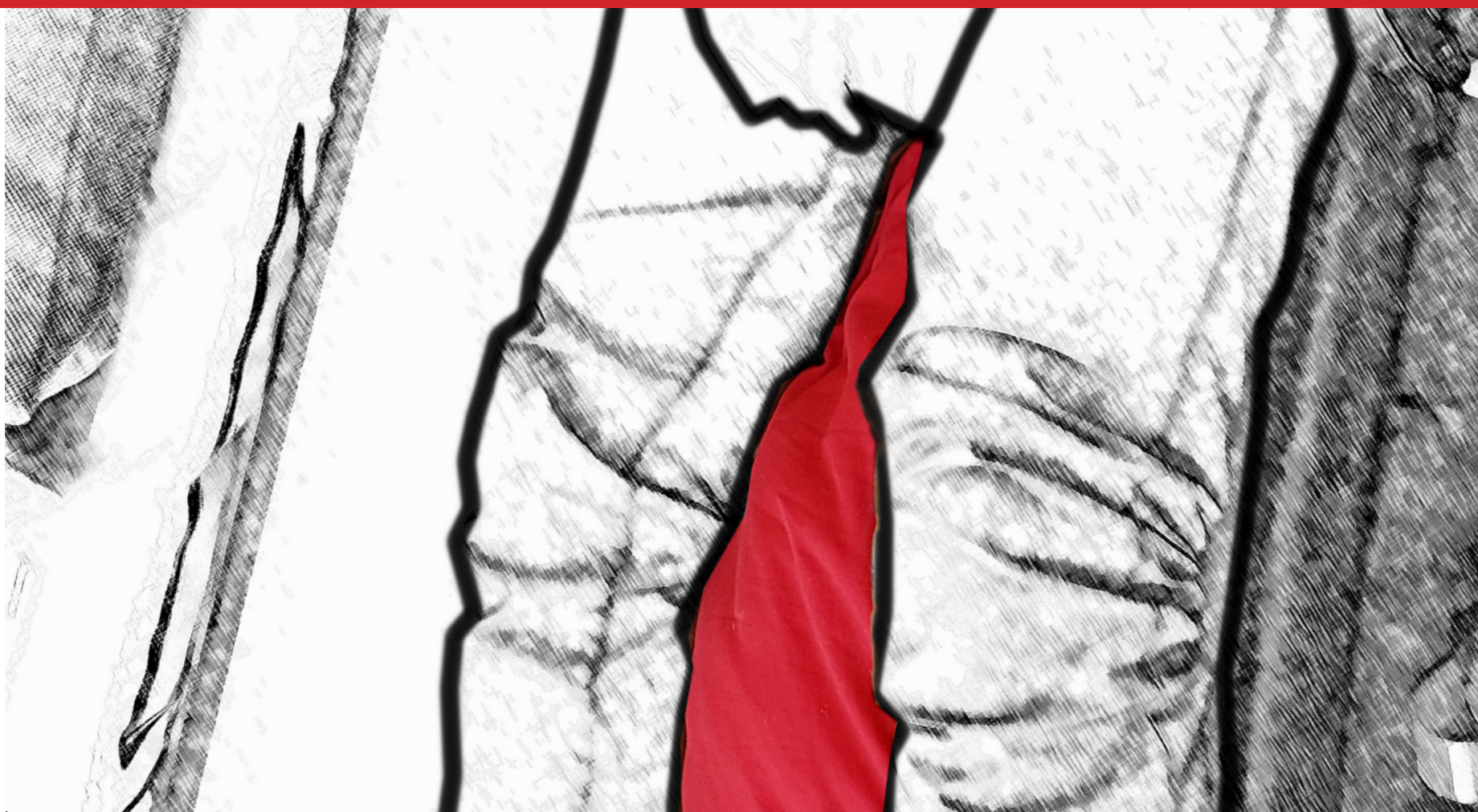
3



This chapter aims to explore the selected design direction.

A metaphor with accompanying qualities was defined, in which ideas were then generated by the means of joint- and individual brainstorming. The subjective terms of comfort and re-assurance were researched, and a program of requirements could be established. In the end, two concepts could be created for further elaboration.

## CHAPTER 3. **IDEATION**



4



5



6



### 3.1 DESIGN METAPHOR

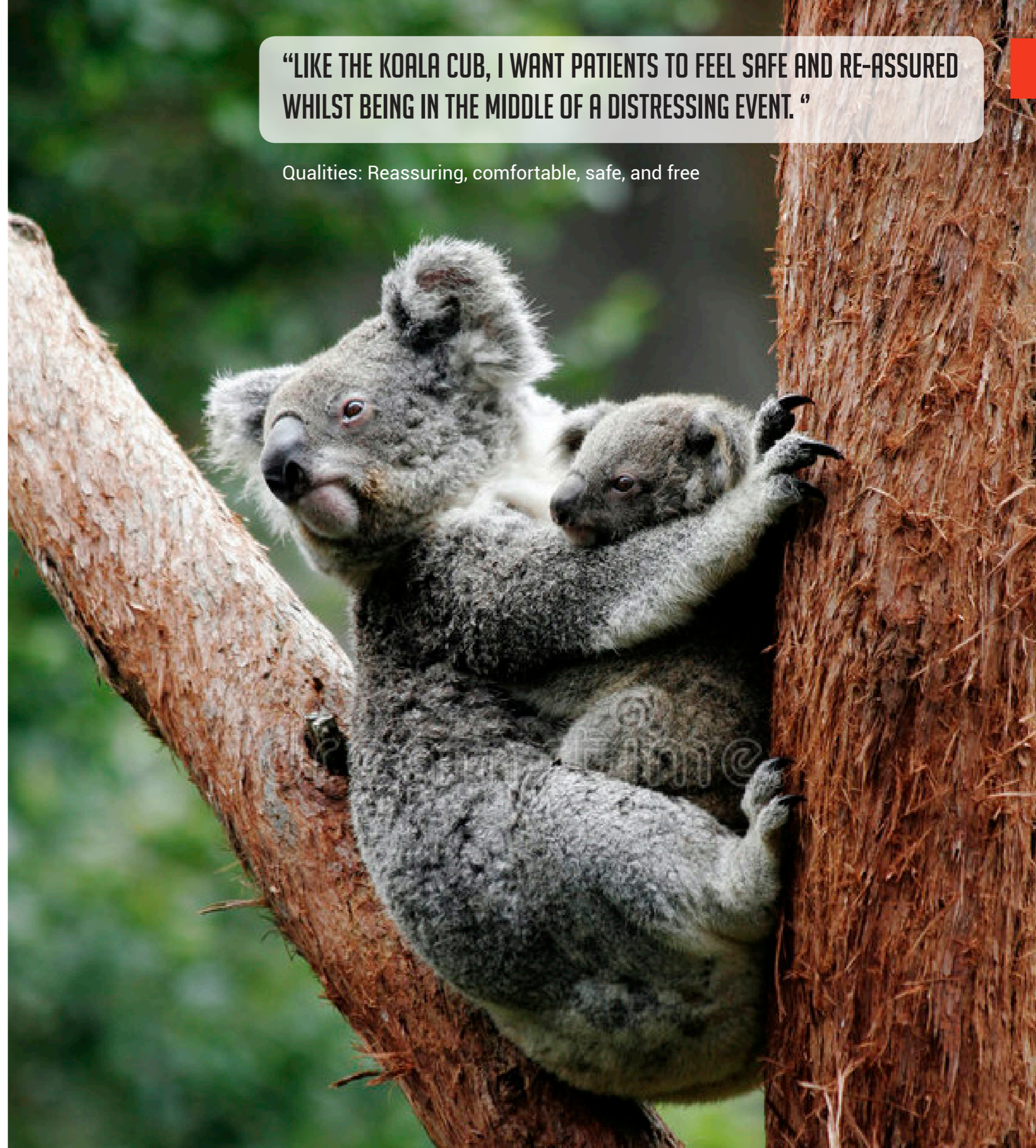
*A metaphor exists of a distinct and concrete entity that already has the quality you intend to convey, and represent the meaning a product evokes (van Boeijen et al, 2013).*

To kick start the ideation, an inspiring metaphor was created and fitting qualities regarding the new patient restraint design were defined.

The design should provide the patients with a sense of safety and re-assurance during the distressing event which is the wish journey. The koala cub is vulnerable in the state it is in now, but is less aware of that as it is protected by the mother who is looking out for her precious cub. The mother uses her claws to secure both her cub and herself whilst she is traveling to the tree tops. The cub can enjoy the nice view and feels safe and re-assured within the grasp of its mother.

**“LIKE THE KOALA CUB, I WANT PATIENTS TO FEEL SAFE AND RE-ASSURED WHILST BEING IN THE MIDDLE OF A DISTRESSING EVENT.”**

Qualities: Reassuring, comfortable, safe, and free



## 3.2 EXTRACTING PROMISING DESIGN FEATURES FROM A JOINT BRAINSTORM

### 3.2.1 Introduction

The goal of the ideation phase is to gain a wide range of inspiring ideas. Therefore, five other IDE students were asked to join a brainstorm session in which several "how to's" were tackled.

How to's are problem statements translated into questions that support idea generation. They are open questions that intent to stimulate creativity almost immediately (van Boeijen et al, 2013)

The students were provided a booklet in which the questions were posed, and asked to build upon each other's ideas (Appendix E).

### 3.2.2 Joint brainstorm

The joint brainstorm provided a wide range of sub-solutions and perspectives on subjects such as a comfort, reassurance, and as how to make being restricted a more positive experience. The sub-solutions which were generated as answer to the how to questions were then used to individually generate ideas.

These ideas could be grouped into five clusters in which ideas with promising features within these clusters were star-marked (figure 3.2).

The clusters which were defined were:

1. A new way to restrain someone whilst feeling more *like a hug*
2. A new way to restrain someone by *enclosing the human body*
3. A new way to restrain someone whilst *providing more freedom of movement*
4. Improving the situation which is there by *adding an element* which would make the existing situation more comfortable and re-assuring
5. *Outliers* - random ideas not fitting the other defined clusters

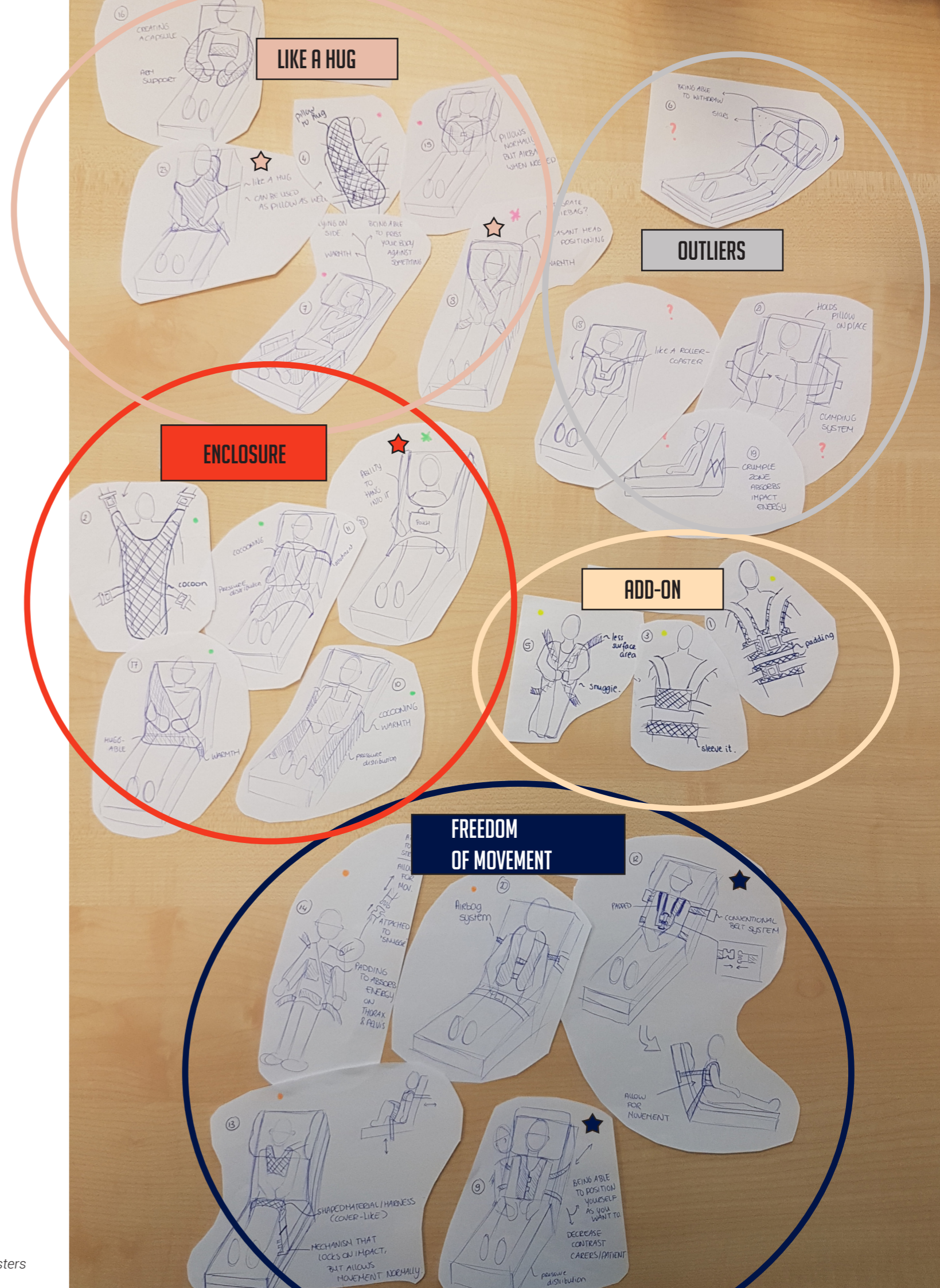


Figure 3.2 The ideas grouped into five clusters

### 3.2.3 Ideation

Combining ideas with promising features resulted in the creation of three promising ideas;

The focus of the first idea, the "Style" (figure 3.3), was on providing the patient **more freedom of movement** during the wish ride by providing a retractable belt system. This belt system would then be attached to a gilet-like jacket and secure the patient on the stretcher when needed. The jacket would be provided prior to the patient being installed on the stretcher and **takes away the hassle of the volunteer bending over the patient to find and install the patient restraints**. In addition, this system would **decrease the contrast between volunteer and patient** by providing a similar kind of jacket.

The second idea, the "Pillow Hug" (figure 3.4), focused on providing a restraint system which **feels more like a hug** and which in addition **provides the patient with adequate head support** during the wish ride. The pillow part would be fixed in position to enable the patient **more head movement** whilst being seated on the stretcher, whilst also providing more freedom in head positioning when sleeping.

The third idea, the "Snuggle" (figure 3.5), also focused on providing a restraint system which feels more like a hug but still enables the **use of the patient's own pillow**. Similar to the second idea, this idea provides **head support on the sides** to enable more freedom in head positioning in case the patient has a **desire to sleep** during the wish ride. Furthermore, this idea provides the patient a pleasant **pressure on the thorax-and belly area**.

In the cases of the "Style" and the "Pillow Hug", there is a **decreased need for the volunteer to stand up during the wish ride** to re-position the restraint system as this would now remain staying correctly positioned throughout the wish ride. In case of the "Snuggle", it depends on the positioning of the attachment systems on the frame of the stretcher.

### 3.2.4 Conclusion

Using the sub-solutions and perspective of other IDE students, enabled the creation of three promising ideas. It also clarified a set of criteria to reach the design goal.

Compliant to the gained insights during the front-end analysis and results of the joint brainstorm, the design should allow freedom of movement of the patient whilst remaining restrained on the stretcher. In addition, elements of the design (e.g. patient's pillow) should ideally remain correctly positioned whilst movements by the passenger occurs, to allow the WAB volunteers to remain seated.

In general, the product should be easy to "attach and detach" for the patient improving the "prepare for journey" and "first goodbyes" phases from the Patient Journey Map, and allow the patient to sleep when desired during the phase "ride to wish location" and "ride to home" to minimize fatigue during the wish journey. In addition, the product needs attachment points to the stretcher to provide safety during travel.

Another feature which could be extracted from the front-end analysis was adequate support of the arms as this was currently not provided for during the wish rides. Therefore, the product should enable arm relaxation of the patient.

To make the restraining experience more positive, the product could feel more like a hug. This would fit the feeling of being cared for fitting Lenie's persona.

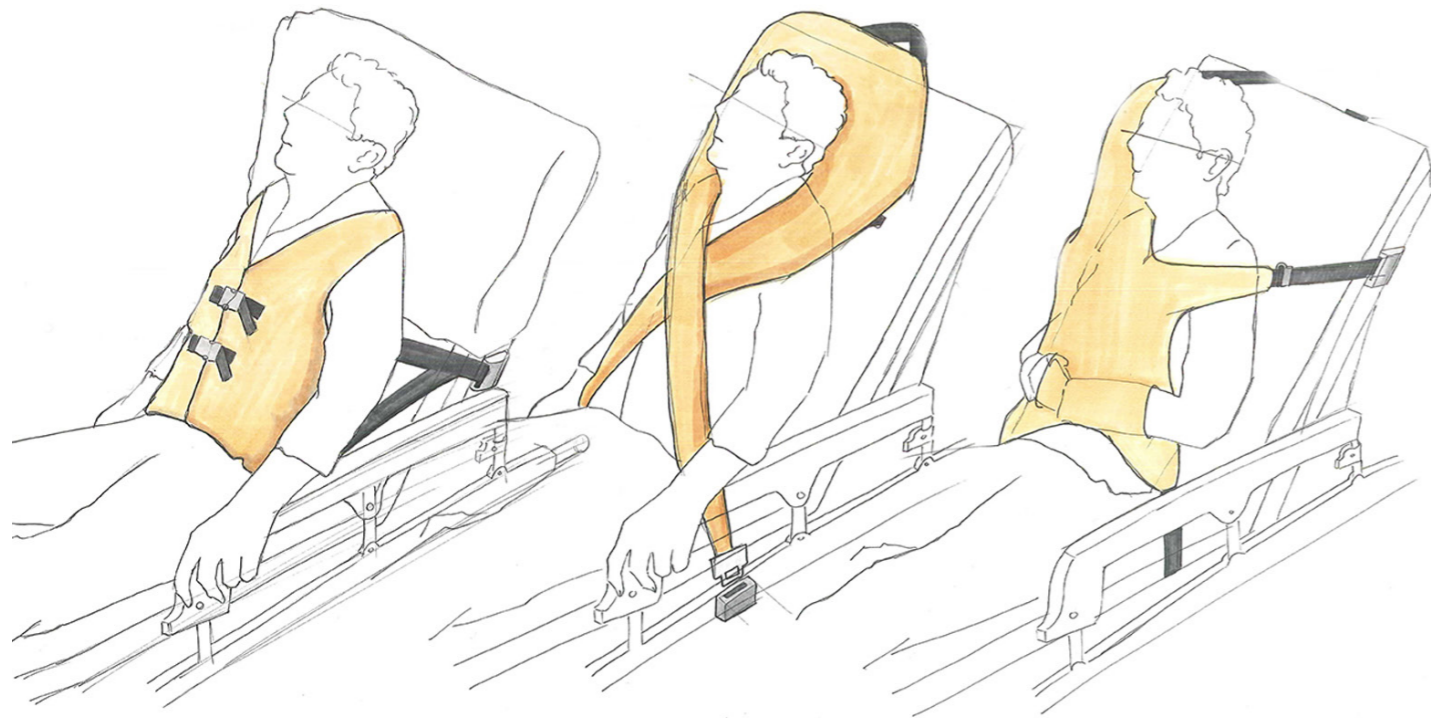
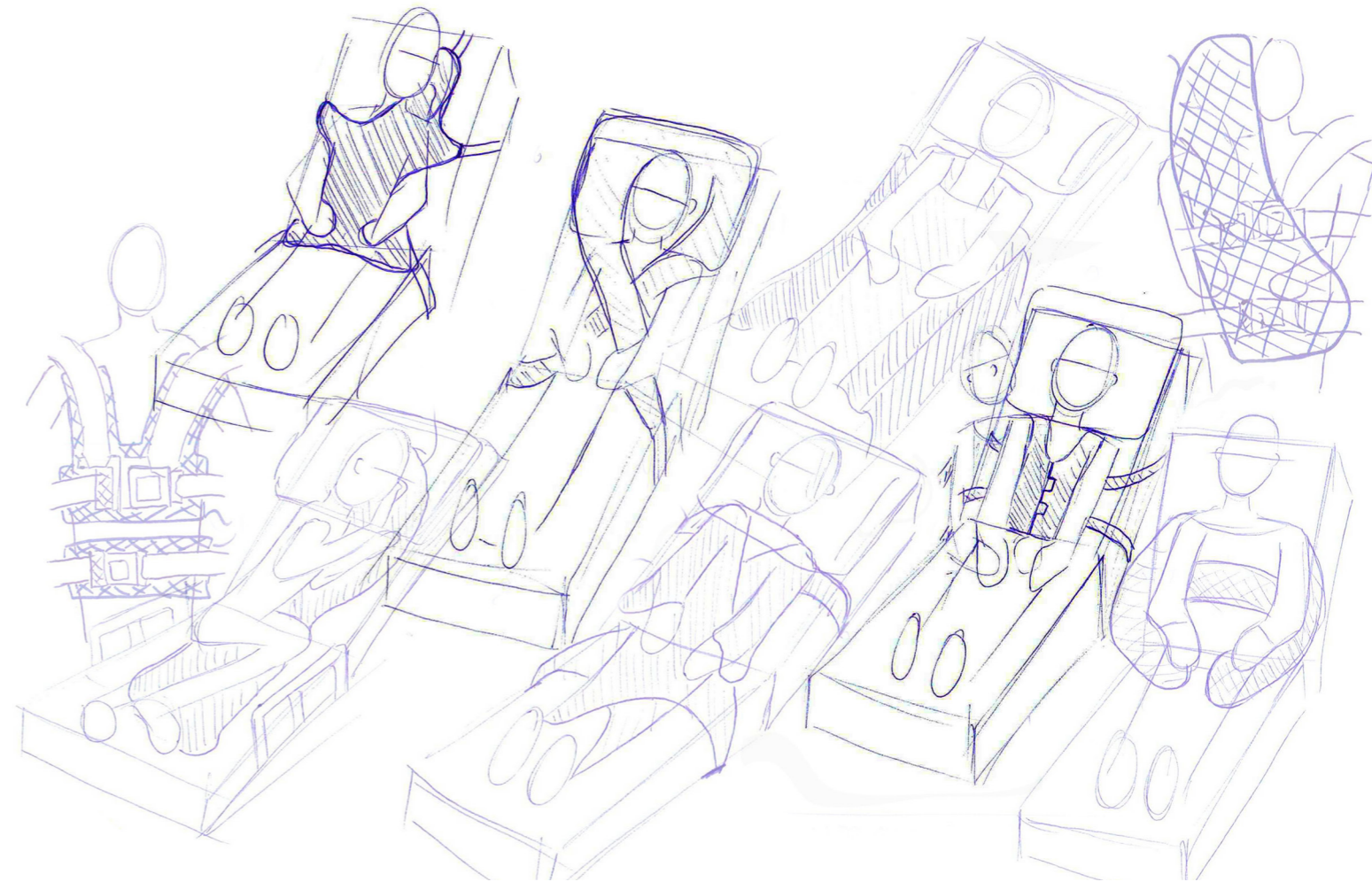


Figure 3.3 Style

Figure 3.4 Pillow Hug

Figure 3.5 Snuggle





### 3.3 EXPLORING PASSENGER COMFORT AND RE-ASSURANCE

#### 3.3.1 Introduction

Comfort as well as re-assurance are terms that are widely used and specifically understood, however, both lack generally acceptable definitions that make them easy to account for in a design process (Vink, 2004).

To establish a better understanding of both, two key activities took place during ideation.

First, the different elements of the comfort model were studied and applied within the context of the wish ambulance. This resulted in general requirements for the design.

Second, a bodystorming session was conducted to extract building blocks for comfort and re-assurance in the context of the wish ambulance. Design students could give their input by experiencing being seated on an ambulance stretcher, and tactilely explore configurations which intent to increase the comfort and feeling of re-assurance. More specific design requirements were extracted from this session.

#### 3.3.2 Comfort model

Comfort defines a pleasant state of physiological, psychological, and physical harmony between a human and his/her environment (Slater, 1985), whilst discomfort is an adequate predictor of musculoskeletal problems and therefore a target for design effort.

Both are however subjective phenomena, as every individual applies his or her own meaning to these terms. There is no model available that describes the cause of comfort, nor is there a comfort design process.

#### Elements of the comfort model

The comfort model provides an overview of elements which are related to each other and which contribute to the total experience. The elements defined in the comfort model are history, state, visual input, smell, temperature and humidity, pressure, touch and texture, and posture and movement, and can be seen in figure 3.6.

These aspects need to be addressed when one would like to positively adapt the comfort experience of a product. Concerning the patient restraint system of the wish ambulance, things to be taken into account could be:

**History:** users evaluate the design by basing it on their past experiences with previous seat belt systems. The design needs to be at least as comfortable as the current solution.

**State:** Extracted from results from a questionnaire filled in by patients and their loved ones who experienced a wish ride, feelings prior to the wish ride include happiness, anxiety, surprise, tiredness, thankfulness, determination and being overwhelmed. In addition, during one of the attended memory-oriented wish rides, a wish requester explained about how the will to live longer returned when having arrived at the desired wish location which was her old home, whilst she was feeling like being on a stand still ever since she needed to move out. Therefore, the design ideally should support this sense of encouragement during the wish ride.

*"Het is raar hè... Als ik daar [in het hospice] ben zou ik eigenlijk wel dood willen gaan, maar nu ik hier zo zit wil ik toch verder leven."*

**Visual input:** Visual information is the first impression of comfort. Therefore, the design should also be visually pleasing, in which this can be embodied by e.g. patterns (hiding dirt), cleanability and fit with the context of the wish ambulance.

**Smell:** An input influencing our experiences, in which we are mostly not aware of its effect. In the setting of the project, a pleasant and familiar smell could contribute in lowering the anxiety the patients and their loved ones are experiencing.

**Noise:** Noise within the back compartment requires e.g. the patients to put more energy in having a conversation with their loved ones or the volunteer.

Therefore, noise has a negative effect on the fatigue the patient is experiencing. In contrast, music has proven to have the ability to positively influence mood whilst driving (van der Zwaag et al, 2011).

In the scope of the patient safety belt, a recognizable use cue of when the safety belt is fastened and removed could increase the usability of the design. In addition, unnecessary noise would ideally be removed, e.g. clanking of the safety belt fasteners against the stretcher when positioning the patient on the stretcher.

**Temperature and humidity:** Thermal comfort is affected by aspects influencing the skin temperature and respiratory system of the human body such as dry air and cold feet. Relating this aspect back to the project, a design needs to be created which take temperature changes throughout the day, and throughout seasons into account.

**Pressure, touch and texture:** In the case of the patient safety belt, these aspects influence the choice of the patient to either remain restrained, reposition the restraints, or have the restraints be removed. When the safety belts would remain in correct position, an equal amount of pressure is provided throughout the wish ride, in a fixed position. However the shifting of the belt results in an increased amount of pressure in the upper arm area.

In addition, the relatively stiff material and sharp edges of the safety belts could also influence the experienced discomfort in this situation. The design therefore should provide an equal amount of pressure on fixed body parts throughout the wish rides.

Texture can be judged on three dimensions; rough/smooth, soft/hard, and elasticity, in which the first two are most relevant (Sonneveld et al, 2008). Due to the constant force of the safety belt during the wish ride, the product should ideally have a smooth and soft texture to minimize the perception of roughness on the body. In addition, shape-adaptable material could also contribute to improved comfort.

**Posture and movement:** The posture and movement of the patient could influence the amount of experienced (dis) comfort. During wish rides, the patients are searching for the most comfortable posture which is variable. This posture could be influenced by what we are used to, but also by disease-related discomfort (e.g. high sensitivity due to metastases). In addition, physical comfort is related to e.g. needed muscle activity of the user. Restricted movement possibilities could however result in discomfort. Therefore, the design should ideally provide for a variable posture, and allow small movements.



### 3.3.3 Exploring re-assurance and comfort through body storming

*Bodystorming is a tool which helps to create stories or themes out of observations and translate this knowledge into rapid communication and idea generation with an envisioned scenario in mind (Balkissoon, 2018).*

#### Set-up of the session

The design students (also, participants) were given an introductory brief about the context of the project. Then they were asked to take on the patient-role for the try out session, and take place on the ambulance stretcher. They were shown different shaped and sized materials, and asked to build a configuration with the available material in which they could imagine to be able to sit comfortably for a wish journey. A small explanation about their configuration was requested. The complete set-up can be found in Appendix F.

Pictures of their configurations were made in order to find answers to the questions:

- What would be adjusted or added to the seat to improve the travel experience?
- How to embody re-assurance and comfort in the context of the wish-ambulance?
  - In which places is pressure experienced as something positive?
  - What positions are preferred?
  - Which materials are chosen and why?

#### Results

The session's aim was to find out how comfort and re-assurance could be embodied within the scope of the patient cot. In addition, doing this session was an effective way to enable thinking out of the box.

Analyzing the configuration which were made by the participants (figure 3.8), resulted in the insight that having the ability to rest the head and arms increases people's experience regarding feeling comfortable and re-assured. In addition, during the session of 7 min per person, people were already often shifting positions to position their legs and head. Multiple participants mentioned that support around the knees or ankles would enable them to sit more comfortably. Also, the head pillow, which was used in all configurations, kept shifting as the participants turned their head to be able to talk to the session facilitator, resulting in them re-positioning their head pillows multiple times.

The occurrence of the head pillow shifting through events was also recognized in the attended wish journeys, in which the caregiver volunteer repositioned the pillow when asked by the patient. Therefore, fixation of the head pillow of the patient would contribute to safety of the volunteer.

Lastly, five out of eight participants chose to hold something on their thorax and/or belly. No specific reasons were given.

*"I don't know why, but I just want to hold something."*  
- Participant 5

The session provided the insight that elements of the design needs to stay put whilst the passenger is moving during the journey. In addition, support around the head and being able to relax your arms contribute to the feeling of comfort and re-assurance. Support beneath the knees and other areas such as the lower back and ankles, as well as thorax- and belly pressure were also observed as contributing to the feeling of re-assurance, but were less prevalent than the latter.

SUPPORT TYPE	PREVALANCE (% OUT OF 100)
Head support (back)	100
Head support (side)	25
Lower arm support	63
Lower back support	38
Knee support	50
Ankle support	38
Pressure on thorax	38
Pressure on belly	38

Figure 3.7 Table of support used during test

### IMPLICATIONS FOR THE PROJECT

- Building blocks of providing comfort and re-assurance in the context of the wish ambulance were defined as these were subjective terms.
- To increase comfort, one should positively adapt the comfort experience which consists of the pillars history, state, visual input, smell, noise, temperature and humidity, pressure, touch and texture, and posture and movement.
- Providing the patient adequate head- and arm support significantly contributes to the amount of experienced comfort and re-assurance, whilst knee-, ankle- and lower back support, and a slight pressure on the thorax and belly area could also be regarded contributors to the feeling of re-assurance.
- Criteria regarding these aspects were included in the program of requirements

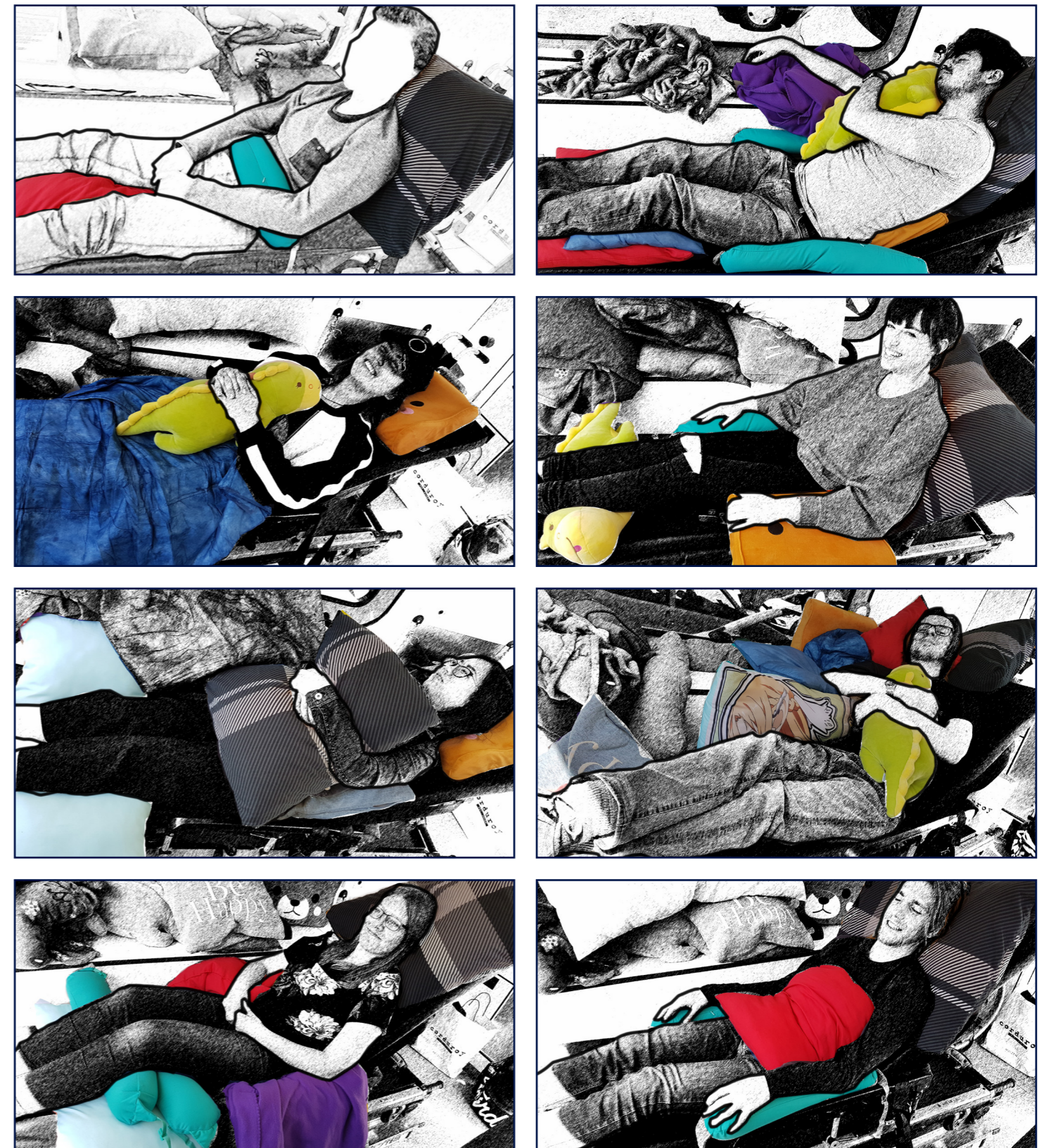


Figure 3.8 Participants' configurations

The design is subjected to fulfill certain criteria which could be defined throughout the front-end analysis and exploratory sessions during ideation.

In this paragraph, norms which are currently applicable on patient restraint systems are presented. In addition, a list of requirements was established, on which future concepts will be tested.

### 3.4.1 Relevant norms concerning patient restraint systems

- NEN-EN 1865-1:2010 "Patient handling equipment used in road ambulances" states that:
  - Patient restraint systems are obliged to have a quick release system
  - A stretcher is required to have a minimum of two quick-release patient restraints
- According to Stryker website, their stretchers comply with the norm SAE J3027:
  - Occupant excursion should not exceed 14 inch during a dynamic crash test at 30 mph (Green, 2013)
  - The solution to come therefore should be able to withstand a pulling force of 5,2 [kN], when human mass = 200 [kg], and acceleration during crash environment = 26 [g] as described in the testing criteria by SAE International (Green, 2013)
- Road Safety Rules 2009 (Vic) rr 265 and 266 states that
  - Both driver and patient are liable when no patient restraint is used. Both would commit an offence if the patient does not wear a seatbelt (Eburn, 2014) given that;
    - The patient is 16 or older
    - "The patient was not receiving medical treatment of an urgent and necessary nature while in or on a vehicle."
- The Accident Compensation Act 1985 (Vic) states that:
  - Any claim for compensation could be reduced to negligence if the patient was not wearing a seat belt without justifiable reason.
- Exemption to the use of a seatbelt can be provided when it can be proofed that wearing restraints is impossible due to medical reasons. This type of exemption needs to be required at the government and is rarely provided due to critical assessment (Rijksoverheid, 2018).

### 3.4.2 Program of requirements

#### ● Product performance

- The product needs to restrain a person onto an ambulance stretcher during acceleration and deceleration of 10 g (Tass International, 2018 – NEN-1789)
  - The product should be able to withstand a pulling force of 2 [kN]
- The product should allow for patient movement during the wish ride
- The product should be easy to attach and detach by the volunteers
- The product should decrease the amount of needed interventions by volunteers during the wish ride
- The product should stay correctly positioned during different events of the wish ride (including head movement and rotation, arm movement, and leg movement)

#### ● Ergonomics

- The product should fit P5 to P95 of Dutch elderly aged 60 to 69 years old
- The product should be unisex

#### ● Hygiene

- The product should be able to withstand the patient's secretions (including urine, feces, sweat, puke, blood, snot and saliva)
- The product should be easy to clean by medical disinfectant spray and cleaning wipes or washable at 60 C

#### ● Comfort & re-assurance

- The product should be intuitive to use and resemble something the patient recognizes (history)
- The product should appear visually clean (visual input)
- The product should not make any hard noises during restraint fastening and removing, other than confirmation that the product is correctly used (noise)
- The product should be implementable through different temperature situations (0-30 degrees) (temperature)
- The product should homogenously divide the pressure over the patient's body (pressure, touch, texture)
- Parts of the product which are in immediate contact with the patient's body should consist of soft material and smooth texture (pressure, touch, texture)
- The product should allow the patient's own pillow to be used (smell & re-assurance)
- The product should enable relaxation of the arms during the wish ride (re-assurance)

#### ● Wishes

- The product should allow the patient to lie on his or her side during the wish ride (product performance)
- The product should decrease the contrast between patient and volunteers (patient attitudes)
- The product should enable the patient to sleep during the wish ride (product performance)
- The product should be able to adapt to personal patient needs (comfort & re-assurance)

## 3.5 THE CONCEPTS

### 3.5.1 Introduction

The desired final result of the ideation phase was to have promising design concepts which effectively integrate passenger safety and re-assurance into one design.

Relevant design criteria were defined based on the front-end analysis and the exploratory sessions and promising features were extracted from the initial idea sketches. These were then all translated into functions in order to set up a morphological chart (figure 3.9 and Appendix E).

Combinations of different solutions/components were made to inspire the creation of concepts, in which two promising concepts could be generated in the end (figure 3.10).

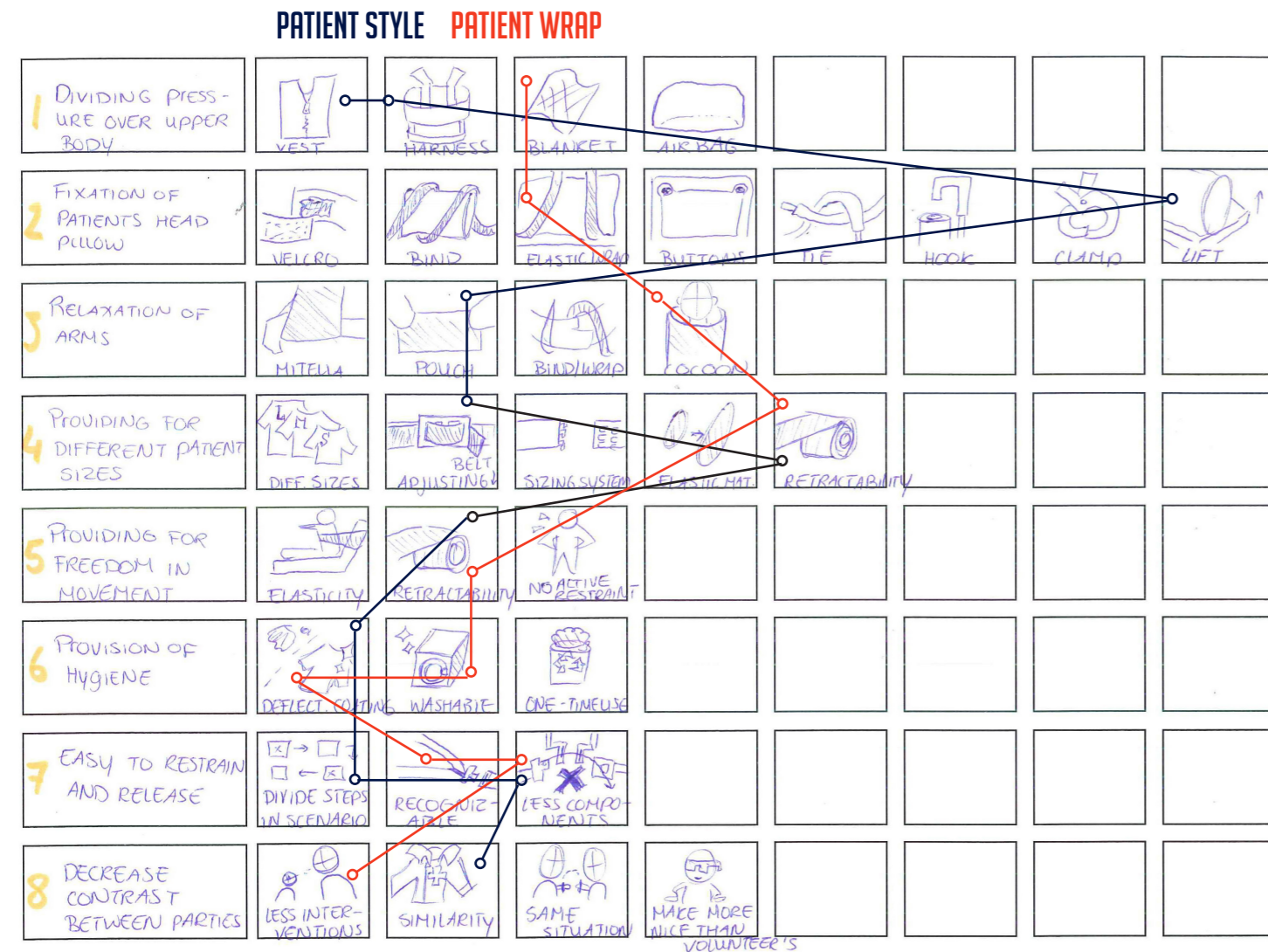


Figure 3.9 Morphological chart

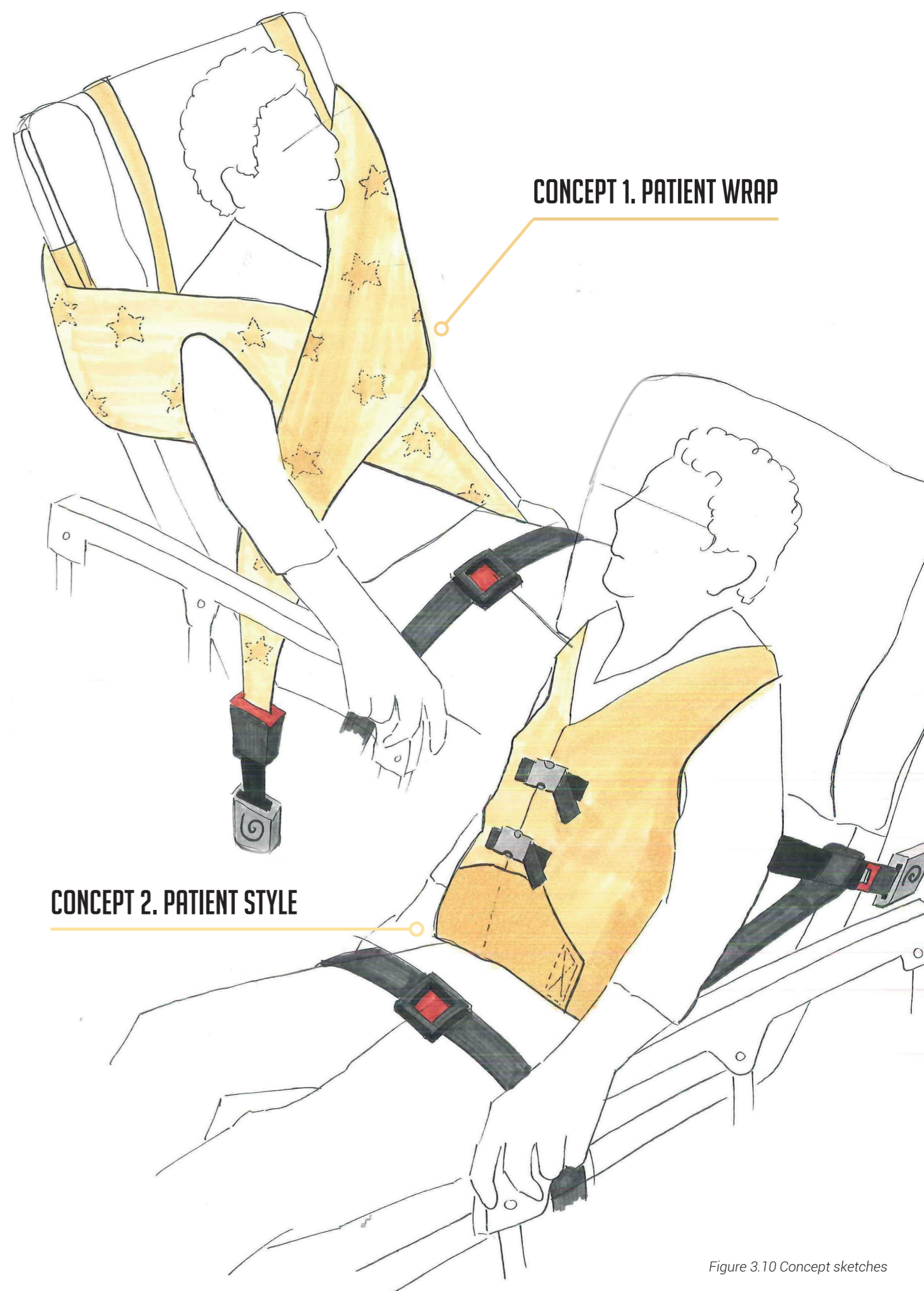


Figure 3.10 Concept sketches

### 3.5.2 Concept 1. Patient Wrap

The Patient Wrap consists of two blanket-like structures which can be attached to the cot, and a pillow holder made of similar material. The blanket-like structures and the pillow holder can be shoved over the additional mattress of the wish-ambulance. The back of the blanket-like structures can be opened to insert the belts with a key (x2).

These belts are attached to the stretcher in a similar way as the original patient restrained system (tied at the stretcher's frame), and the key can leave the end side of the blanket-like structures. These keys can then be fastened to the belt clickers which are attached the retractor systems at the left- and right side of the stretcher. These retractor systems allow for variation in patient sizes and for a bit of movement during the wish ride. The retractor system secures the belt clickers when not in use, preventing unnecessary sounds.

The pillow holder ensures the patient's pillow to stay fixed during the wish ride, and therefore also decreases the amount of times the WAB volunteer has to stand up to correctly position the patient's pillow. Using elastic material, the pillow holder allows for different sizes of patient pillows.

The blanket-like structures are made of soft material to provide the patient a comfortable feel. When wrapped around the body during the wish-ride, it allows to patient to feel more re-assured, potentially allowing the patient to sleep when desired. When the patient would like to sleep, the arms can be placed inside the blanket-like structures to prevent them falling of the stretcher.

The working principle of this concept is similar to the original patient restraint, as it acts as a 4-point belt.

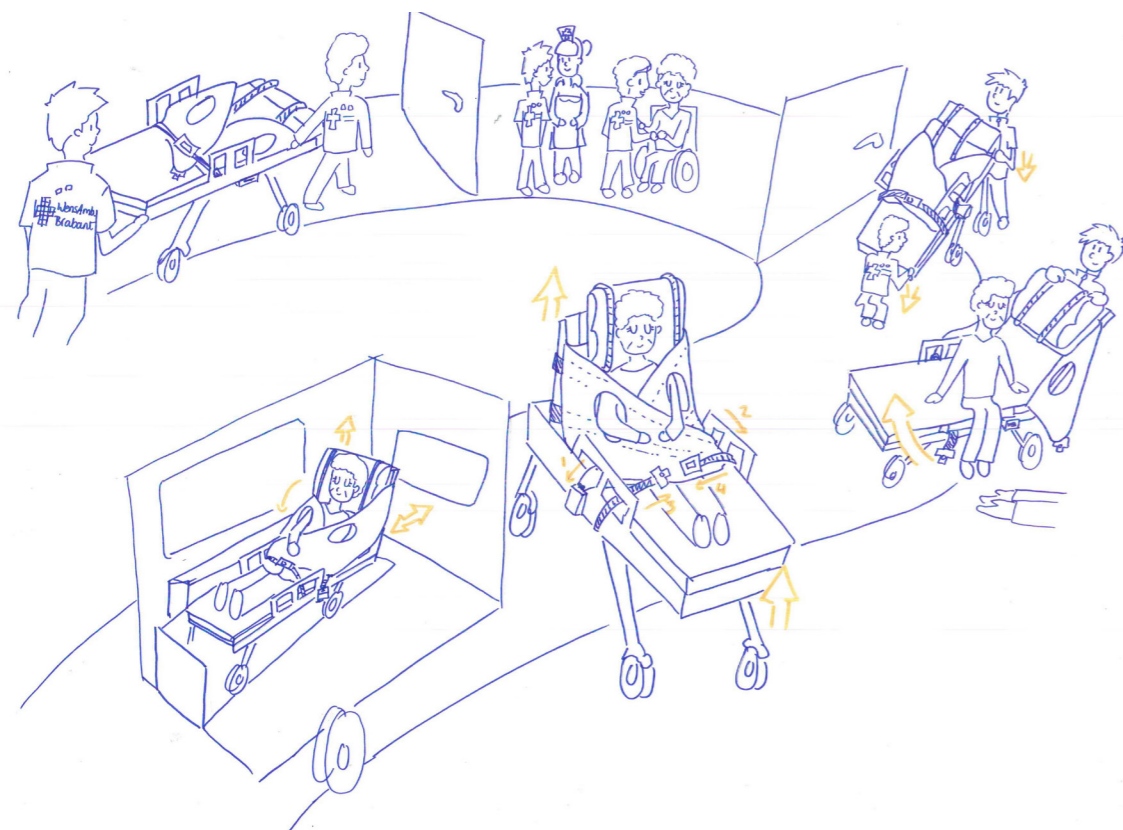


Figure 3.11 Scenario - Patient Wrap

### 3.5.3 Concept 2. Patient Style

The Patient Style consists of a patient vest and a cot attachment system, in which the vest can be put on the patient prior to him/her sitting on the stretcher. On each side of the vest, there is a belt with a key, which can be used to attach the patient to the belt clickers at the left- and right side of the stretcher. These belt clickers are attached to a retractor system which allows the patient to move during the wish ride. In addition, the retractor system secures the belt clickers when not in use, preventing clanking sounds when the belts are not attached to the patient vest.

At the back of the vest there is a belt with a key as well to facilitate a 3-point belt mechanism. This belt also makes sure the pillow is kept lifted during the wish ride.

The vest can be closed using two click mechanism, which give a clear sound cue when the vest is closed. In addition, the patient is provided a soft pouch in which the hands can be secured if desired (e.g. when the patient wants to sleep). This pouch is fixed to the vest on the right side, in which the left side can be secured by Velcro after the vest is put onto the patient.

This concept form is quite close to the original patient restraint system, however makes sure the forces are equally distributed over the patient's body and removes the feeling that the belts constantly move off the shoulder. It also aimed to decrease the contrast between the WAB volunteers and the patient by providing a distinguishable piece of clothing.

The vest can be easily attached and detached to the stretcher, removing the hassle of collecting different belts when securing the patient onto the stretcher, and allowing easy transferring on and off the stretcher. In addition, the patient can say goodbye to his or her loved ones on wish day inside the wish-ambulance without being restrained by the belts.

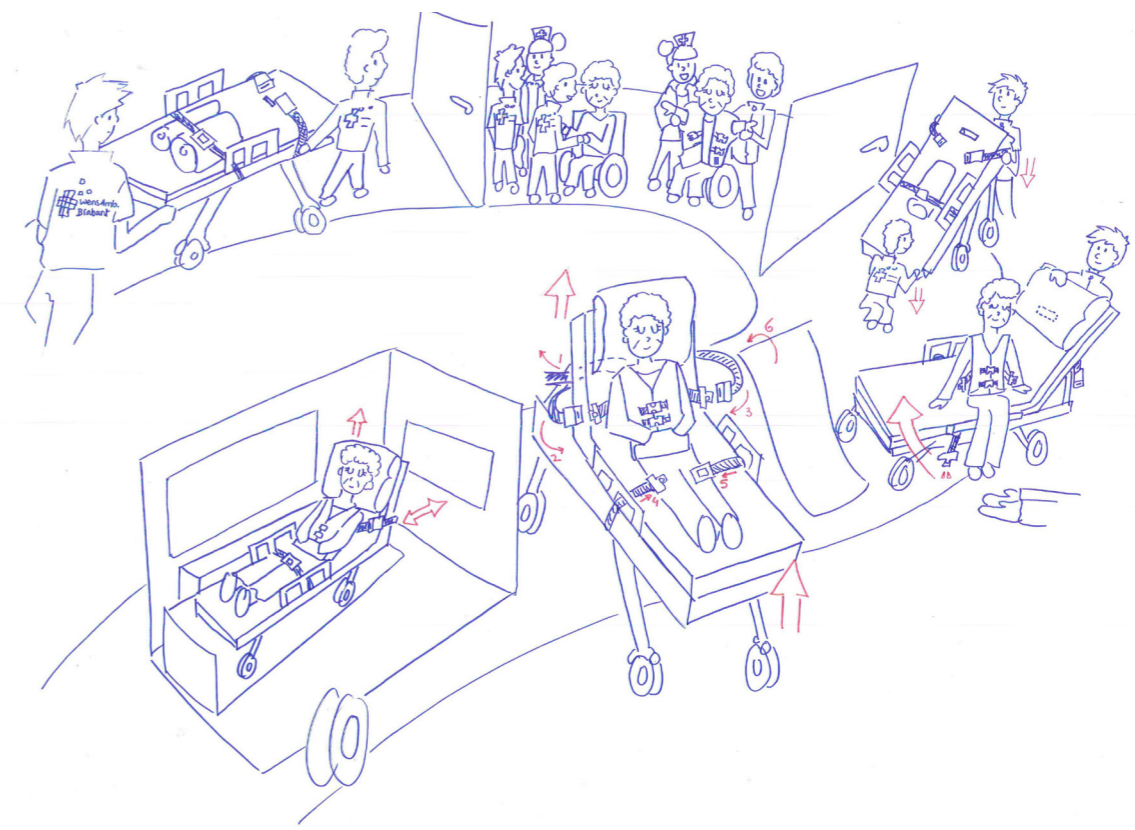


Figure 3.12 Scenario - Patient Style



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## CHAPTER 4. CONCEPT REFINEMENT

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In order to select a concept to proceed with, an user test was conducted on the faculty of Industrial Design Engineering and feedback was acquired from an expert on the domain of ambulance crash safety at Tass International.

New insights and recommendations were acquired through these activities and enabled an iterative step.



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## 4.1 EVALUATING THE CONCEPTS

### 4.1.1 Introduction

The goal of the user test was to evaluate the two concepts on desired design features and their effect on the user experience. In addition, recommendations for both concepts were acquired from the participants to be used for iteration.

Based on the evaluation results, a pre-selection could be made regarding which concept fulfilled the requirements the best and thus was deemed most promising.

### 4.1.2 Prototyping the concepts: what was included and what was not?

Using a variety of existing materials, mock-up prototypes could be created of the two concepts. Not all elements presented in the concept sketches were included in the prototypes due to various reasons.

This paragraph shows the included and excluded aspects of the prototypes for user testing.

#### Patient Wrap

This concept was made using a thin blanket, star-patterned fabric, fleece blankets, four seatbelts with sown loops to attach the blanket-like structures to the stretcher's frame, two seatbelts included keys, two belt clickers which were sown onto the retractor systems, a sown pillow holder, and elastic material to position the patient's pillow (figure 4.1).

The aspects which were not included in the prototype were the arm holes as there was a desire to compare the level of experienced freedom of this concept without freedom of the arms and that of the original patient restraint.

In addition, the prototype was not made to be adaptable to different patient sizes.

#### Patient Style

This concept was made using a ready-made gilet, two seatbelts including keys, two conventional retractor systems which were attached to the stretcher's frame, two belt clickers which were sown onto the retractor systems, two click systems for vest closure, a self-made hand pouch, and some Velcro (figure 4.2).

The aspect which was not included in the prototype was the third belt with key and belt clicker which was supposed to be attached to the vest between the patient's shoulder blades. This was due to the inability to apply a hole in the additional mattress of WAB.

Similar to the other prototype, this prototype was not adaptable to different patient sizes.

### 4.1.3 User test set-up

In order to evaluate the two concepts against the original patient restraint system, an user test was conducted at the faculty of Industrial Design Engineering. A total of eight students participated in this test.

Students were chosen as participants as it was deemed unethical to involve the real target group, who are terminally ill patients, in this stage of the design. Furthermore, the aspects which were to be tested were regarded universal, in which the result of the test was envisioned to be also applicable when concerned with the real target group.

The participants were asked to take place on the ambulance stretcher and to test and rate the three types of restraints systems one by one. The order in which the three restraint systems were tested were counterbalanced to avoid the introduction of confounding variables.

The restraint systems were rated on the feeling of safety, freedom, re-assurance, pride and comfort using 1-7 Likert scales. In addition, the participants were asked to rate the overall experience, to argue their choices and to give and/or draw recommendations in order to improve the concepts.

The complete set-up and evaluation form from this user test can be found in Appendix G.

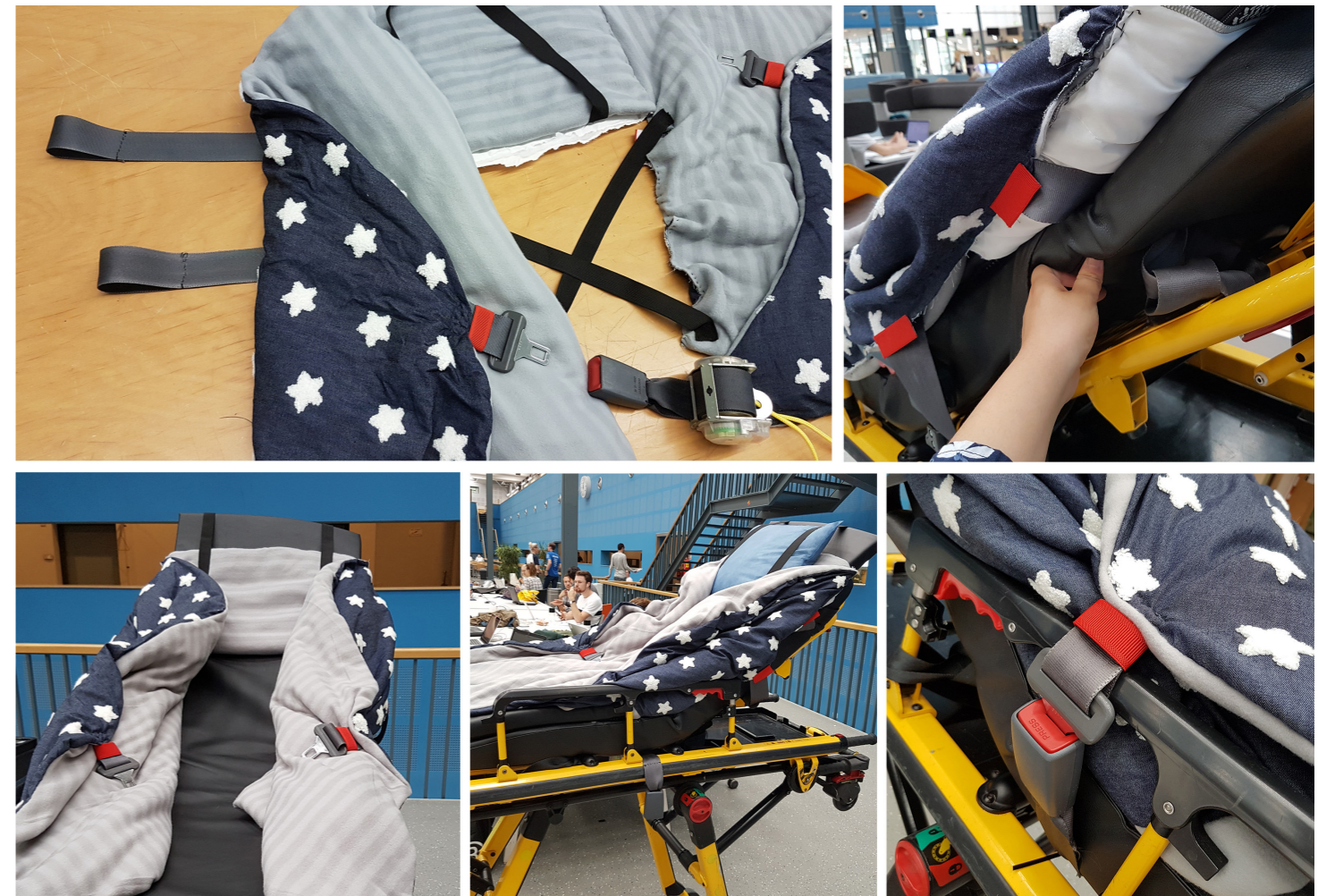


Figure 4.1 Prototype of Patient Wrap



Figure 4.2 Prototype of Patient Style

#### 4.1.4 User test results

The score for each aspect of the three restraint systems was calculated by extracting the mean of all participant's results.

##### Original patient restraint system

When looking at the scores (figure 4.3), the original patient restraint system was experienced as safe, limiting regarding freedom of movement, and slightly uncomfortable to uncomfortable. It made the participants feel slightly anxious to anxious, and ashamed.

The overall experience was regarded slightly negative.

##### Patient Wrap

When looking at the scores (figure 4.4), the Patient Wrap was experienced as safe, slightly limiting regarding freedom of movement, and comfortable. It made the participants feel re-assured, and not ashamed nor proud.

The overall experience was regarded slightly positive to positive.

##### Patient Style

When looking at the scores (figure 4.5), the Patient Style was experienced as slightly safe, slightly free to free regarding freedom of movement, and slightly comfortable to comfortable. It made the participants feel slightly re-assured, and nor ashamed nor proud.

The overall experience was regarded slightly positive to positive.



	P1	P2	P3	P4	P5	P6	P7	P8	Mean (out of 7)
Safety	5	6	6	6	5	5	7	6	5.8
Freedom	6	3	3	2	2	2	3	2	2.9
Re-assurance	7	6	6	6	6	3	7	6	5.9
Pride	4	6	4	4	4	4	4	4	4.3
Comfort	7	6	6	6	6	5	7	5	6
Experience	6	6	6	5	6	5	7	3	5.5

Figure 4.4 User test results- Patient Wrap



	P1	P2	P3	P4	P5	P6	P7	P8	Mean (out of 7)
Safety	7	6	7	5	4	6	6	6	5.9
Freedom	2	2	1	2	1	2	2	2	1.8
Re-assurance	6	4	4	3	3	4	2	3	3.6
Pride	4	3	3	2	4	4	4	2	3.3
Comfort	2	4	2	3	2	3	3	2	2.6
Experience	4	3	3	2	3	5	3	2	3.1

Figure 4.3 User test results- Original patient restraint system



	P1	P2	P3	P4	P5	P6	P7	P8	Mean (out of 7)
Safety	6	5	5	5	7	6	3	4	5.1
Freedom	3	6	6	5	6	6	7	5	5.5
Re-assurance	3	6	6	5	7	5	3	4	4.9
Pride	5	4	3	5	4	5	4	4	4.3
Comfort	3	6	6	7	7	6	5	4	5.5
Experience	4	5	5	6	7	6	5	6	5.5

Figure 4.5 User test results- Patient Style



Both concepts scored lower on the feeling of safety when compared to the original patient restraint system, however the Patient Wrap came close to the original score. This was surprising as the Patient Style was designed to be more close to the original restraint system, showing more belts. From the arguments participants provided for the scores, it could be extracted that being able to see the belts does not necessarily add to the feeling of safety. Participants trust in the ability of a restraint system to do what it is designed for. In addition, the Patient Wrap was experienced as being a hug and providing warmth, which added to the feeling of safety.

Regarding freedom, both concepts scored higher than the original restraint system. However, the Patient Wrap was still experienced as being limiting in movement. In the recommendations, participants noted that they would like to have freedom to move their arms, in which especially the lower arms.

The feeling of re-assurance provided by both concepts were higher than the original restraining system, in which the hug-like design of the Patient Wrap scored highest. The low score of the original restraint system was explained to be caused by the cold feel of the belts and attachment parts, the perceived and experienced weight of the attachment parts and the feeling that the belts did not have the ability to stay onto the shoulders.

Regarding the experience of pride, both concepts scored higher and were given the same score which was "not feeling ashamed nor proud", whereas the original restraint system made people feel "slightly ashamed".

The experienced comfort scores of both concepts were doubled compared to the score given to the original restraint system, in which the Patient Wrap scored slightly higher than the Patient Style. It is mentioned however, that over time the Patient Wrap could cause temperature issues in which the ability to adapt this could be essential.

Both concepts conveyed a "slightly positive" to "positive" experience, in which the original restraint system conveyed a "slightly negative" experience.

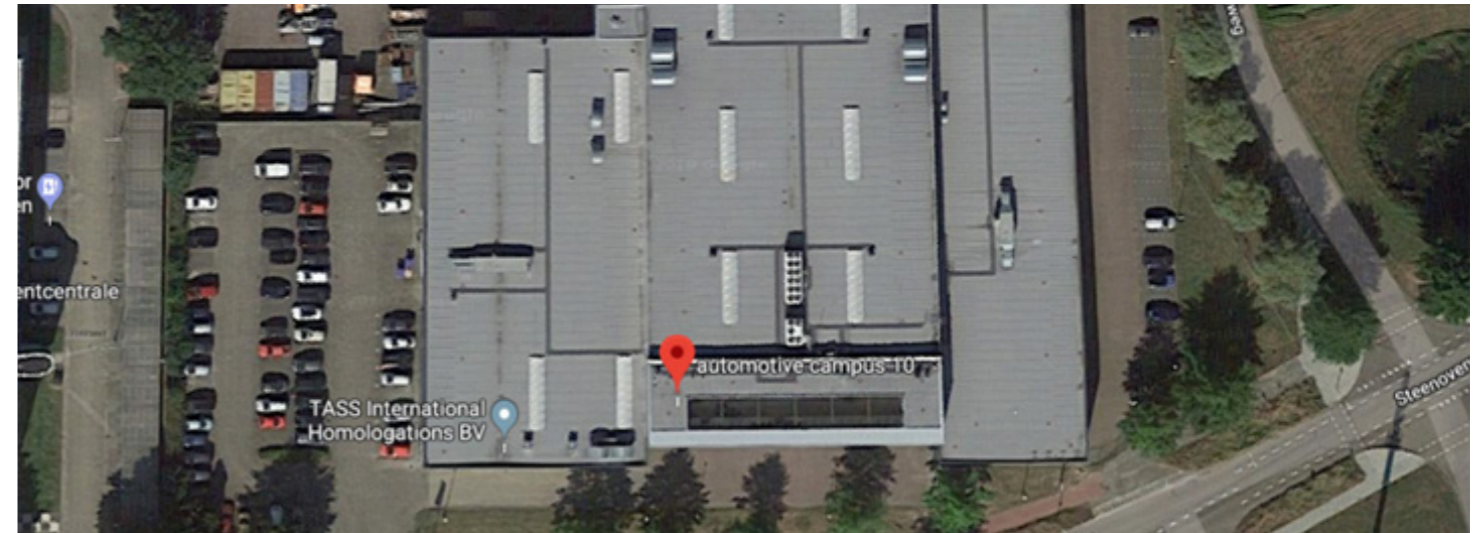
Recommendations regarding the Patient Style were to integrate the leg belt as this interfered with the overall experience. Although, the slight pressure provided when the belts were attached was contributing to the feeling of safety, the participants would prefer a better distribution of forces as the vest closure systems were now positioned around the lung area interfering with breathing if the vest was to be too tight. In addition, woman preferred the vest closure systems to be positioned elsewhere due to their chest. Also, a need to keep the pillow fixated was noticed as it had to be re-positioned multiple times during the test.

Recommendations regarding the Patient Wrap would be to provide for arm movement by providing either complete arm holes or providing lower arm holes. In addition, participants recommended the adaptability to temperature differences by for example making a summer and winter edition, or by making different layers. It was noticed that the concept would also benefit from if the bands to keep the pillow on place would be a bit angled to support multiple pillow sizes.

#### 4.1.5 User test conclusion

When looking at the results of the user test, it could be concluded that the Patient Wrap could be deemed the more promising concept.

Except for the feeling of freedom, it scored even or higher on all aspects when compared to the Patient Style, in which the feeling of freedom could be improved by fitting design adjustments. Furthermore, it scored higher on all aspects except the feeling of safety when compared to the original patient restraint system, although coming close.



#### 4.2.1 Visiting Tass International Crash Test Centre

Figure 4.6 Tass International

A visit to Tass International, Helmond was organized to establish a better understanding regarding ambulance- and occupant safety, relevant aspects to take into account during designing for this context and regulations regarding patient restraint systems. In addition, gaining feedback of an expert presented new insights and recommendations in order to further improve the concepts.

##### Tass International

Tass International is a Siemens Business supporting the global automotive industry by offering development methodology that lead to the creation of safer, smarter and greener vehicles (Tass International, 2018). Regarding safety, they offer solutions and services for passive, active and integrated safety. Two main types of crash tests can be performed at Tass International: the full scale crash test and a simulator test using an inverse crash sled.

For the full scale crash testing, real cars are used to perform frontal, side and rear impact tests as well as vehicle-to-vehicle tests.

The inverse crash sled is used to test occupant restraint systems, vehicle and aircraft seats and other interior vehicle components. A propulsion system allows the set-up of a variation of simulations such as whiplash testing and side-and front impact simulation. This type of test would be relevant if the design would be realized and implemented for use.

#### 4.2.2 Conclusion of the visit

During the visit, the domain expert, Herman Tavenier, gave an elaborate explanation about occupant safety within the ambulance regarding restraint systems. Different footage of inversed crash sled tests were shown by the expert in order to get insight in the magnitude of forces applied to the human body during frontal- and side impact crashes and the places where these forces are exerted. An official norm (NEN-1789) is applied in all the tests they perform, which accounts for an acceleration of 10 g during crash.

The expert explained that support on top of the patient's shoulder and hip are essential to counter upwards translation during the crash. This is both essential in seated position (presence of an angle) as when the patient would be lying down.

Using the current 4-point seat belts, a great proportion of the force during crash is translated in the soft tissue around the abdomen due to patient translation. An ideal situation would translate the forces only to the "hard parts" of the human body including the shoulder bones and the pelvis.

There is no norm that disregards the use of a retractable seatbelt system for the patient cot. However, the expert advised to take into account that using such system is only possible if the retractors maintain the same position over time, and thus these cannot be applied on parts of the patient cot that change angle.

Regarding materials, the expert discouraged to use only fabric as a means to restraint the patient. To counter the forces exerted during a crash, regular seatbelt material should be used as there is currently, to his knowledge, no other fabric available which would be able to do so. An internal harness therefore would be needed for both concepts.

Recommendations of the expert regarding the concepts were to add a part to the stretcher that would hit the shoulders during crash as this is currently absent in the specific stretcher that WAB uses.

The Patient Style needs something that blocks the shoulders as currently it would be unsafe. However, the level of safety of how the original belt was used during wish rides and which is provided by this concept is similar as both would act as a belt around the abdomen.

The Patient Wrap is fine regarding safety as long as there is a belt running across the shoulders.

## 4.3 CONCEPT SELECTION & ITERATION

### 4.3.1 Concept selection

Based on the results of the user test and the insights gained during the talk with the safety expert, it was chosen to continue to project with the Patient Wrap. During the user test, this concept came out as an improvement compared to the original patient restraint system on the aspects of feeling of freedom, re-assurance, pride and comfort. In addition, the overall experience was rated more positive than the original restraint system.

On these aspects, the Patient Wrap has scored higher than the Patient Style except on the feeling of freedom. However, with the correct adjustments to the concept, improvements on this aspect were still to be reached, in which different patient sizes need to be taken into account.

Regarding the feeling of safety, this concept scored lower than the original patient restraint, although almost similar. However, when looking at the intended use of the original restraint system and what happens in practice, this concept would be safer as the exerted forces would be distributed over a larger area whereas in the original restraint (during incorrect usage), all the force in the upper region of the body would be exerted on the soft tissue of the abdomen.

From the expert's point of view, support on top of the shoulders is essential to guarantee non-fatal patient translation during potential crash situations. This is not accounted for in the current frame of the stretcher, nor by the current patient restraint system due to incorrect positioning. The Patient Wrap however does account for this if the top of the blanket-like structures maintain their position onto the shoulders during the wish ride.

Lastly, the regulation of temperature during use of the Patient Wrap still is in need of exploration. Materials which provide temperature regulation or different versions throughout seasons are options to solve this challenge.

### 4.3.2 Concept iteration

Following the results and recommendations from the user test and expert meeting, several changes were made to the Patient Wrap concept (figure 4.7). As it was recommended to always secure the shoulders of the patient, it was chosen to still implement arm holes into the concept.

For one, this could provide the patient with an increased feeling of freedom, also providing some ventilation whilst being seated. However, as consequence the feeling of re-assurance is susceptible to decrease. As the drop in feeling of re-assurance is not desired, a pouch will be provided to secure the lower arms and hands when desired, as a counter measure.

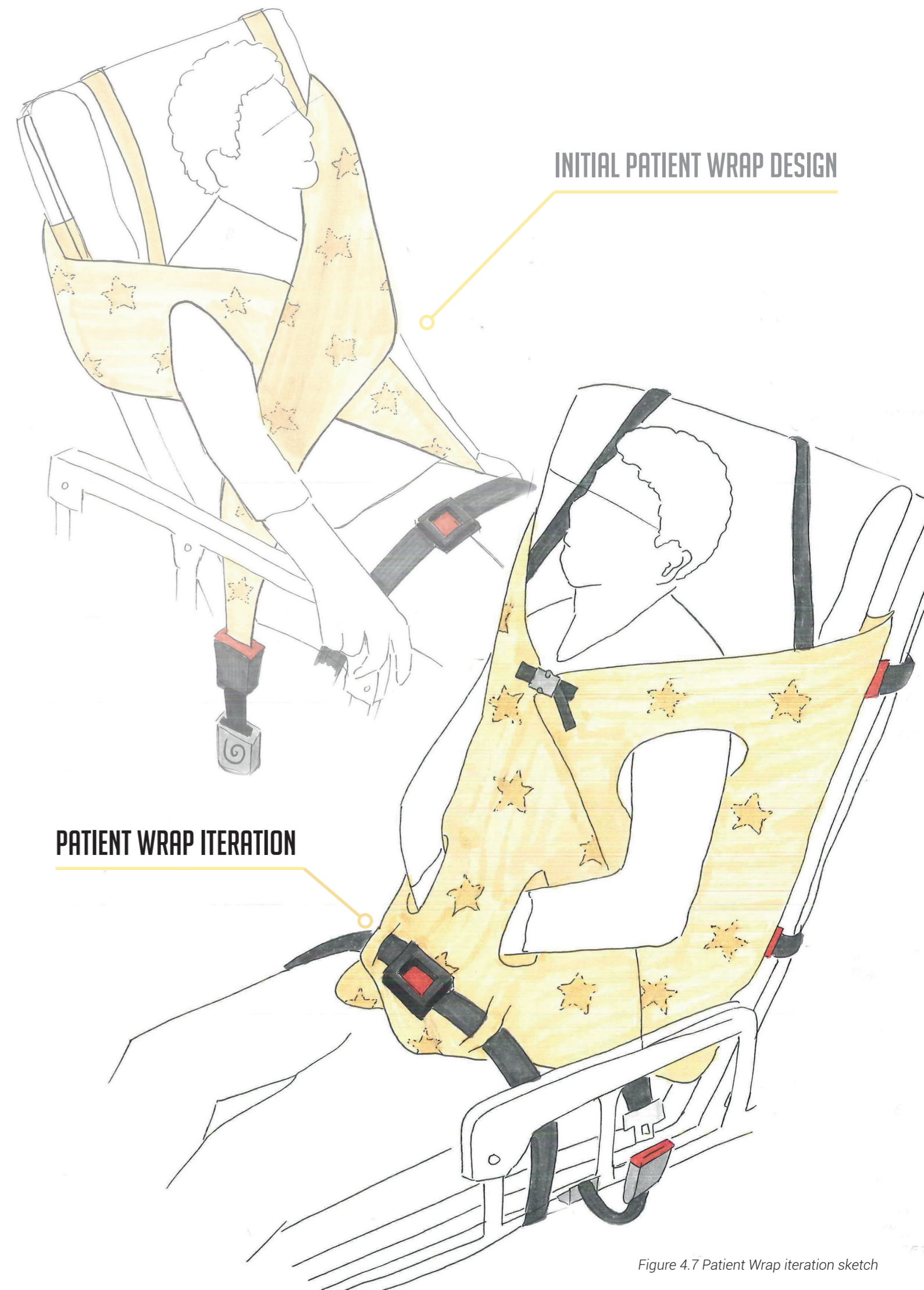
As there is a need for the belts to maintain positioned over the shoulders, no structure was designed in which the patient could easily retract his/her arms into the blanket-like structures.

Second, this enables two 3-point belt systems to be implemented in the blanket-like structures in which together they work similar as a 4-point belt system. Together with the leg belt, these would counter the forces exerted during crash, translating the forces majorly to the shoulder region and pelvis.

To maintain a correct positioning of the internal seatbelts, an additional strap is added around the sternum of the patient. This strap also allows for differences in patient sizes.

The elastic material which aims to maintain the correct position of the patient's pillow throughout the wish ride will be fixed in a slight angle. This enables different sizes of patient pillows to be positioned onto the product.

As a final step, a cut out on the outer blanket-like structure is provided for the belt key of the other blanket-like structure to exit to prevent the hard components of the seatbelt touching the patient.





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This chapter provides an overview of the final concept in detail, such as sizes and measurements, materialization, assembly, and production costs.

In addition, a final use scenario was made and an envisioned Patient Journey Map will be presented.

## CHAPTER 5.

# FINAL DESIGN



6



## 5.1 BENEFITS OF THE DESIGN

The design (figure 5.1) improves the experience of the wish ride by providing the patient a safer, more re-assuring and more comfortable restraint system.

During this emotional event in which prevention of anxiety and fatigue are essential in order to ensure the fulfillment of someone's last wish, the ability for the patient to shift, move, find a comfortable position and rest/sleep during the ride could make the difference.

In addition, as the original stretcher is designed for a different context, the design contributes to the sense of pride someone could be feeling on wish day. During the user test, it was proven that wearing the original restraint system made the user feel slightly ashamed and provided a slightly negative experience whereas wearing the design makes the user feel no shame nor pride and provided a slightly positive experience. On wish day, many other aspects contribute to these aspects, but it is satisfactory that the restraint system could contribute to a more neutral and positive starting point.

Also, the patient can easily access the belt keys- and clickers of the design in which these can be easily attached and detached during saying goodbye's on wish day, enabling a more intimate parting.

For the WAB volunteers, the design increases the time they can remain seated during the wish ride as the patient's pillow remains secured throughout the ride, increasing their own safety. In addition, the design helps to secure the hands of the patient when desired, in which there would be no more need for e.g. mitella's folded from bed sheets.

The downside of the design however will be a slight increase in the preparation time prior to a wish ride as the design needs to be applied to the stretcher. This increase needs to be minimized by making smart choices regarding use and will be further elaborated in this chapter.

Lastly, the currently used blankets (and pillows) by WAB are for single-use only. Volunteers have communicated that providing patients with better bedding was deemed relevant and desirable. Therefore this design aims to provide a more comfortable and higher quality alternative, whilst still remaining accessible (e.g. required costs) for WensAmbulance Brabant.



Figure 5.1 Patient Wrap final sketch

## 5.2 SIZES AND MEASUREMENTS OF THE DESIGN

To define relevant sizes for the final design, various measurements of the Dutch elderly were analyzed using DINED 1D database (DINED, 2018). The used DINED measurements can be found in Appendix H.

For the horizontal measurements of the blanket-like structures, the smallest (Dutch elderly P5 females) measurements were used as the product needs to maintain in tension in order to be able to secure the patient during crash. The size variation which is needed for bigger persons is then provided by the retractable seat belt systems and the additional clip.

For the vertical length of the blanket-like structures and for the arm holes, the biggest measurement (Dutch elderly, P95 male) were used as these aspects need to ensure that the product fit everyone in the target group.

To define the measurements of the pillow holder and mattress overlay aspects of WAB's additional mattress have been used as a reference.

In figure 5.2, you can find the measurements of the design's components.

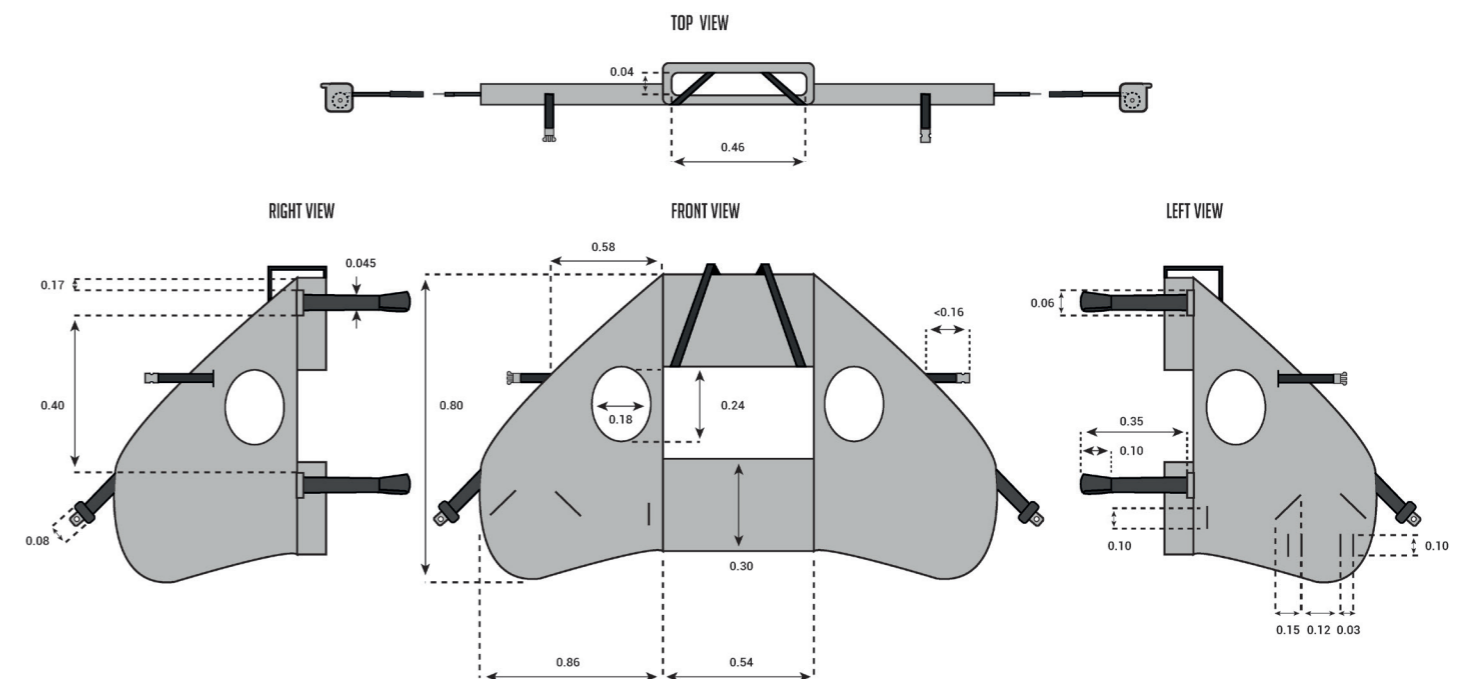


Figure 5.1 Measurements

5.3.1 Introduction

The design consists of two main components, namely the seatbelt system which will ensure the patient's safety during the wish ride and a cover wrap which will divide the pressure and provide the patient with a comfortable and reassuring feel. In this paragraph, materialization of these two components will be elaborated.

5.3.2 Seatbelt system

The seatbelt system consists of webbing material, and conventional belt clickers and keys. Prior to 1980, automotive seat belts were made of nylon, whereas nowadays they are mainly made of polyester (Steinbush et al, 2000). The shift to the use of polyester can be explained by the need for less elongation when the retractor systems and airbags were implemented.

Polyester has been proven to be the best material currently available regarding seatbelt webbing, and therefore the design's internal seatbelt system will also consist of polyester webbing.



Figure 5.3 Seatbelt weaving

5.3.3 Cover wrap

The cover wrap will consist of lining- and shell fabric, sheet filling, and zippers for assembly purposes. Lining fabric refers to the inner layer of the cover wrap. This is the layer that will be in constant contact with the patient. Shell fabric refers to the outer layer of the cover wrap.

Shell- and lining fabric

Regarding fabric production, there are two main processes to produce cloths: weaving and knitting. Knitted cloths consist of stitches/loops of yarn consecutively run together, whereas woven cloths are made by interlacing two types of yarns (DifferenceBetween.net) (figure 5.4).

Within knitted cloths, the yarn follows a path forming proportioned loops over and under the yarn's path. These loops can then be easily elongated into most directions, providing elasticity in the end product. Within woven cloths, the yarns run straight and perpendicular to each other, resulting in the end product being able to be stretched in only one direction.

As the user of the product will be likely to move during the wish ride, it was desirable to provide elasticity in the cover fabric of the product. This also prevents the product from tearing when force is applied during assembly onto the stretcher. Therefore, in the final design, it was chosen to use knitted fabric as cover of the blanket-like structures.

The textile finishing process has an effect on the physical properties of the fabric such as feel, softness, tensile strength, shrinkage and insulation properties (Shishir, 2014).

Regarding knitted fabric, there are three main finishes; terry, velour and fleece (Nannen, 2014) (figure 5.5).

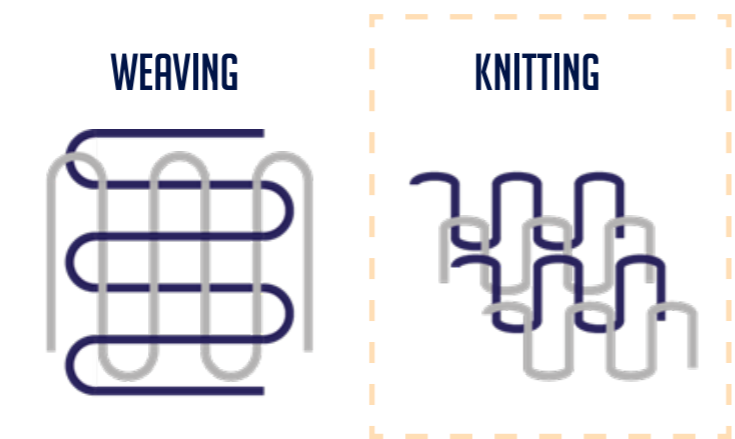


Figure 5.4 Main processes of fabric production

Terry cloth is a fabric with uncut loops. Due to its increased surface area, absorbency of fluids is enhanced (Graciousstyle, 2018). This material is often used in bathrobes, slippers, sportswear accessories such as head- and wrist bands, baby wash cloths- and plush toys (Hunker, 2018). Due to its way of manufacturing, prints are not usual in terry cloths as these would easily wither.

Velour cloth is manufactured in a similar as terry cloth, however the loops are cut giving the fabric an incredibly soft-to-the-touch finish in which the cut fibers follow the stroke of your hand (Grossman, 2018). This fabric is often used in bathrobes, bath towels, draperies and beach cover ups.

In fleece, the loops of the fabric are roughened (Nannen, 2014). Fleece is a very durable material as it is made of 100 percent polyester. Due to it being made of polyester, it does not absorb water nor odors, and functions as good insulation material (Hunker, 2018). Although the texture of fleece is similar to wool, it is light in weight. This fabric is often used in sweaters, blankets, outer wear (for backpackers and hikers), deep-sea diving suits, and underwear for astronauts.

As lining fabric (inner layer) of the final design, fleece was chosen as its non-odor absorbency, durability and light weight aspect were desirable. In addition, fleece fabric initially does not provide a cold touch to the skin, making the first contact pleasant for the patient.

Velour fabric could have the tendency to irritate the skin of the patients when moving during the wish ride as the fibers have one correct stroke direction, whereas terry fabric could be subjected to hygienic issues when used over a longer period of time due to its increased surface area. Hence, fleece fabric was deemed the most promising for application as lining fabric in the final design.

In addition, it was chosen to give the lining fabric a single color as this implies a homogeneous feel which came out as one of the contributors to comfort in the How To-brainstorm conducted during ideation.

As shell fabric (outer layer) of the final design, polycotton (65%/35%) was chosen as it combines the softness and moisture absorption of cotton, with the durability and no-iron crispness of polyester (Minerva crafts, 2018). It is a versatile, and breathable material which is often used in sleeping bags, bed sheets, linen and clothing. It provides a cooler feel than fleece.

Within the shell fabric, it was chosen to apply a pattern made of terry fabric on the shell as during the user test, participants mentioned having this pattern made the shell interesting and pleasant to touch. As the terry pattern is in less direct contact with the patient, it is expected that hygienic issues and skin irritations are less apparent.

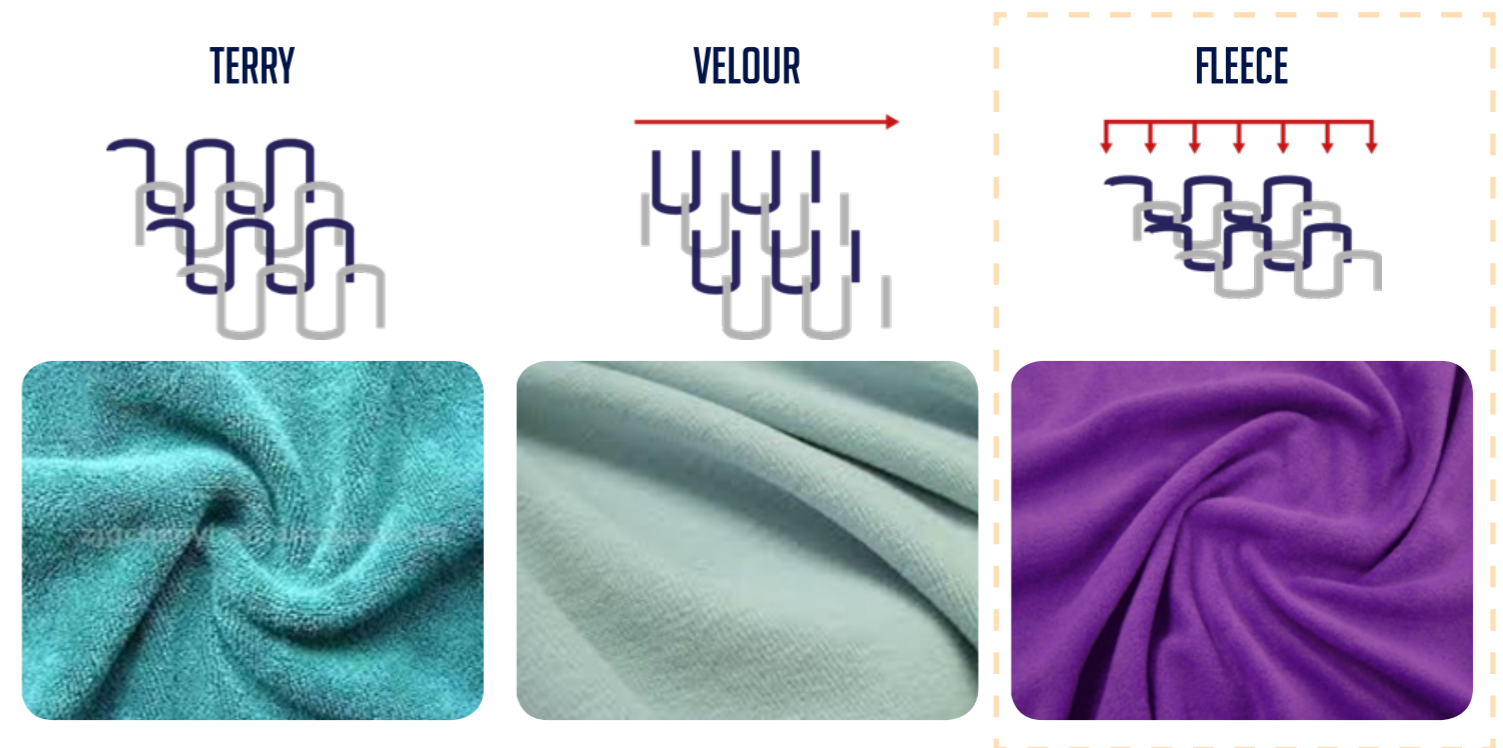


Figure 5.5 The three main finishes of knitted fabric

Within the context of the wish-ambulance the product will need to resist various kinds of fluids and moisture (e.g. human fluids but also disinfectants), resist staining, and have antimicrobial properties. WAB now counters this challenge by using single-use blankets (and pillows). However, a defined wish during the project was to provide a more sustainable option.

Therefore, the fabrics of the design will need to be coated in antimicrobial coating (Gerhardts, 2016), and resist constant washing and drying at 80 degrees (Nannen, 2014).

As WAB currently does not have options to wash their properties, it is recommended to either purchase washing machines for their four affiliates, and/or to explore potential agreements on cleaning with the hospitals which currently supply their blankets and pillows.

As for the coating, it was proven that agents which are silver or biguanide-based achieved the most effectiveness regarding preventing colonization of bacteria and pathogens on textiles (Gerhardts, 2016). Microban SilverShield would therefore be recommended. This coating is currently used on everyday items which are prone to odors and stains caused by bacteria such as (hospital) towels, tablecloths, mattress pads and clothing (Microban, 2018).

Applying an antimicrobial coating makes the textile easier to clean, keeps the textile fresher in between washes, prevents permanent odor build up and increases the life span of the product.

#### Sheet filling

For the sheet filling, it was of importance that the product would be able to account for temperature differences due to variations throughout seasons, but also due to different patient needs. Therefore an analysis was conducted on materials which could provide for temperature and moisture regulation. Also, the material also needs to be machine washable and be lightweight.

The filling of sleeping bags was an interesting material to consider for the product, as sleeping bags insulation does not provide warmth itself. Sleeping bags are an example of a product that receives EN-temperature ratings (EN-13537).

The comfort rating is the lowest temperature at which the sleeping bag will keep the average woman or "cold sleeper" comfortable, whilst the lower-limit rating is the lowest temperature at which it will keep a man or "warm sleeper" comfortable (REI, 2018).

For the product the lower-limit would be viable, as it would be easier to make someone warmer if needed rather than taking the heat away.

The two types of insulation for sleeping bags are down- and synthetic fill (polyester) (figure 5.6). Down has the benefits of being lightweight and easy-to-compress, whilst synthetic is quick-drying and non-allergenic.

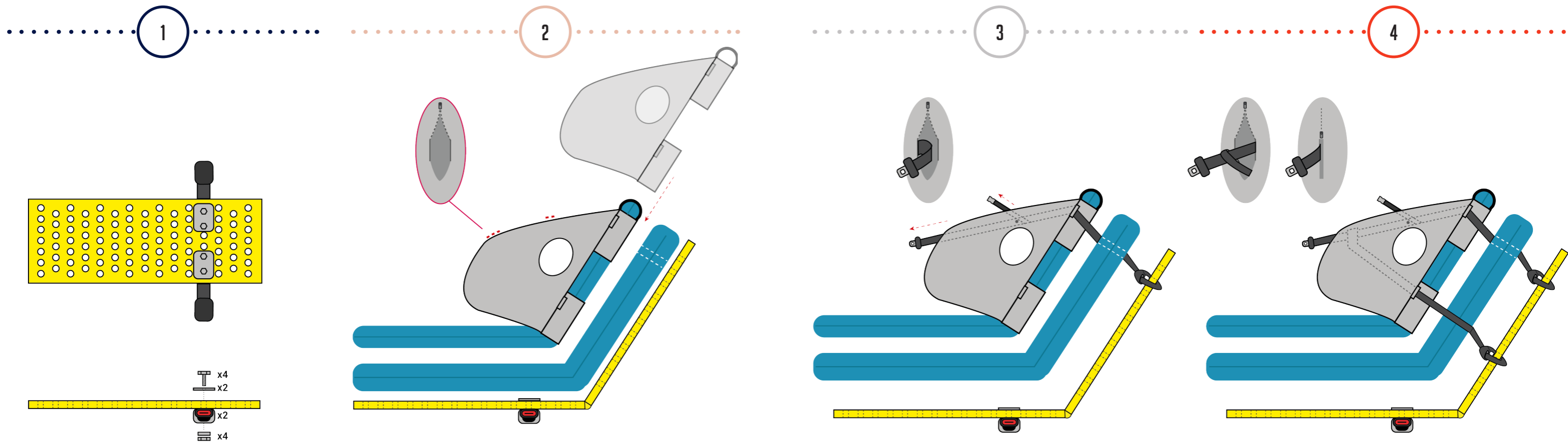
Down is more expensive than synthetic fill, and loses its ability to retain heat when wet. However, its heat-trapping ability is kept at a near-original state longer than synthetic fill. Synthetic fill offers less warmth for its weight, and its insulating power gets reduced each time it is stuffed into a bag. However, it is cheaper, easier to clean and require less care than down fill (Mountain warehouse, 2018).

Looking at the pros and cons of these two types of insulation fills, it was chosen that synthetic fill would be a promising fill for the product due to it being non-allergenic, cheap, easy to clean, and quick-drying. As the product does not need to provide an equal amount of warmth as a sleeping bag (it is not used during nights), the weight issue of synthetic fill is regarded not an issue if it were to be selected as fill for the product.



Figure 5.6 Sleeping bag filling material

## 5.4 ASSEMBLY OF THE DESIGN



The product is assembled onto the stretcher in four main steps (figure 5.7):

1. First, the two retractable seatbelt systems are fastened to the frame of the stretcher using four nuts, bolts and spacers (M8) and two assembly disks.
2. Stryker's original mattress and WAB's additional mattress are then placed back on top of the frame, and the wrap is slid onto the additional mattress. The zippers of the wrap are opened.
3. The additional clip is then slid onto the diagonal seatbelts, and the belts are then fastened to the stretcher's frame in the same way as the original seatbelt system. The seatbelts are slid through the seatbelt holes of the original mattress and placed into the wrap. Hands can reach inside through the opening of the wrap to extract these seatbelts.
4. The horizontal seat belts are then fastened to the stretcher's frame in the same way as the diagonal seatbelts. These seatbelts are then slid through the wrap, and placed over the diagonal seatbelts back into the wrap. Finally, the zipper of the wrap is closed and the product is ready to use.

Enabling the separation of the seatbelt system and the wrap will lower the costs as WAB will need more wraps than they need seatbelt systems. The seatbelt system can be used for multiple wish rides after each other, whilst the wrap needs to be cleaned in the meantime. Cleaning of the product and its maintenance is eased as no metal components are present during washing, and the wrap could be easily replaced if it were to be damaged.

In addition, the seatbelt system can remain assembled on the stretcher, whilst the wrap is being replaced, lowering the additional preparation time for WAB volunteers needed in advance of a wish ride. Also, the wrap could be easily replaced if desired during a wish ride.

In conclusion, enabling the separation of the seatbelt system and the wrap will lower costs of purchase and maintenance, minimize additional preparation time for the volunteers in advance of a wish ride, and ease cleaning of the product.

On the other hand, the choice was made to disable the separation of wrap components (e.g. pillow holder, blanket-like structures, mattress overlay). This was due to WAB's desire for the least amount of separate components as these are easily lost or forgotten by volunteers during both preparation and execution of activities on wish days.

Figure 5.7 Assembly of the product onto the stretcher. Take note that several parts of the stretcher are not visible in the image.

## 5.5 COST ESTIMATION

Basically, the product consists of two parts: the restraint system and the wrap. The seatbelt system ensures the patient is safely secured during the wish ride, whilst the wrap is the outer layer which makes the product comfortable to use and provides a re-assuring feel to the user.

In figure 5.8, an overview has been made of the needed materials, their accompanying prices per meter or per piece, and the estimated material costs in order to make one product.

MATERIAL	NEEDED AMOUNT FOR ONE PRODUCT	PRICE PER AMOUNT	SOURCE	MATERIAL COSTS FOR ONE PRODUCT [EUR]
Fleece fabric	3.4 [m]	8.51 [EUR/m]	(Naaiplezier.nl, 2018)	29.83
Elastic material	1.2 [m]	1.50 [EUR/m]	(Direct textile store, 2018)	1.80
Polycotton fabric	1.6[m]	6.41 [EUR/m]	(Direct textile store, 2018)	10.26]
Synthetic fill	1.38 [m]	4.99 [EUR/pcs]	(IKEA, 2018)	4.99
Terry fabric	0.52 [m]	10.50 [EUR/m]	(Rijs textiles, 2018)	5.46
Click belt 20mm	2 pcs	0.21 [EUR/pcs]	(Ijzerwarenwebshop.nl, 2018)	0.42
Zipper	0.06 [m]	1 [EUR/m]	(Joan's comfortschuim, 2018)	0.06
<b>Total mat.costs cover wrap</b>				<b>51.92</b>
Polyester seatbelt webbing	6.06 [m]	0.8 [EUR/m]	(Staal, 2018)	4.85
Retractor system incl. clicker and key	2 pcs	44.55 [EUR/pcs]	(Winparts auto onderdelen, 2018)	89.10
M8 nuts, bolts and spacers	4 sets	2.05 [EUR/m]	(Kollies parts, 2018)	8.20
RVS plate 2mm	0.06 x 0.05 [m]	67.76 [EUR/m <sup>2</sup> ]	(Ijzershop, 2018)	3.39
<b>Total mat. costs seatbelt system</b>				<b>105.54</b>
<b>TOTAL MATERIAL COSTS</b>				<b>157.46</b>

Figure 5.8 Table of needed materials and estimated material costs for one product. Grey = cover wrap, Pink = seatbelt system

The material costs of one product was estimated to be 157.46 EUR (figure 5.7). The majority of these costs is caused by the price of the retractor system (89.10 EUR), which was based on a retail price per piece. If WensAmbulance Brabant would be to buy them, a lower price could potentially be reached.

In order to account for the antimicrobial coating which needed to be implemented on the fabrics, the cost of the fleece- and polycotton fabric were estimated using the prices of similar fabrics designed for a hospital context.

An hourly rate for a seamstress could be found and was estimated to be 16.98 EUR (Payscale, 2018). If the seamstress would be provided all materials, it was roughly assumed she could produce one wrap in two hours.

The assembly will take place directly onto the stretchers at the ambulance posts, resulting in the total material and production cost of one product being estimated at **191,50 EUR**. These costs are deemed not an issue by WAB.

As mentioned in the previous paragraph, the wrap and the seatbelt system were designed to be able to separate to minimize the costs for WensAmbulance Brabant.

A total of four (in the future, six) seatbelts systems are needed in order to provide the wish-ambulances in the possession with this new patient travel experience, whereas multiple wraps are needed to facilitate the amount of wish rides conducted. Having the ability to equip all the ambulances with a complete system, whilst being able to wash the wraps bi-weekly, and with the possibility to have one wish ride a day would result in the need of 56 (in the future, 84) wraps.

The total costs to implement this new system would then be 633.24 (seatbelt systems) + 7213.92 (wraps) = **7847.16 EUR** when implemented for use in six wish-ambulances.

Not yet included in this cost estimation were the costs of the crash safety tests (NEN-1789) the product needs to abide to.

At Tass International a frontal-, side-, and back impact crash test could be performed using an inversed crash sled (figure 5.9). According to their domain expert, the total costs to perform these tests would be **10.500 EUR**. Included in these tests would be one adaption to the test setup, three tests in three directions (+x, -x, y), two high speed on-board camera's per test, two seatbelt force analyses per test, and one 50% H3 dummy per test.



Figure 5.9 Crash test picture sequence using inversed crash sled. Snapshots required from Youtube. Acquiring footage from visit to Tass International was not possible due to non-disclosure agreements.



## 5.6 USE SCENARIO OF THE DESIGN

In figure 5.10, the scenario of use of the product is illustrated using a storyboard consisting of a relevant selection of phases of the Patient Journey Map. The change in experience will be elaborated upon in the next paragraph.

### Scene 1

Upon arrival of the volunteering couple (one nurse and one driver) on wish day, the seatbelt system is already assembled onto the stretcher by previous use. The WAB volunteers need to get a clean patient wrap and assemble this onto the seatbelt system. Together, this takes about ten minutes.

### Scene 2

The WAB volunteers discuss all of the wish day's content with each other and depart to the address provided by the wish requester. It will be a one hour drive to the hospice the patient is currently staying. Upon arrival, the volunteers extract the prepared stretcher out of the wish-ambulance and leave for the patient's room. They need to take the elevator to the second floor of the building. During the walk they are greeted by various staff members of the hospice.

### Scene 3

The WAB volunteers found the correct room number and are welcomed by the nurse outside of the room. They park the stretcher in the hallway next to the patient's room and enter the room together with the nurse.

The volunteers are then greeted by the patient and her daughter who will join the wish ride. The volunteers re-assure the patient and go over what they are about to do on today. They will visit her son and grandchildren who live two hours away and together visit the beach. The patient mentions she is a bit tired, but overall feels thankful and excited.

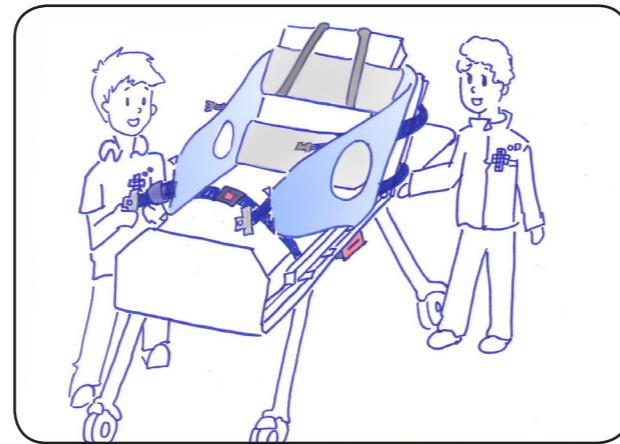
The nursing volunteer approaches the hospice's nurse for the medical supplies they agreed upon (oxygen tank and tube, and some pain relief medication), and the other volunteer collect the patient's pillow as requested.

The daughter updates the other family members who will join the wish event.

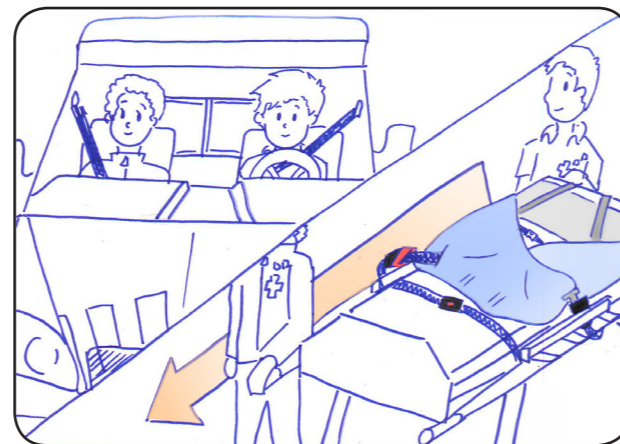
Having everything ready, everyone can prepare for the wish journey.

### Scene 4

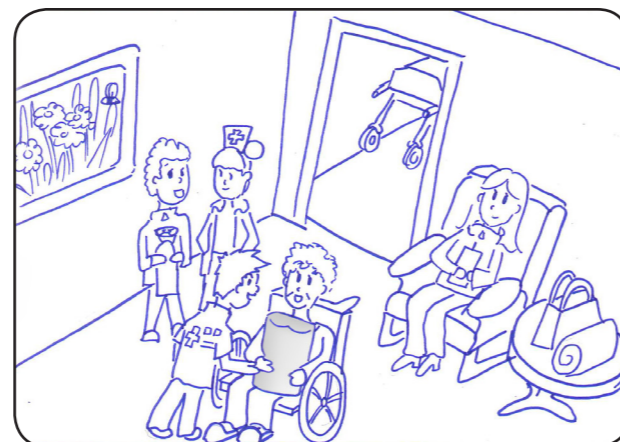
The volunteers fix the patient's pillow onto the product, and drive the stretcher into the patient's room. With the two of them, they lower the stretcher in order for the patient to be able to sit on the stretcher. The volunteers help the patient onto the stretcher.



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### Scene 5

When the patient has found a comfortable position and angle, the volunteers start to secure the patient using the product.

First the left wing is placed over the patient's left arm and attached to the right side of the stretcher. Then the right wing is placed over the patient's right arm and attached to the left side of the stretcher. Then, the leg belt is positioned and secured over the patient's upper leg. Lastly, the clip on the patient's sternum is fixed in order for the product to stay correctly positioned. A visual of this procedure can be found in figure 5.11.

The arm support are put up and together the volunteers place the stretcher in elevated position.

### Scene 6

The volunteers, the patient and her daughter check if all supplies are present and then start the journey towards the wish-ambulance. They pass the hallway in order to get to the elevator, and reach the ground floor. On the way, the patient greets the staff and friend she passes.

### Scene 7

The volunteers position the stretcher with the patient and the supplies inside the wish-ambulance. The patient's daughter and the nursing volunteer join the patient in the back-compartment on the drive towards the wish location.

During the ride, the patient talks to her daughter and the volunteers, enjoys the view from the windows, drink some water and tries to rest for a bit. When she is feeling uncomfortable due to the time she is seated, she re-positions herself a bit, dividing the pressure exerted on her buttock. The retractable seatbelt system facilitates this by providing or retracting seatbelt length.

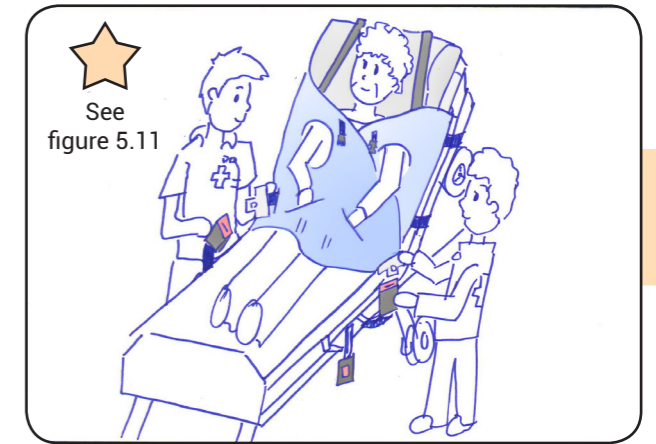
When resting, the patient inserts her hands in the soft pouch of the product.

Except for medical interventions, the nursing volunteer can remain seated as the patient's pillow is secured using the product.

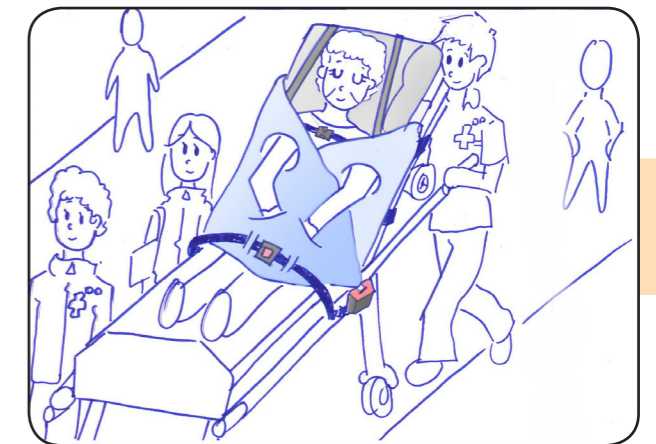
### Scene 8

Upon arrival on the wish location, the stretcher with the patient is extracted from the wish-ambulance. The patient's son and grandchildren were already present on the beach and see their (grand)mother arriving in the wish-ambulance and eagerly await to say hello.

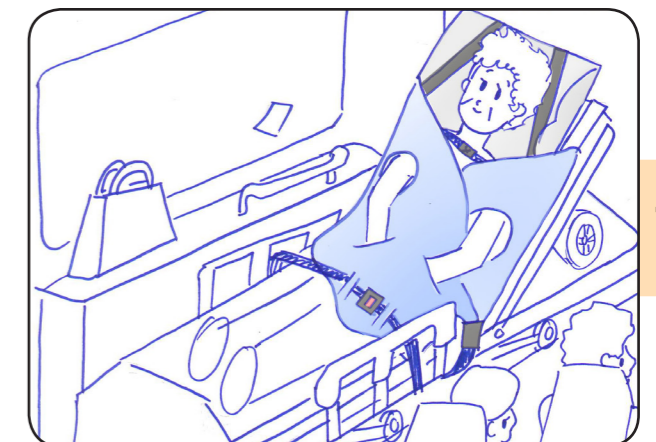
The volunteers help the patient get off of the stretcher and position her in a wheelchair as agreed upon for the wish activity. They will use the wheelchair to have a small walk along the beach, and have lunch together. The volunteers are asked to join the activities.



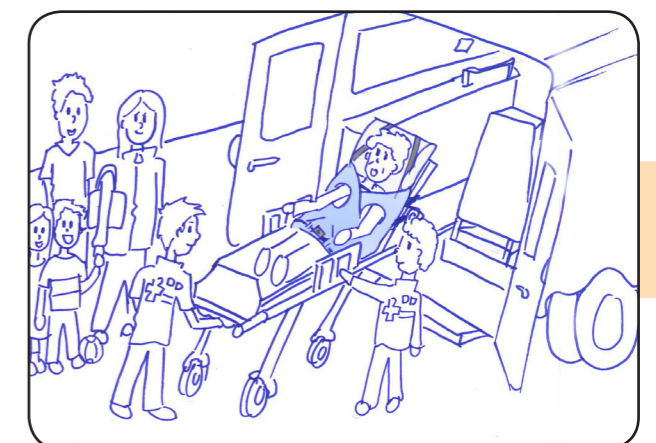
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7



8

**Scene 9**

A couple of hours after, the patient mentions she feels exhausted and would like to travel back to the hospice. The volunteers help the patient get on the stretcher, fasten the product's seatbelts and drive the patient into the wish-ambulance.

Inside the wish-ambulance, the patient's seatbelts are released in order for the patient to say proper goodbyes.

One by one the son and the grandchildren go inside the wish-ambulance to hug their (grand)mother and to say goodbyes, in which the daughter will join the ride home.

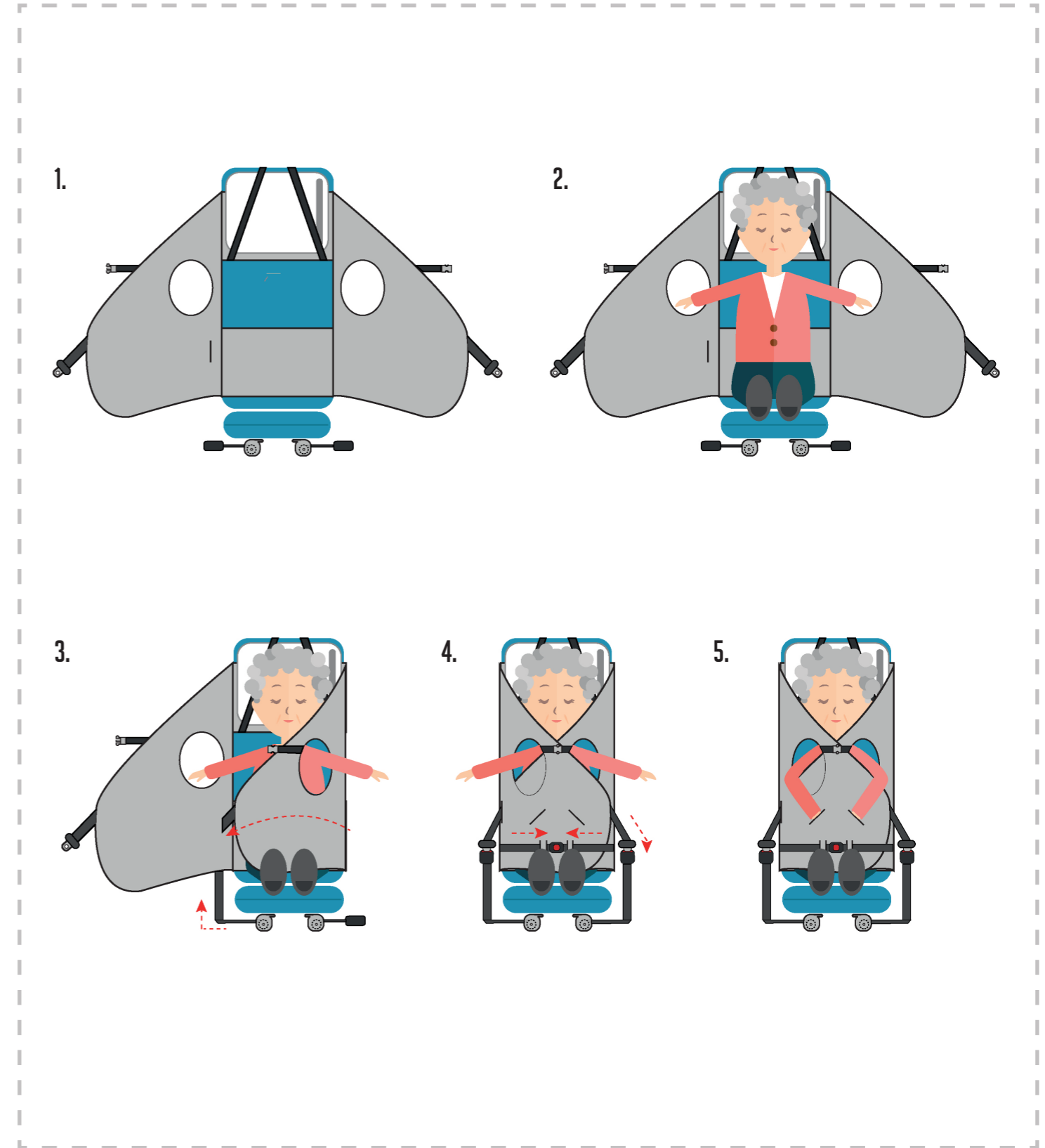
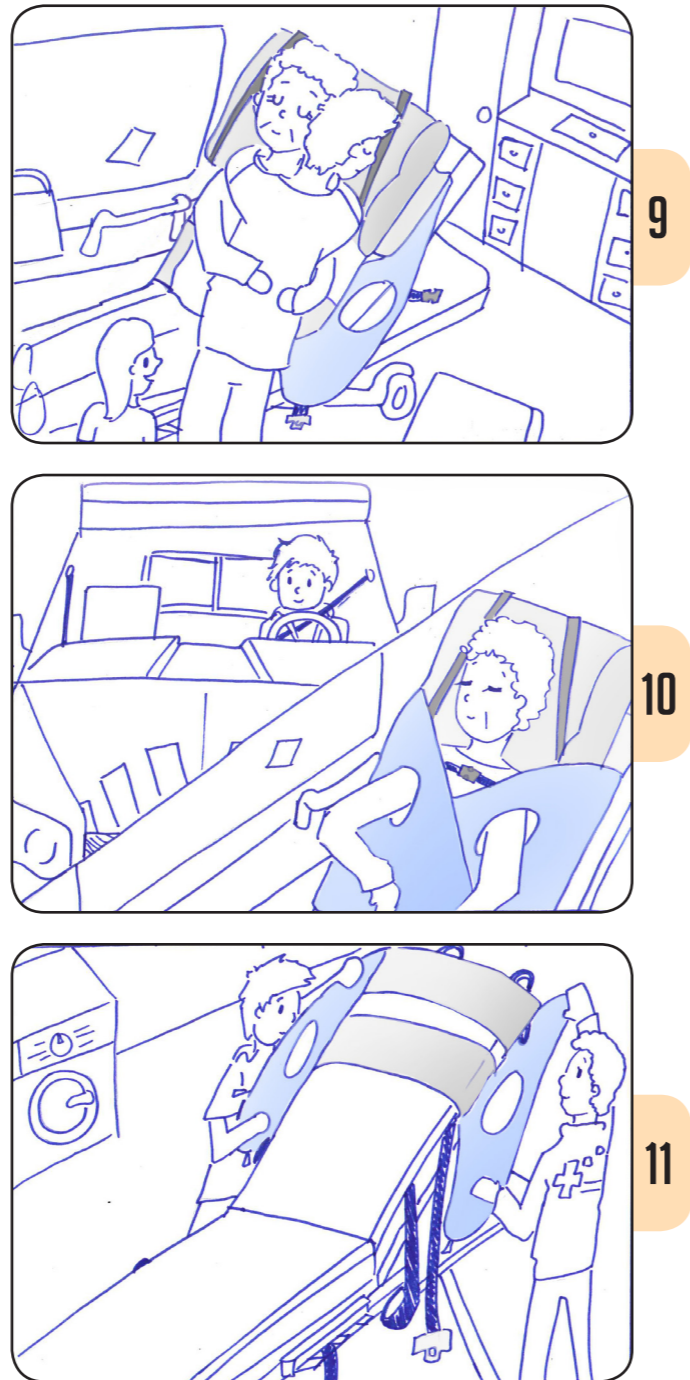
The product is then entirely fastened for the ride home.

**Scene 10**

During the drive home, the patient is fast asleep.

**Scene 11**

The volunteers dropped the patient and her daughter off at the hospice and say their goodbyes to the patient. Upon arrival at the ambulance post, they remove the patient wrap from the restraint system and put it on the location to be washed. The seatbelt system remains assembled onto the stretcher.

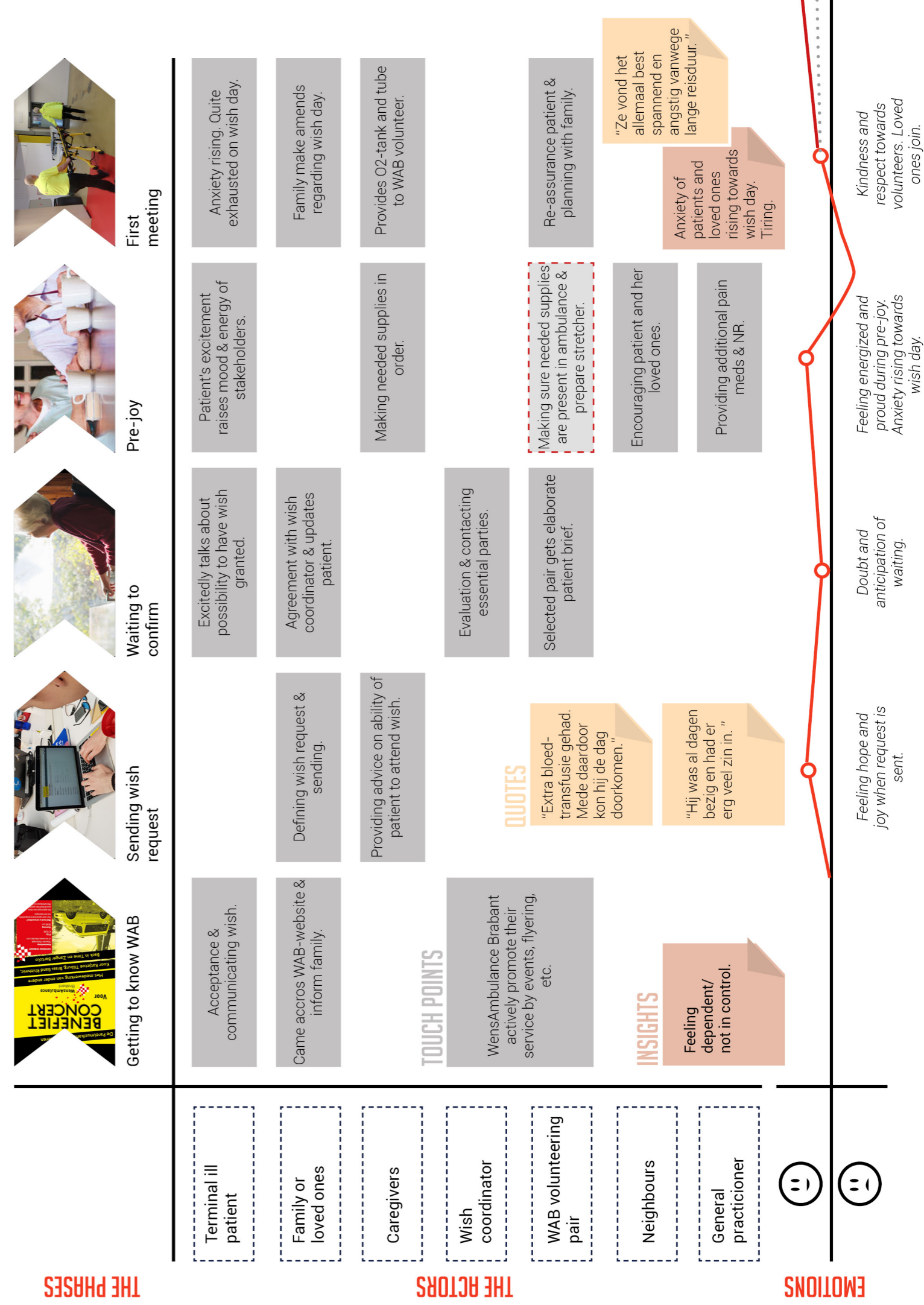


## 5.7 ENVISIONED PATIENT JOURNEY MAP

### 5.7.1 Introduction

The goal of this project was to improve the patient's experience of a wish ride with WensAmbulance Brabant, in which as the conclusion of the analysis phase the accent was placed on the phases "ride to wish location" and "ride to home" of the Patient Journey Map.

A new, envisioned Patient Journey Map was created, in which the use- and expected benefits of the design are integrated. In figure 5.12, the touch points which are expected to be affected by the design are shown using red dashed borders. These affected touch points influence the emotion line of the Patient Journey Map. Therefore a new emotion line was created, in which the initial emotion line is presented using a grey dotted line.





### Prepare for journey

Looking forward & Enjoy change of environment. Pleasant feel on skin.

Patient

Daughter joins in the ambulance, others in own transport.

Family

"Mevr. kan niet liggen door pijnklachten t.g.v. bot ca."

C.G.

Converting patient to stretcher & attach the product providing comfort

WAB vo

Privacy in back-compartment needed due to deep conversations.

Neighb.



### Ride to wish location

Feeling a bit of discomfort, but manageable. Sleeps a bit.

Talking with the patient. Feels relieved when seeing patient sleep.

"Gezien gezondheids-toestand wensvrager, geplande act. niet haalbaar."

Wish co

Deep conversations & minimizing discomfort (fewer attempts)

WAB vo

Patient, loved one and WAB volunteer (nurse) cannot hear each other well.

Neighb.



### Arrival at wish location

Overwhelmed. Enjoys fresh breeze and sun.

All members join patient. Relief of arrival.

"Later knapte hij op. Hij at goed en genoot buiten op het terras."

Wish co

Converting patient to wheelchair & making arrangements.

WAB vo

WAB volunteer nurse not secured during ride. Talking to patient, loved one, and driver.

Neighb.



### The activity

Lost in thoughts about memories & decides to want to have lunch.

Glad to see patient happy. Forget about hardships for a bit.

"Heeft nog veel hoop voor de toekomst?"

Wish co

Taking a step back & informing family of their presence.

WAB vo

Side step of the ambulance not observed by its passengers.

Neighb.



### Prepare for return

Fatigue taking over, desire to go home.

Make amends about who will join patient. Reality kicking in.

Little space to say goodbye.

Wish co

Waiting for patient and family's return & converting to stretcher.

WAB vo

How to prolongue the peak of joy?

Neighb.



### First goodbye's

Patient says goodbye's son and (grand)children. Hugs them tightly.

Daughter joins ride home.

Feeling relieved, quiet. Knows procedure of ride.

Wish co

Re-energizing in the days after. Incubation pride & relief.

WAB vo

Providing listening ear.

Neighb.

Re-energizing, proud & thankful. Anticipating End of Life.

Wish co

Joyful memories and pictures. Talking about it when visiting.

Wish co

Re-energizing. Glad & thankful to grant someone's wish.

Wish co

Providing listening ear.

Wish co

Through time, exhaustion increases.

Wish co

A time of love, relief and relaxation; being with loved ones. Feeling wish is complete.

Wish co

Euphoria of arrival.

Wish co

Feeling moments of distress due to pain, but manages by repositioning

Wish co

Anticipation of wish activity.

Wish co

Very exhausted. Sleeps during the ride home.

Wish co

Telling WAB volunteer about their day & sleeps

Wish co

Providing a quiet ride home.

Wish co

Experience of sound, touch and light more intense. Little adaptions would contribute.

Wish co

Letting everything go. Loss of control. Relief of lying in own bed.

Wish co

Feeling relieved, quiet. Knows procedure of ride.

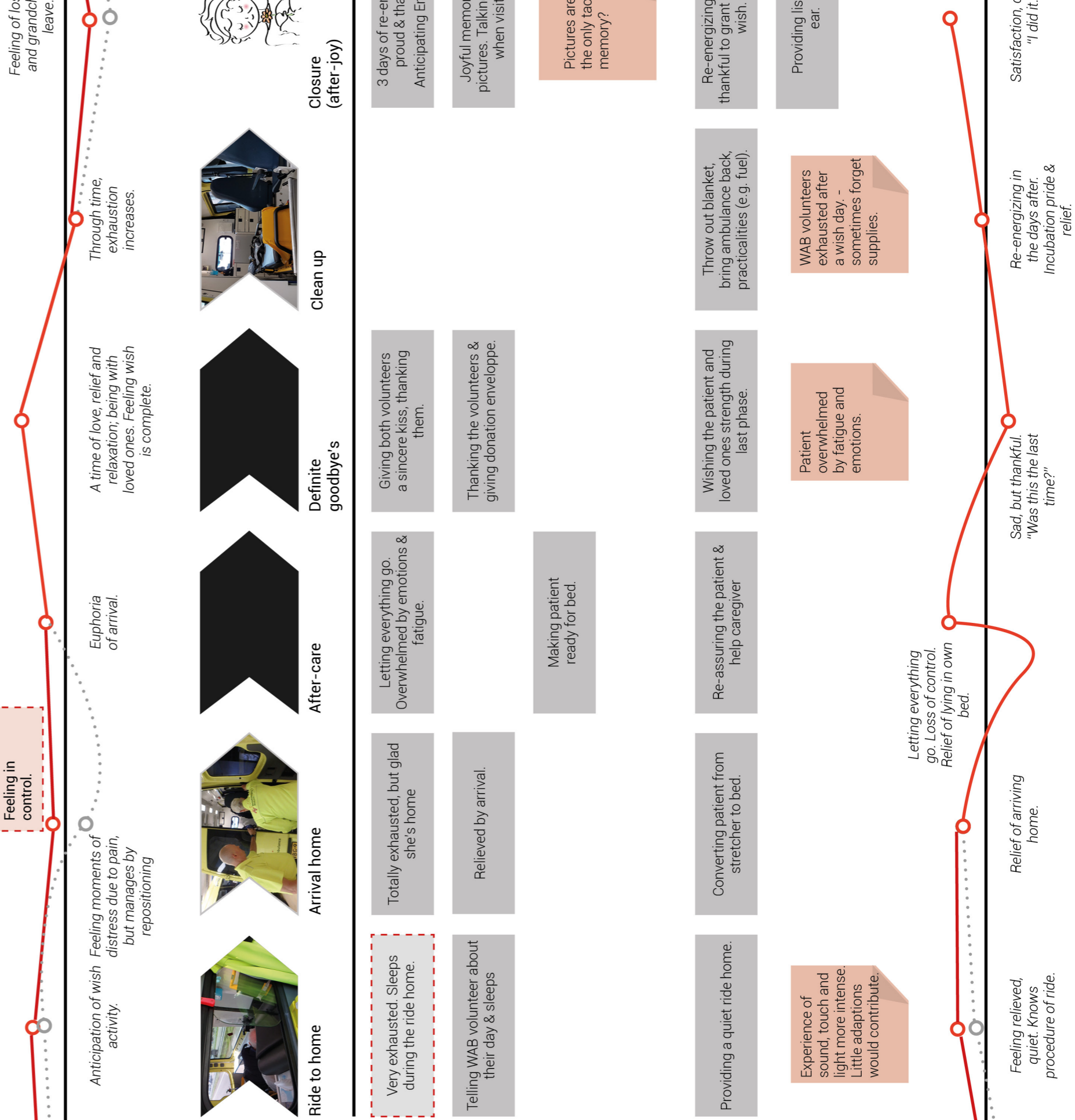
Wish co

Relief of arriving home.

Wish co

Satisfaction, closure, "I did it."

Wish co



### Ride to home

Very exhausted. Sleeps during the ride home.

Patient

Telling WAB volunteer about their day & sleeps

Family

Providing a quiet ride home.

C.G.

Experience of sound, touch and light more intense. Little adaptions would contribute.

Wish co

Letting everything go. Loss of control. Relief of lying in own bed.

Wish co

Feeling relieved, quiet. Knows procedure of ride.

Wish co



### Arrival home

Totally exhausted, but glad she's home

Patient

Relieved by arrival.

Family

Making patient ready for bed.

C.G.

Converting patient from stretcher to bed.

Wish co



### After-care

Letting everything go. Overwhelmed by emotions & fatigue.

Patient

Re-energizing in the days after. Incubation pride & relief.

Wish co

Providing listening ear.

Wish co



### Definite goodbye's

Giving both volunteers a sincere kiss, thanking them.

Patient

Thanking the volunteers & giving donation envelope.

Family

Wishing the patient and loved ones strength during last phase.

Wish co

Patient overwhelmed by fatigue and emotions.

Wish co



### Clean up

Throw out blanket, bring ambulance back, practicalities (e.g. fuel).

Wish co

WAB volunteers exhausted after a wish day. - sometimes forget supplies.

Wish co



### Closure (after-joy)

3 days of re-energizing, proud & thankful. Anticipating End of Life.

Patient

Joyful memories and pictures. Talking about it when visiting.

Family

Pictures are the only tactile memory?

Wish co

Re-energizing. Glad & thankful to grant someone's wish.

Wish co

Providing listening ear.

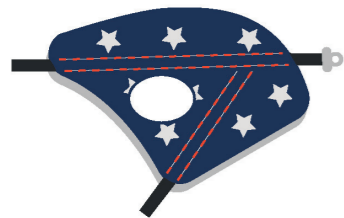
Wish co

Satisfaction, closure, "I did it."

Wish co

**NEW!**

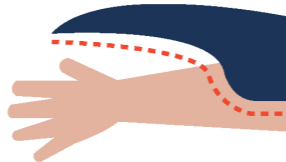
Integrated system provides a protective and hug-like feeling, without compromising safety.



A more gentle approach of securing the patient.



Homogeneous pressure distribution increases patient's comfort, and allows resting or even sleeping.



Fixation of patient's pillow decreases needed interventions during ride.



More intimate parting & increased autonomy/control.



Better bedding compared to the currently used throw-outs.



### 5.7.2 Affected phases

The design is envisioned to affect various phases during the patient journey. Below, the effects of the design in the different phases are described.

#### Prepare for journey

Regarding the patient, the first affected touch point is during the phase 'prepare for journey'. This is the first moment of contact between the patient and the product and takes place when the stretcher enters the patient's room and the patient is secured onto the stretcher by the WAB volunteers. It is envisioned that the product radiates a visually pleasant appearance and therefore the expected level of comfort by the patient is envisioned to be higher when compared to the initial patient restraint system. In addition, due to the soft elements of the design, no hard sounds are present when the volunteers prepare the use of the restraint system inside the patient's room.

When the patient is being secured on the stretcher, the product provides a pleasant, homogeneous pressure against the patient's skin which is expected to give the patient a re-assuring feeling. Due to these aspects, the emotion line is envisioned to increase during this phase as the anticipation towards the wish ride and activity is experienced to be more pleasant.

#### Ride to wish location

The second affected touch point is during the phase 'ride to wish location'. In the initial Patient Journey Map, a dip was shown in the emotion line as distress and discomfort were experienced due to the patient being unable to find a comfortable position. These emotions were enhanced by the initial patient restraint system which caused pressure points on the patient's body due to incorrect positioning and shifting of the patient. In the envisioned Patient Journey Map. It is expected that the duration of distress is shortened as the patient is allowed to move and find a more comfortable position. The allowed movement by the product is limited to guarantee safety, however this is compensated for by providing a system which stays correctly positioned, minimizing pressure points. The patient is cocooned into the product, and the patient's pillow stays fixed throughout the ride. These aspects are envisioned to increase the likelihood that the patient is able to relax or even sleep, decreasing the experienced level of fatigue throughout wish day. The emotion line is therefore envisioned to increase during this phase. In addition, it is envisioned that the patient will feel in control earlier in the process due to these improvements than in the initial Patient Journey Map.

#### First goodbyes

The third affected touch point is during the phase 'first goodbyes', where the patient says her goodbyes to the family members who are not joining on the ride back home. In the current scenario, the patient is secured to the stretcher (for safety), the stretcher is put in elevated position by the WAB volunteers, and the patient is driven into the ambulance. Then the family members go in one-by-one to hug the patient and say their goodbyes. The order of events did not change in the envisioned scenario. However, the old system was relatively difficult to fasten inside the ambulance due to its different components resulting in the patient being restrained during saying goodbyes. The design however facilitates easy attaching and detaching of the product, in which the patient is able to have a more intimate parting. The restraint system can be easily released for the parting, and secured again when the goodbyes are said. The feeling of loss whilst saying goodbye to family members after a wish activity will remain, however it is expected that the emotion line will just elevate a bit due to possibility to be released of the restraint when saying goodbyes.

#### Ride to home

The fourth and final affected touch point of the patient is during the phase 'ride to home'. Similar to the phase 'ride towards wish location' it is expected that the increased level of experienced re-assurance and comfort will increase the likelihood of the patient to be able to rest and sleep during the wish ride. As the volunteer needs to intervene less (e.g. re-positioning the patient's pillow), the duration of the periods of rest and/or sleep is expected to increase, therefore also providing an increased emotion line.

### 5.7.3 Phases which were excluded

#### Arrival at wish location, the activity and prepare for return

Due to the selection of a memory-oriented ride as the scope of the project, the aspect of appearance of the patient is less prevalent as small wishes often take place in less public areas. However the product is expected to have an effect on the feeling of shame and pride of the patient as being presented during the user-test. This will affect the phase 'arrival at wish location', 'prepare for return' and dependent on the wish activity also on the phase 'the activity'. Due to the aim and scope of the project, its effect on these phases were not included in the envisioned Patient Journey Map. A more elaborate user study will be needed to analyze these aspects.

#### Closure (after-joy)

During a conversation with a former wish requester, it became clear that the patient is in need of days to re-energize after participating in a wish ride. It is expected that the product will influence the amount of fatigue the patient experienced throughout the wish day, and therefore also affect the days after the wish ride. However, as the scope did not focus on the phases after the wish ride, further research should be conducted prior to estimating the product's long term effect. Therefore the touch point in the phase 'closure (after-joy)' was highlighted, but no change in the emotion line was implicated.

#### Effects on WAB volunteers

The effect on the WAB volunteers is less prevalent in the Patient Journey Map as the emotion line of the patient remains unaffected by changes in touch points of the volunteers due to the absence of interaction between the patient and another actor. Therefore, prior to writing the conclusion to this chapter, the affected touch points of the WAB volunteers needed to be highlighted as well.

The affected touch points concerning the WAB volunteers were the phases 'pre-joy' and 'ride to wish location'.

The product requires additional preparation time of the volunteers prior to the wish ride, as the wrap part of the product needs to be assembled onto the stretcher in advance of departure towards the patient. As mentioned in use scenario, it is estimated to take the volunteers five minutes to prepare the product.

In the phase 'ride to wish location', it is expected that less interventions by the volunteer are needed due to less discomfort being experienced by the patient and due to the patient's pillow remaining correctly positioned.

**NEW!**

Figure 5.13 Envisioned improvements

No significant changes are envisioned to be present in the phase 'ride to home', as in the attended wish rides (and therefore, in the initial Patient Journey Map), the patient was more reserved during the ride home.

### 5.7.4 Conclusion

The product is expected to improve the patient experience during a variety of phases within the Patient Journey Map of conducting a wish ride with WensAmbulance Brabant.

The most major improvement is expected to occur during the ride towards the wish location, where the feeling of re-assurance and improved comfort of this new patient travel experience is envisioned to increase the likelihood that the patient is able to relax or even sleep, decreasing the experienced level of fatigue throughout the wish day. As consequence, the likelihood of the patient to succeed their set wish goals and being able to enjoy this special event to the fullest are envisioned to be improved.

Other aspects which are envisioned to contribute to this goal, are the re-assuring feel of the product in which the patient experience starts during the preparation for departure to wish location, the facilitation of a more intimate parting with family members at the end of the wish activity, and the ride home in which the benefits are similar to the ride towards the wish location.

Benefits during the wish activity and after the wish ride has been conducted are also expected to occur, but more field research would be needed in order to be able to correctly define them.

The benefits for the patient go hand in hand with the benefits for the WAB volunteers. It is expected that less interventions are needed due to the less discomfort being experienced by the patient and due to the product remaining correctly positioned throughout the ride. Safety of the volunteers is therefore envisioned to improve, as the time they remain seated and secured during the wish ride increases. In order to facilitate these benefits, additional preparation time of about 10 minutes in advance of departure from the ambulance depot is required to assemble the wrap onto the seatbelt system of the stretcher. The same time is needed for wrapping up wish day in which the wrap needs to be disassembled. Looking at the acquired benefits, this is regarded a reasonable trade-off.



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# 6

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In order to assess the final concept of this master graduation thesis, two evaluation moments were organized using the set-up of a System Usability Scale (SUS) (UCD Toolbox, 2018) in combination with a brief interview in order to gain a global view of subjective assessments of usability.

The tests provided new insights regarding the final design, and enabled the setup of recommendations.

## CHAPTER 6. **EVALUATION & CONCLUSION**

## 6.1 ASSESSING THE FINAL DESIGN'S (USER) EXPERIENCE

### 6.1.1 Introduction

The first evaluation focussed on the experience from the patient's point of view, thus the people who will be secured onto the stretcher using the product.

The goal of this evaluation was to assess to what extent the design meets the set design goal which was:

*"Providing a feeling of security, re-assurance and comfort whilst being restrained onto an ambulance stretcher."*

### 6.1.2 Research questions

In order to assess the design goal, the main question was defined as:

***"To what extent is the design being perceived as secure, re-assuring and comfortable?"***

Several sub-questions have been set up in order to find answers to this question:

- To what extent does the product make the participant feel re-assured whilst being secured onto an ambulance stretcher? And why?
- To what extent does the product make the participant feel comfortable whilst being secured onto an ambulance stretcher? And why?
- To what extent does the product make the participant feel safe whilst being secured onto an ambulance stretcher? And why?
- To what extent does the product make the participant feel restricted in movement whilst being secured onto an ambulance stretcher? And why?
- To what extent does the product make the participant feel confident whilst being secured onto an ambulance stretcher? And why?
- To what extent does the design support the likelihood of the patient to be able to relax whilst being secured onto the stretcher? And why?
- How do users value the aesthetics and tactile experience of the design?
- What are potential problems and suggestions regarding the overall experience?

### 6.1.3 Session set-up

The evaluation was conducted with Industrial Design Engineering students at the "Care room" of the faculty of Industrial Design Engineering (figure 6.1). The room's setting is similar to the rooms which were observed during attending wish rides and therefore deemed more realistic to the context which the product is designed for.

A prototype of the product was made for the evaluation sessions (figure 6.2), in which in this session the prototype was already assembled onto the stretcher prior to moment of contact with the participants, similar as in the use scenario.

The evaluation was conducted one-by-one. Participants were given a brief introduction to the project and consent to record the process was acquired. They were then asked to take place on the ambulance stretcher on which the design was already assembled, and evaluate the design. During the evaluation, the participants were asked to think out loud. Questions in order to stimulate this were prepared (Appendix J).

After the evaluation, the participants were asked to fill in an evaluation form consisting of ten-item scale (Appendix J). After each item, the participants were asked to explain their answer. A small reward was given for participation.

Similar to the previous conducted test, students were chosen as participants as it was deemed unethical to involve the real target group, who are terminally ill patients, in this stage of the design



Figure 6.1 Set-up of the test (lower)

Figure 6.2 Making the final prototype (upper)

## 6.1.4 Results

### Participant 1

When participant 1 first saw the design, he mentioned he was surprised by the click belt which has a more popping color than the rest of the prototype. His attention was drawn to that part of the design immediately and recommended to make it a softer color. He then started to touch the prototype and said it felt soft and comfortable to touch.

#### Procedure of securing the participant

The participant took place on the stretcher and was secured to the stretcher using the prototype. The first thing the participant did when laying on the stretcher was re-positioning the pillow, which was allowed for by the elastic bands. The student then proceeded to fasten the left wing. The participant re-positioned the part above the shoulder using his right hand, and then discovered there was a belt inside, which felt a bit uncomfortable.

Then the right wing was fastened, in which the participant discovered the pouch whilst the student was fastening. Prior to the product being secured wholly, the participant found a position he wanted to be in (figure 6.3).

The student then proceeded with fastening the click belt and leg belt. When the fastening procedure was completed, the participant mentioned that there seems to be a lot of steps needed to fasten him, and it felt like he was waiting till all steps were finished.

**Participant 1:** " ... simplifying this setting, so you can easily put all this stuff on the body and patient doesn't need to wait for ehhh... 2 minutes. Maybe that is a future direction, but for now I am really comfortable and would like to sleep."

**Student:** "Do you think you would be able to sleep in this setting?"

**Participant 1:** "Yeah, I think it is warm, soft, but being tied [to the stretcher] restricts me in my movement so over time I maybe will feel fatigued and sore. For now, I think the lower back has the most pressure."

**Participant 1:** "Overall, I think it was good. I can move my legs freely, I can turn my body...no I can't."

### Evaluation form

Participant 1 was quite positive as regards his answers and arguments on the evaluation form. The aspects which made the product re-assuring for him was the feeling that he was completely covered:

*"It is like something is surrounding you and protects you, instead of having a thin belt on your body. You can imagine if you want to tie a person, you use a rope. So the belt is not that big, so they are similar. For this one [the prototype], it is like... when you sleep you have ehh ... a kind of blanket... when you are scared at night, you can always put the blanket on your head. That why it feels like it protects you. Similar feeling."*

Due to the feeling of covered, the product did not make him feel anxious.

*"When I lied on down on the top, I just wanted to go sleep. So that makes me feel very comfortable and warm. And I know that there are a lot of caretakers around me, so I am being taken care of."*

The prototype in overall was experienced as quite comfortable. As the student noticed the participant re-positioned the belt during the process, the participant was asked how this influenced his comfort experience:

*"The only thing was maybe the belts on my shoulders, which exerted some pressure. But the rest was good. The belts maybe affect a little bit of the experience, but that could be personal. The overall experience was good and really comfortable."*

The participant then filled in his answer on the experience of safety, but when asked about the aspects of the prototype that made him feel safe, the participant struggled with the difference in definition between re-assurance and safe. The student asked the participant about what his definitions would be:

*" [Re-assuring is] everything is settled, settled down, everything is stable. So it works well. And to feel safe is that I won't get any injury, or I won't be hurt by any person, or this product will not harm me."*

On the question of feeling unsafe, the participant strongly disagreed.

*"Everything is soft, I don't see any metal or any pinch points."*

The participant answered neutral on the feeling of confidence, because he was not able to experience this feeling as it was not the real situation of the wish requester. This question would be more suited for the real life situation in which confidence would relate to the wish requester feeling confident that he or she would be able to reach their wish goal.

The participant slightly agreed on the product limiting his movement on the stretcher, in which he mentions that that is not negative as that meant feels he cannot fall of the stretcher. The inability to move however did not contribute to the feeling of safety for participant 1:

**Participant 1:** "The seatbelt makes me feel safe because I know how it works, I know it will protect me. But putting it on, doesn't make me feel safer. We are used to the feeling that a seatbelt in for example a car will protect us."

**Student:** "Is the fact that you don't see the seatbelt in the product, affect your feeling of being safe?"

**Participant 1:** "No, I think if I didn't see the seatbelt, it makes me feel more comfortable, and [the product would feel more] accessible. Or more, more... I just think I can deal with it peacefully when there is no seatbelt seen."

The participant mentions he could imagine he would be able to relax and sleep for short periods of time. For long, he would probably like to flip his body.

## SUMMARY

- Additional belt would benefit from a less popping color, as the participant's attention was immediately drawn to it prior to experiencing the prototype.
- The design was soft and comfortable to touch. Furthermore, it conveyed a feeling of protection and being cared for to the participant.
- The shape and position of the pouch were recognizable, therefore the participant intuitively put his hands inside the pouch.
- Not being able to see the seatbelts made the participant feel more comfortable, and made the product feel more accessible.





## Participant 2

The first impression of participant 2 of the prototype was that it looked cute. It did not look like other medical stuff, which would be expected when seeing the stretcher:

*"Other medical devices look hard and cold, and [the prototype] is like the pillow at my home. It is home-feeling."*

### Procedure of securing the participant

The participant then took position on the stretcher and was secured using the prototype. During the placement of the left- and right wing, the participant hold her hands up as she was not sure whether the student still needed use the space to perform action. The student mentioned the availability of the pouch, in which the participant then reacted by putting her hands in there (figure 6.4).

The participant mentioned the prototype is very comfortable. However, she was unsure about the capability of the patients to make the movements required to put on the product. Then, the participant explained that she became a bit nervous when the seatbelts were fastened because it feels like she is losing the control over herself.

When the product was fastened, the participant mentioned that although she cannot imagine how she would feel when driving or for a longer period of time, but for now she felt comfortable and sleepy and would be able to relax being secured in this way.

## Evaluation form

The participant found the product made her feel re-assured, but the interaction made her feel a bit anxious:

*"It is warm, it is soft. It feels like a hug of people. That makes me feel re-assured. By soft, I don't only mean the material. Because it has two layers and something in between. I also mean that."*

*"I don't think re-assured and anxious are polar sides. Because the material, touch, and feeling makes me feel re-assured, but the interaction makes me feel a bit anxious, because other people do that for me and I feel I lose the control of myself."*

The participant experienced the product securing her to the stretcher as comfortable, in which she left some space between agree and strongly agree because she is not sure how this would be over a longer period of time. The same was mentioned about the feeling of safety as in the set-up of the test, she did feel safe but was not sure about how it would be in a dynamic setting:

*"Because I do not know, if I would lay there for an hour or more, probably I would feel a bit more uncomfortable."*

*"I do not know what to expect during transportation. When the car is shaking or when it is turning the corner, I do not know how I would feel because the product is not tightly holding me down."*

The participant would feel confident about going on a journey using this setting, because it felt comfortable.

On the questions of freedom of movement, the participant mentioned that she did not feel limited because she could perform all the basic movement she wanted in the setting. Therefore, she was of opinion that sufficient freedom to move was provided for by the product.

*"I do not expect people wanting to do big movements during the ride."*

The participant felt like she was able to relax when being secured in the way the product facilitated, however some space was left because the uncertainty of when being seated for a longer period of time.



## SUMMARY

- The prototype conveyed a home-like feeling. The participant found that it looked cute rather than hard and cold like other medical devices.
- The participant felt a bit nervous having someone else securing her. It felt like she lost control over herself.
- The participant felt comfortable and sleepy, and would be able to relax in the setting which was provided. A dynamic, ambulance setting in which the test would be conducted over a longer period of time could yield more realistic results.
- The prototype felt like a hug to the participant.
- The required arm movements in order for the product to be positioned may be difficult for elderly to perform.

### Participant 3

Participant 3 first noticed the look of the stretcher, which made her feel anxious. In contrast with the product which looked gentle and friendly.

#### Procedure of securing the participant

After conducting the steps of securing participant 3, the student and participant noticed that the camera aborted in the middle of recording. Therefore, a debrief by the means of an interview was conducted (figure 6.5).

The product initially gave her the impression that securing would be difficult, but in the end it took just five steps which were intuitive for her.

*"In vijf stappen was super makkelijk. En het was... hoe zei ik het nou... intuïtief. De gaten zijn er, en je kon je armen erdoor heen steken. Dat is de enige energie die ik er in moest steken. Ik neem aan dat de patienten worden geholpen [door de vrijwilligers]."*

Furthermore she explained that the product met her expectations. One thing she mentioned was about the structure on the shell of the product, in which although she personally liked the pattern, for patients it could be maybe more abstract:

*"Doordat het er zo zacht uitzag, kreeg ik gelijk een sein van mijn brein dat het wel lekker zou moeten liggen. En dat deed het uiteindelijk ook. Daarom waren er geen inconsistenties."*

*"[De pouch], kon ik lekker mijn handen in doen en was lekker warm. De binnenkant van het product is heel fijn, omdat het lekker tegen je lichaam is. En de buitenkant voelde lekker aan, omdat je er met je handen overheen wrijft. Ik weet niet... sterretjes zijn opzich leuk, maar ik weet niet of de patienten dat leuk vinden. Het konden voor mij ook cirkeltjes of rondjes zijn. Maar het helpt zeker wel, dan ben je gewoon bezig."*

### Evaluation form

The patient found that the product made her feel reassured, because the product didn't look like a conventional seatbelt, but more like something that wraps you which unconsciously could revive the memories of when you were small and being taken care of.

Although the stretcher did make the participant feel a bit anxious, the product helped her to decrease that feeling:

*"Alleen gewoon "secured to the stretcher" als normale wijze dan misschien wel, maar dit product zorgt er wel voor dat het wat makkelijk en aangener maakt."*

The aspects which made the participant feel comfortable were the feel on the skin, because the product was made of fleece which was also recognizable. It provided her with a pleasant feeling.

The participant agreed to the product making her feel safe due to the surface area which was covered. The fact that no seatbelts could be seen did not negatively affect her feeling of safety:

*"De voornaamste reden om een gordel te gebruiken is om je veilig te voelen en dat je veilig wordt vervoert, en dit [product] heeft zoveel oppervlakte dat het een veiligheidsfactor aangeeft."*

*"Het feit dat je de gordels bovenin het product niet zag nam niet af aan de gevoel van veiligheid. Uiteindelijk, als je je bovenlichaam en onderlichaam moet vergelijken dan zitten er in je bovenlichaam organen, botten... heel veel dingen die je moet beschermen."*

The participant explained that her definition of feeling confident means that she would be able to stay calm through a journey using this set-up. And in this scenario, she would feel confident but she was doubtful about how she would feel over a longer period of time.

The participant then explained that she did experience that the product limits her in her movement on the stretcher. However, she did not see this as something negative. She also was of opinion that she sufficient amount of freedom was provided for by the product.

*"Ja agree, maar is niet slecht. Want het is voor je eigen bestwil en het is belangrijk om veilig vervoert te worden."*

*"Ja dat wel, zeker. Want ik kan gewoon mijn armen.. en mijn benen zijn ook nog niet ehh... Het is gewoon, het belangrijkste deel, de romp, die is gewoon vast. Het is gewoon een goede balans. Het beschermt de belangrijkste delen en de ledenmaten zijn los, die net mij de vrijheid en controle geven."*

*"Dat betekent dat ze ook nog even een ander liedje op kunnen zetten of handgebaren kunnen doen, en een deel van hun vrijheid behouden terwijl ze op de brancard zitten."*

The participant felt like she was seated pleasantly and therefore would be able to relax in this setting. Long-term would be unknown.

## SUMMARY

- The look of the stretcher made the participant feel anxious, in contrast with the product which looked gentle and friendly.
- The process of getting secured using the design was deemed intuitive by the participant.
- The lining (inside) fabric of the design felt pleasant to the skin, and the shell (outside) fabric was interesting to touch.
- The participant suggested using a more generic/abstract pattern as this may suit the target group better.
- The design made the participant revive memories of when she was small and being taken care of.
- The great surface area of the product made the participant feel safe.



Figure 6.5 Participant 3 explaining what she experienced by the means of a debrief interview

#### Participant 4

The fourth participant's first impression of the product was that it looked happy.

*"I think the color affects a lot of how I perceive this thing. Overall this feels like a random blanket that will be put on. So more like my family put this on me, instead of the hospital."*

#### Procedure of securing the participant

The participant took place on the stretcher and when attaching the wings over the participant, he started to stroke the left wing and mentioned that the prototype felt really comfortable (figure 6.6). More comfortable than he initially expected the prototype to be:

**Participant 4:** "This is really comfy. I like it. What is this texture? It feels like a small blanket."

**Student:** "Is it more comfortable than you expected?"

**Participant 4:** "Yeah, exactly, it actually feels more comfortable than I expected."

*"I am so glad I took a rest this morning, otherwise I would just fall asleep."*

After the securing process ended, the participant mentioned that the movements he had to make in order to be secured were not difficult.

He said that he can imagine that normally the volunteers would be available to help him position if he would not be able to. In addition, he mentioned that is does not feel like he is secured, because it is comfortable and therefore he feels like he is able to relax:

*"I don't feel being secured, actually. I feel very comfy, relaxed. Ehhh... well let's say I don't feel like I was fastened on something. I feel okay, I don't feel very dangerous. Well a bit wobbly. But that is okay. The grips help me to feel like I am not going to fall off. And this blanket feels it's like hugging me all around. So with this hug I feel quite safe, but I don't feel I am being tied on something. So I feel safe in a good way."*

*"Its more soft than I thought. A bit warm. But for an ill person, that might be a good thing. Because I know they don't want to be cold. Also their body temperature is lower than normal people's. So this is really helpful. Other than that, I think it is the feeling of I am surrounded by it. Also, somehow I can feel something here. Now that I touch it, I know it is a belt. But when I am not touching it, it feels like someone just has his arms around me. So this is a really good spot to me, that is something I cannot foresee by just looking at this blanket. When I looked at it, it was like "Oh it is just a blanket", but I did not expect something like this, this is good. Hmm ... any drawbacks... Let me think about that... No, not really. Feels quite good."*

**Student:** "At this moment, did you feel like you mentioned all things you wanted to mention?"

**Participant 4:** "I don't think the colors are consistent. This color (turquoise of the click belt) looks okay-ish. But it won't make me feel happy...yeah it's okay actually. But probably that is also a good thing. Because if the color looks way to happy for me, in the opposite effect I would feel like..."This is way too happy, I am not that kind of person anymore. I am pathetic. I am going to die." So I think there is a good balance. Then this color (dark blue, star-patterned), is not the color I would expect to bring to seriously ill patients. This color (turquoise of click belt) provides a medical feel. I think it is a neutral color in which you don't feel really bad, but also not happy."

*"To me, the pattern of this blanket and how the design is to bring up the feeling of warm and happier than just staying in the hospital. I guess that the colors can be more vibrant... I like the stars by the way... they are quite interesting."*

#### Evaluation form

The participant strongly agreed to the statement that the product made him feel re-assured:

*"So... re-assured for me means something like "everything is going to be okay-feeling". So I think, definitely, I really liked the feeling of it kind of like having a gentle pressure on my shoulder, and that feeling just reminded me of being hugged. That is the most strong... If it was only on the belly part of chest part, it wouldn't feel like that, but because it goes around my shoulder, it gives that huggy-feeling."*

For the same reasons, the participant did not feel anxious whilst being secured on the stretcher using the product. But he mentions that it would be different in a wobbling situation. That is why he selected general disagree instead of strongly disagree.

The product did make the participant feel "safe-safe", but it was like "comfy-safe":

*"I won't notice that I am well-secured in the stretcher, but that is because I also won't notice it is insecure. So... ehhh... I don't know how to put this, but like if you are sitting on this chair, you don't really care about if it will hold you well enough or not, because you know it will. But you also won't think "Oh, it is so well holding" because that is what it is supposed to do. The same goes for the product on the stretcher. It feels very safe and that is what it is supposed to do."*

*"I can feel them. I don't feel them as they are belts. I feel like they are a hug-around blanket. So, I feel safe because I can feel it not because I can see it."*

The participant felt confident about being secured to the stretcher. He related that a bit to feeling safe, in which it was mentioned that too much belts would negatively impact that feeling because you lose freedom, but a good balance makes confident.

The participant disagrees to the product limiting his movement. He feels that he wasn't necessarily tied up, whilst it was good that he could still move his arms and legs. He feels okay about not being able to move his torso.

*"Being able to feel the parts of the stretcher around me also makes me feel more secure that I won't fall off. And having my hands free also means I can use them to interact with my family and friends, so that is good. Maybe one thing I would like to do is choose whether I sit more up straight or more flat, so I then can have a bit more rest."*

The participant mentioned that the product does allow how sufficient amount of freedom of movement, and in overall he is definitely able to relaxed being secured using this product.

## SUMMARY

- To the participant, the design looked like something he received from his family, rather than something provided by a hospital.
- The design was experienced as being really comfortable, and would enable the participant to fall asleep.
- The design did not feel like being tied down on a stretcher, but more like something that hugged the participant.
- The participant did not notice belt being inside the design, until exploring the design by touch.
- Colors of the design could be more consistent (additional belt).
- Being able to move his arms was deemed a good thing as the participant felt like he would like to interact with his family being given the situation.



## Participant 5

When first confronted with the prototype, the fifth participant mentioned that it looked quite closed/secretive and expected that the prototype would be quite warm. He was unsure about whether he expected the product to be comfortable or not.

### Procedure of securing the participant

When securing the participant, he mentioned that the product caused some pressure points on his shoulders in which it was assumed that was caused by the height on which the prototype was assembled. The student then re-positioned the prototype on the stretcher's additional mattress to be higher. A second attempt to secure the participant was conducted in which this time it felt better. However, in order to do so, the participant had to be released and sit up straight in order for the prototype to be elevated (figure 6.7).

**Participant 5:** "Ik heb het gevoel zegmaar... dat normaal gesproken wanneer je een bodywarmer hebt, dan zit hij maximaal tot aan je schouder. Ik denk dat ik het fijner zou vinden wanneer ik mijn schouders open zou hebben"

**Student:** "Hoe voelt het nu?"

**Participant 5:** "Het voelt nu wel beter dan net... ik voel nog wel de gordel een beetje erdoor heen. Je zou wellicht nog een beetje meer padding mogen gebruiken."

**Student:** "Zou dat erg bijdragen aan je ervaring met het product?"

**Participant 5:** "Nou ik denk...ja.... die gordels hebben normaal een scherpe kant. Normaal zou ik mij daar niet aan hinderen, maar omdat de rest zo zacht is, valt dat opeens heel erg ook."

The student then proceeded with the question if there were other aspects that the participant would like to react upon:

**Participant 5:** "Voorderest voel ik mij redelijk vrij, ik kan mijn armen en benen nog gewoon bewegen. Gewoon prima. Als man, heb ik wel een beetje het gevoel alsof ik een jurk aan heb."

**Student:** "Betekent dat dat je vindt dat je het product niet zo bij je vindt passen, of begrijp ik dat verkeerd?"

**Participant 5:** "Hmmm... ik zou wel het gevoel hebben dat een laatste wens vaker gedaan zou worden door vrouwen dan door mannen. Het zou mij in ieder geval niks verbazen, zo zit het meer in mijn hoofd denk ik."

The student posed the question whether there are inconsistencies between what the participant expected the product to feel like and how it really feels.

**Participant 5:** "Nouja, ik vind het wel warm. Dat is het...Het is wel prima comfortabel. Ik denk wel dat je hier opzich goed in vervoert kan worden. Maar het is natuurlijk geen lange studie, dus als je hier twee uur in zou moeten zitten, dat zou ik niet durven te zeggen."

**Student:** "Voor nu, zou ik hier wel in kunnen ontspannen. Er is niks echt drukkends ofzo."

The student then posed a question about the interaction of securing the participant:

**Participant 5:** "Ja, om je armen door de gaten heen te krijgen. Dat vond ik lastig. Oudere mensen zouden daar wel hinder van kunnen hebben."

For this session, the student asked the participant to try and release himself from the prototype. The participant then proceeded in doing so in which he moved his left arm along the side of the stretcher in order to find the lock:

**Participant 5:** "Dit was op gevoel, want ik zag hem niet."

The right lock was then quickly found, and the participant got off the stretcher.

### Evaluation form

The participant mentioned the prototype made him feel slightly re-assured:

**Participant 5:** "Ik denk ja, een beetje, dat ik mij iets meer verzekerd voel omdat ik wel de banden voelde. De banden waren toch wel hetgeen wat mij me verzekerd liet voelen want de rest dat doe je om je heen en je denkt ja, ik lig daar."

**Student:** "Je bedoelt dat de deken geen toegevoegde waarde heeft?"

**Participant 5:** "Nee, niet heel veel... Ja wel iets, want je hebt wel het drukkende gevoel op je huid. Het was een prima gevoel dat je de twee dekens om je hebt, want dat geeft je hetzelfde gevoel als wanneer je in bed ligt, maar het liet mij me niet meer verzekerd voelen."

The product did not make the participant feel anxious.

On the question of comfort, the participant selected "slightly disagree" based on the interaction which was needed in order to put his arms through the prototype. He mentioned that slightly bigger holes could benefit the product, in which this would become easier.

**Participant 5:** "Als hij eenmaal aan is, zou ik "agree" zeggen."

On the question of safety, the participant mentioned he did feel safe. The aspects which contributed to that feeling were the belts which were noticeable. In the end, it did give the feeling of a harness.

**Participant 5:** "Ik zou met normale riemen hetzelfde antwoord gegeven hebben, maar het laat mij even veilig voelen als met normale riemen."

The participant felt that he would feel slightly confident using this setting for the journey. However, he did notice that he would have liked some support on the lower back.

Furthermore, the participant did not feel like he was that restricted in his movement, as he felt that he could move more than with regular seatbelts. Therefore he felt like sufficient amount of freedom to move was provided for by this product.

Then onwards to the last question which was about the ability to relax using the provided setting:

**Participant 5:** "In deze setting, ja. In een ambulance, die heel hobbelig is... mwah. Weet ik niet, vind ik lastig. In dit geval zeg ik "agree", maar dit zou iets lager uitvallen zoals "slightly agree" wanneer in de ambulance."

## SUMMARY

- The height on which the design is applied to the additional mattress, should be adjusted to the participant's height prior to the participants taking seat on the stretcher.
- The participant experienced the design to be a bit warm, but in overall quite comfortable.
- The movement required to position the arms through the design could be difficult for elderly to perform.
- Being able to feel the belts contributed to the participant's experience of safety.
- The participant experienced the product to be as equally safe as the original patient restraints.
- The participant was able to relax in the provided setting, but would expect this to be less in the dynamic situation.



## Participant 6

The sixth participant's first impression of the product was that it looked professional. She mentioned that the zippers made the product feel refined.

### Procedure of securing the participant

The student started with asking the participant if the height of the pillow was okay. After elevating it once, the participant confirmed it was okay. Then the prototype was used in order to secure the participant.

The first wing was attached in which the participant mentioned the movement of the arm feeling a bit awkward. When the second wing was attached, it went smoother as the participant now knew what to do (figure 6.8).

"Ja met de armen erin, was een beetje wurmen. Ik denk dat het zou helpen als de gaten naar beneden iets meer ruimte zouden bieden... als dat kan. Ik kan me voorstellen dat als je bejaard ben, dat je dat niet meer met je armen kan"

Then the participant proceeded with evaluating the prototype:

**Participant 6:** "Verder, ja, het is lekker warm. En je kan je handen kwijt. Dat is wel fijn. Ik zou wel neigen naar hem onder deze flap te doen."

"Het voelt wel veilig, ik heb wel het idee dat ik echt vast zit." "Ik heb niet het idee dat er ergens knelpunten zitten. Fijn dat je armen vrij kunnen bewegen, en ik voel me ook niet belemmerd bij mijn benen."

**Student:** "Waren er inconsistenties tussen hetgeen wat je verwachtte, en de situatie hoe het nu is wanneer je vast zit?"

**Participant 6:** "Hmmm... nee. Het zag er comfortabel uit, en het voelt ook comfortabel. Ik zit wel relaxed."

## Evaluation form

The participant agreed with the statement that the prototype made her feel re-assured:

"Want ik denk dat het feit dat je vast zit, maar wel de vrijheid hebt om je armen te kunnen bewegen een re-assuring gevoel geeft."

In this setting, the participant mentioned she did not feel anxious. However, she could imagine this would be different if the product would be placed in the ambulance:

"Ik kan me voorstellen dat als je ook nog in de ambulance zit, met toeters en bellen. Dat je meer anxious zou zijn."

On the question on the feeling of comfort, the participant mentioned that she did feel comfortable, in which this was majorly caused by the feeling of the materials:

"Ik voelde me comfortabel. Niet strongly agree, want dat met mijn armen. De aspecten die mij comfortabel lieten voelen waren het feit dat het wat dikker materiaal was. Het was gevoerd, dat maakte het wel comfortabel. Het grote kussen was ook fijn."

The participant also mentioned that she did feel safe, although not limited in movement:

"Verder, de gordels zaten absoluut niet te strak of te los. Ik voelde geen druk op mijn schouders."

"Ik heb wel echt het idee dat ik goed vast zit. Ik heb niet het idee dat ik eruit kan schieten of af kan vallen. Dat komt volgens mij door het gevoel dat ik op drie punten vast zit. Net als in de auto. Ik kon er niet onderdoor [schieten]."

"[Dat de gordel niet zichtbaar waren] deed niet af aan het gevoel van veiligheid. Je hoort ze klikken. Je hoort dus dat ze vast zitten. Je ziet dat ze vast gaan. En je voelt dat ze vastzitten. Ik probeerde nog omhoog te komen, maar dat lukte niet."

"Ik voelde wel dat mijn armen vrij waren en ik vond het fijn dat ik mijn benen kon bewegen. Ik hou er nooit zo van als je bij je enkels vast zit. Maar dat was hier helemaal niet het geval. Je kon gewoon vrij bewegen en ik kon nog een beetje omhoog komen."

"Ik denk dat je wel redelijk relaxed bent. Je kan je handen erin doen en je handen eruit halen. En nog je telefoon vasthouden ofzo."



## SUMMARY

- The participant's first impression of the design was that it looked professional.
- The process of positioning the arms through the design became easier over time. However, the required movement could be difficult for elderly to perform.
- Being able to store her hands, contributed to the feeling of comfort of the participant. In overall, the participant found that the design was comfortable.
- The participant initially tried to store her hands underneath the wings, rather than the pouch.
- Although the participant felt she was really secured to the stretcher, no pressure points were experienced.
- The design was recognizable for the participant (conventional seatbelts in the car), and this contributed to her feeling safe.

### 6.1.5 Conclusion

In overall, the product was well-received by the participants of the evaluation session, and provided them with a relaxing experience in which they felt re-assured, comfortable and safe (figure 6.9).

The parts that surround the shoulders, make that the product feels like a hug or something protective. The pressure which was exerted together by the belt and wrap was mostly experienced as something pleasant, whilst it was also mentioned that because the rest felt soft and comfortable, the participant became extra wary of the sharp edges of the belts when felt.

Participants mentioned that not being able to see the actual seatbelts contributed to the feeling of safety and re-assurance and made the design feel more accessible. Because of familiar aspects of the design with conventional seatbelt systems, there is a certain sense of trust of participants that the product will do what it is supposed to do. Therefore, all participants were of opinion that not being able to see the belts did not affect their experience in a negative way. The auditive- and haptic feedback provided by the design were therefore deemed sufficient to provide participants with a feeling of safety, and in overall the product was perceived as being at least equally safe as conventional seatbelt systems.

All participants found that the materials which were used felt nice to the skin and were pleasant to touch. Fleece was a material which participants quickly recognized, and reminisced them about being at home. Although some participants, at first impression, did not see a functional benefit in the terry pattern, a major part of the participant found it pleasant and interesting to touch when seated and secured.

The ability to perceive other parts of the ambulance stretcher contributed to the feeling of safety. For example, having the hands free enabled the participants to hold the arm supports of the stretcher which decreased their fear of e.g. falling off the stretcher. Also, it was mentioned that being able to use the hands whilst talking, interacting with friends and/or family or performing other activities was desirable.

Feedback on the interaction steps of securing the user were varied amongst participants. Several participants gave the feedback that they felt that they were waiting till the steps of securing were finished because no action from them, other than raising their arms, was required during the test.

One participant mentioned that the design was intuitive and seemed easy to assemble, whilst another experienced this as losing control.

Relating this back to the Patient Journey Map, it would be beneficial to assess individual patient needs prior to taking over steps the patients are willing and able to perform themselves in order to minimize the feeling of anxiety. This is provided for by the product, by making all securing points easy to reach from the patient's point of view, whilst in principle the placement of the securing points was defined by determining easy to reach places for the volunteers who, on attended wish rides, were the ones mainly performing the securing actions.

A bottleneck in the design which was observed throughout the evaluation, was the required movement of the arms during the securing interaction. Although no abundant movements are needed, the required movement of the arms could be hard for the patients to perform. Prior to the first wing being applied, the user who secures the patient should provide explanation and/or support on positioning the arm in order for the patient to perform the action with the least amount of effort. It was observed that after applying the first wing, the positioning of the arm to apply the second wing was more intuitive and could be performed with less trouble.

Recommendations provided by the participants on this part of the design consisted of providing more open space at the lower part of the arm holes.

In addition, the position of the product should be determined prior to the patient taking seat on the stretcher. The product can easily be re-positioned in height, but doing so when the participant was seated required effort of the participant to sit up straight after being positioned on the stretcher. This should be avoided when dealing with patients as they often deal with (motoric) limitations and fatigue. Therefore, in the use scenario, the position of the product should be confirmed prior to the patient taking seat.

Another recommendation given was to find a balance in the feeling that the product radiates. The product was perceived as being happy and/or joyful by the participants, and one of them mentioned that this could have a negative impact on the state of the patients who may feel the opposite way. A more neutral color scheme and/or an abstract pattern would therefore may be more suitable.

Although some participants were skeptical at first glance of the product, the outcome of the evaluation forms and the arguments which were given to support their answers were positive. This was interpreted as although some users might find the product not suitable to their character, they are able to pinpoint, understand and value the benefits which the design could provide on the wish journey.

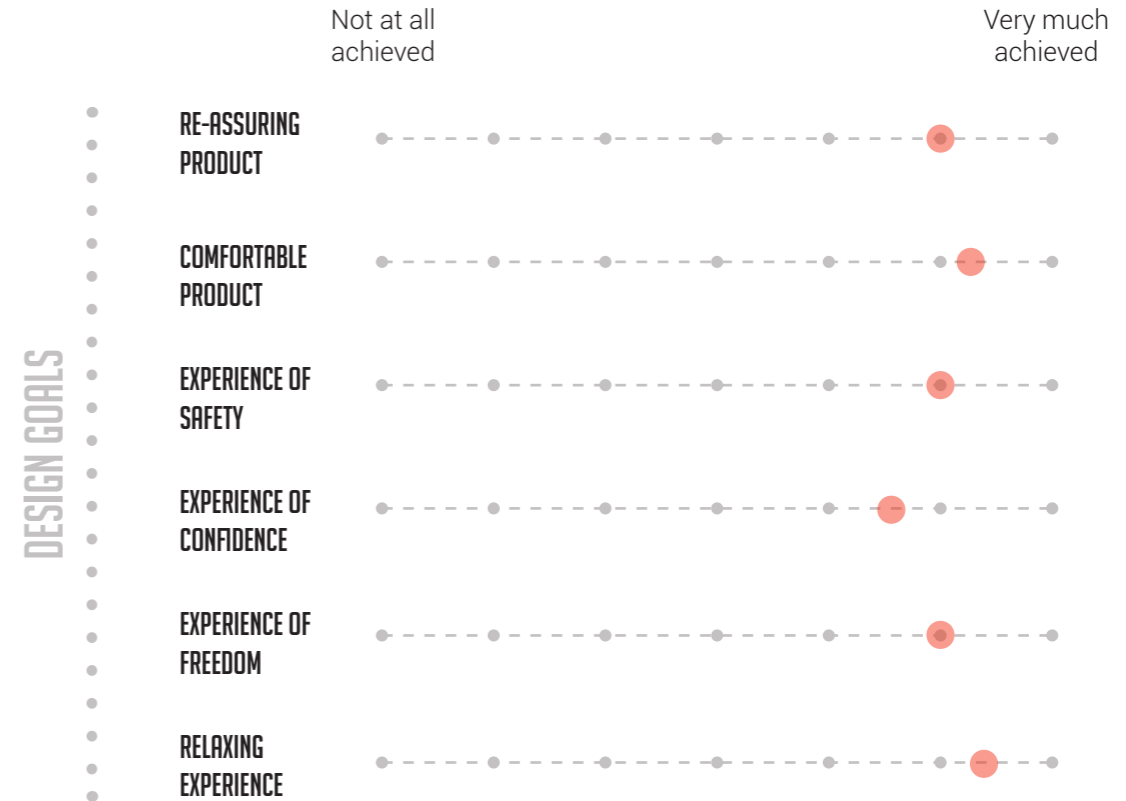


Figure 6.9 Conclusive visual of static, short-term study with IDE students

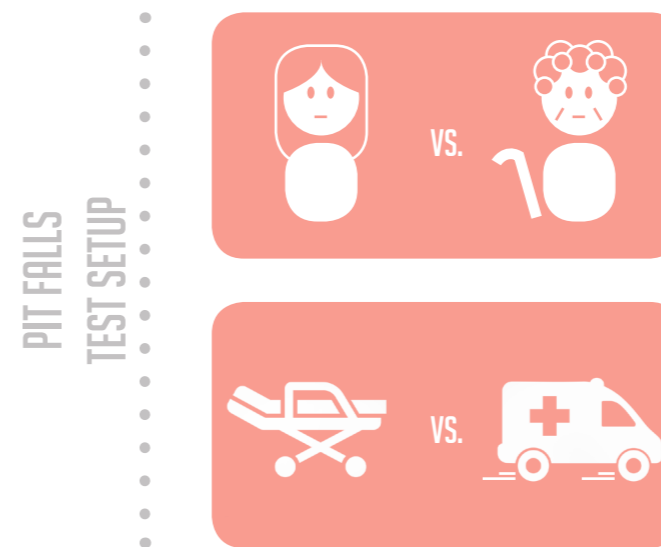


Figure 6.10 Pitfalls/downsides of test set-up

Multiple options were considered in order to set-up this evaluation, each accompanied by their advantages and pitfalls (figure 6.10):

First, the evaluation was carried out with IDE students rather than the real target group as it was deemed unethical to burden the terminally ill patients in this stage of the design, and due to the students being available and accessible at the moment the design was to be tested. However, terminally ill patients are assumed to be more sensible to the design features and it is recommended to include more comparable users in future studies, e.g. healthy elderly.

In addition, the prototype was evaluated in a static rather than a dynamic setting due to the prototype not being able to guarantee the passenger's safety if something were to happen in a dynamic setting.

These aspects most likely influenced the outcome of this evaluation, but were deemed sufficient in order to assess the design as is now. A recommendation for future studies, when the design reached a higher level of development, would be to carry out an evaluation in a setting closer to the reality.

## 6.2 ASSESSING THE FINAL DESIGN'S USABILITY

### 6.2.1 Introduction

The second evaluation moment was conducted with WAB volunteers at the ambulance depot at Valkenswaard, the Netherlands. This test focussed on the usability from the volunteers' point of view, thus the people who will be using this product to secure someone to the stretcher.

The goal of this evaluation session was to involve the people who will be asked to use this product, and evaluate the general usability of the product.

### 6.2.2 Research questions

In order to assess the general usability, the main question was defined as:

***"Does the design facilitate an effective and easy-to-use patient restraint system for the WAB volunteers?"***

***'Is the design envisioned to contribute to the wish ride experience?'***

Several sub-questions have been set up in order to find answers to this question:

- How did the volunteers experience the use of the previous patient restraint systems?
  - Did the volunteers experience any problems regarding the use of the previous patient restraint system?
- How do volunteers experience the use of the new patient restraint system design?
  - How do volunteers experience assembling the design onto the stretcher?
  - How do volunteers experience the use of this design to secure someone to the stretcher?
  - How do volunteers experience being secured to the stretcher using the design?
- To what extent is the design expected to decrease the needed amount of volunteer interventions during the wish ride?
- How do the volunteers value the aesthetic and tactile experience of the design?
- What are the tips and tops of the design?

### 6.2.3 Session set-up

A focus group with six WAB volunteers was organized and conducted at the ambulance depot at Valkenswaard (figure 6.11). An ambulance stretcher was made available for the evaluation session, and the prototype of the product was brought along for the evaluation.

The participants were briefed about the project, the design challenge and the goal of the day by the means of a summative presentation (Appendix K), prior to trying out the design and engaging in discussion (figure 6.12).

The participants were able to try out assembling the design onto the stretcher, securing each other using the design and thus experiencing being secured using the design, and releasing someone from the stretcher.

Questions regarding the product were posed, in which the volunteers then engaged in discussion in which they were allowed to interact and influence each other.

Consent for recording and using the footage was obtained prior to the start of the evaluation.



Figure 6.11 Focus group consisting of six WAB volunteers



Figure 6.12 Trying out the design

## 6.2.4 Results

Observing how the volunteers used the design, listening to them thinking out loud and discussing about the potential contribution of the design to the wish rides presented insights in the usability of the design.

All volunteers were able to try out securing someone to-, and being secured to the stretcher using the design, and give their input. All volunteers found that the design facilitated a comfortable way of being secured to the stretcher, in which the major improvements were mentioned to be the lack of pressure points on the body, and the absence of the weight of the securing mechanism around the belly area. In addition, securing someone to the stretcher using this design was regarded intuitive and easy to perform.

### **A desire to enable the patients to lie on their side**

During the evaluation, it became clear that the volunteers have a strong desire to have the ability to allow the patient to lie on their side. Therefore different ways of making that possible using the design were tried out. The volunteers tried out securing someone whilst being in a sideways lying starting position, in which the wings of the wrap were not able to be correctly positioned as one lock became unable to reach, and one arm could not be put through the wing (figure 6.13). This resulted in an end-result which was envisioned to be unsafe.

Then the volunteers tried out securing someone whilst lying on the back, in which the person who was being secured then rolled over to his/her side (figure 6.14). Sufficient freedom to move was provided by the design in order to allow this, in which the hip belt needs to be loosened a bit.



Figure 6.13 Unintended



Figure 6.14 Sufficient freedom provided in order to roll on side

### **Sizing of the design features**

The participants of the focus group consisted of different sizes, in which it was observed that the size of the wrap does both fit a bigger sized male (figure 6.15) and smaller sized female (figure 6.16). However, the additional clip and strap which puts tension on the diagonal seatbelts should be made shorter in order to sufficiently secure the the smaller sized patients.

In addition, it was mentioned that the patients would benefit from decreasing the height of the design, as they prefer open space around the neck area (figure 6.17).

### **Materials of the design**

Similar to the evaluation with IDE students, the materials of the design were regarded comfortable and pleasant to touch. However, it would be desirable to use lining material which has better capabilities to provide ventilation, especially if wish rides were to be conducted on days similar to the day of the evaluation in which it was 38 degrees.

In addition, a small suggestion was made to provide a terry pattern with a theme which would fit the patients more, e.g. travelling.



Figure 6.17 Access wrap material around



Figure 6.16 The design fitting a smaller sized female



Figure 6.15 The design fitting a bigger sized male



### Assembly of the design onto the stretcher

Whilst debriefing the evaluation, it became clear that improvements could be made regarding the ease of assembly of the design onto the stretcher. The assembly of the design was envisioned to be quick and easy, but experienced differently by the volunteers who just had their first experience with the design (figure 6.17).

The volunteers experienced the assembly as quite difficult, in which this was mainly caused by the assembly of the seatbelt system ("which seatbelt goes where"). It was expected by the volunteers that the assembly of the design would cause problems for volunteers who do not often execute a wish ride.

A more intuitive assembly process was therefore desired in which the volunteer suggestions included a color coding system of the belts and mechanics, enabling assembly of the belts on top- instead of inside the wrap, a click-onto-the-stretcher system in which there is no need to separate the wrap and seatbelt system (it was mentioned that the costs would not be an issue), and a chart with clear instructions on how to assemble the product in which this could be placed on the backside of the stretcher.

### Modularity

A discussion was held regarding if modularity of the design components would be beneficial. Whereas being able to e.g. remove the wings of the wrap could potentially increase the amount of patients willing to use the product, the risk of losing components during wish day poses a threat.

The volunteers were of opinion that everyone has a shared responsibility to return the wish-ambulance with all its components after a wish ride, in which one of the founders, Giel van Genugten, explained that this turns out differently in practice. For example, at the moment of the evaluation, two out of four wheelchair cushions were missing.

A potential solution would be to provide a design in which the components can be removed, without the removed components being loose components.

In addition, two volunteers (caregivers) posed the question whether it would be able to secure one arm inside the wrap, whilst one being outside the wrap due to some patients suffering from a disease in which they are no longer able to sufficiently move their arm(s).



Figure 6.17 Struggling to assemble the design

### 6.2.5 Conclusion

In overall, the design was well-received by the WAB volunteers who joined the evaluation session.

Multiple recommendations for the design to be improved were extracted, and the core goal of the design, to facilitate a more comfortable and pleasant wish ride experience in order to fulfill wish goals, was validated.

### TIPS

- **Ventilating material:** Use ventilating materials, as it is easier to add warmth than to remove it.
- **Easy assembling and disassembling:** Provide an easier way of assembling and disassembling in order for the volunteers to be able to quickly apply- and use the design, e.g. using loops on top of the wrap or using color coding on the belts and securing mechanisms.
- **Modularity without loose components:** Enable the removal of wrap components without it being loose components
- **Open space around the neck:** Make the collar of the wrap a bit lower as patients prefer open space around the neck as this enables better breathing.
- **Different positions:** Research whether the design facilitates sufficient safety when not all arms are positioned outside the wrap

### TOPS

- **Comfortable restraint system:** A comfortable way of being secured in which pressure is distributed homogeneously, resulting in no pressure points. Especially removing the weight of the belt lock on the belly area was desirable.
- **Ability of lying sideways:** Enabling the patients to lie on their side whilst remaining secured is a big improvement, as the current seatbelt system does not facilitate this unless the restraints are removed, impairing the patient safety. It is expected that this feature will make the wish ride more pleasant for the patient as lying sideways is a more natural position (van Genugten, 2018).
- **Easy securing and releasing:** The steps which needed to be undertaken in order to secure- and release someone from the stretcher were regarded easy to perform.

## 6.3 RECOMMENDATIONS

The final evaluations provided new insights regarding the design, in which these could be taken into account for future development:

### 1. Minimize required effort by patient

Through the final evaluation with IDE students, it became clear that the required movement of the arms in order for the volunteers to apply the design could be hard to perform by terminally ill patients. A next iteration on this design should therefore include research on how to secure the patient in such a way that the least amount of effort is required by the patients, whilst keeping the design easy to use by the WAB volunteers.

One could think of an elastic connection between the mattress overlays and wings of the design, in which the requirement of the patient's arm to move backwards is substituted by the ability of the design's arm holes to move forward temporarily when securing.

Another way of thinking could be exploring whether the volunteers could help and position the patient's arms throughout the securing process, in which the positioning should require the least amount of effort by the patient (figure 6.18). This could however contribute to the loss of control which the patient could already be experiencing, and could therefore affect the experience in a negative way.



Figure 6.18 Arm positioning which required the least amount of effort of patient: Place hands over each other > When wing is placed over the body, move arm outward.

### 2. Account for temperatural differences

Throughout the process (especially when performing tests on warm days) it became known that the materials which were specified for the design could cause the patient to be too warm.

More research on available materials, or ways to tackle this issue is therefore recommended. Although fleece has desirable material properties and has proven to be comfortable for the patient's skin, a less insulating material could be beneficial. One could think of using spandex, which is now widely applied in apparel where stretch, comfort and fit is desired such as active wear, bra straps and skinny jeans. Or implemented a fine mesh in the fleece, through which air could travel.

During a visit to Vicair, it became known that fleece is often used during a first batch due to its comfort and it being cheap. Therefore, it could also be chosen to produce a first batch with fleece, evaluate, and go from there.

### 3. Different colors and patterns for different patients

Throughout the final evaluation, it became clear that the chosen colors and pattern of the prototype may be too joyful for certain patients, in which the statement was mainly aimed at the shell (outside)- rather than the lining (inside) fabric.

A darkish blue color and the implementation of a pattern on the fabric were selected to hide potential dirt on the fabric over use (comfort model) and due to positive feedback through the initial user test. However, variation in colors and type of patterns could be researched to define a better fit for the target group, in which retaining the home-like feel of the design is recommended.

By providing multiple color options and/or by using a fitting main theme for the pattern (figure 6.19), the design could better fit different types of wish requesters. This could potentially counter the idea of the product to be mainly suited for females.

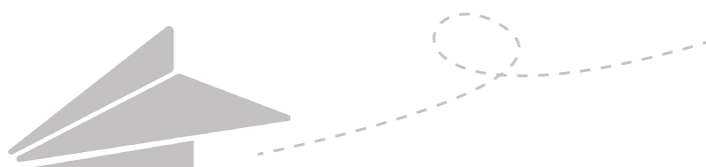


Figure 6.19 Design students from St. Lucas (MBO) came up with a travel theme pattern for WAB, to be used as interior foil. If succesful, this theme could potentially also be applied to the Patient Wrap.



Figure 6.20 Enjoying the wish activity without the need to be secured to the stretcher. Pictures acquired from WAB's facebook page.



### 4. Modularity vs. risk of loss of components

Through the design process it became clear that the least amount of products is desired inside the ambulance due to the possibility of the volunteers losing the product throughout the different events on wish day. The final design of this project therefore consists of two main parts: the seatbelt system which remains assembled onto the stretcher, and the wrap which is assembled prior to departure from the ambulance depot and dissembled after returning at the depot.

In the wish rides which were attended throughout the project, all patients had the desire to attend their wish activities by wheelchair. However, it is known that some patients remain seated on the ambulance's stretcher during their wish activities in which the seatbelts are released (figure 6.20), and that some patients may have a desire to travel without the wings of the wrap.

In these cases, it could be beneficial for the volunteers to have the ability to remove and add certain features of the design. For example, the ability to remove the wings whilst the pillow holder remains on the stretcher.

More research should be performed to create an overview of desirable configurations of the design, in which solutions which do not require loose components should be explored (figure 6.21).



Figure 6.21 Quick illustration of solution example: Roll up the wings when not desired, whilst they still stay attached to the rest of the design.

### 5. Collaborate with hospitals and/or hospices

The one-time use blankets currently used by WAB provide the benefits that they are easy to maintain (throw-out) and cheap to obtain (for free at hospitals). The design proposal however is intended to be used for a longer period of time, in which hygiene plays an important role.

The use scenario (figure 5.10) proposed the purchase of four washing machines to be installed at the four ambulance depots, in which the used wraps can be washed bi-weekly. This was deemed the easiest option as no other parties were involved and therefore would require the least amount of organization.

Another option to solve this could be to use WAB's existing relationships with hospitals and/or hospices, and explore the possibility to include the wraps in their daily amount of laundry.

This requires a higher amount of organization, but could also establish vast relationships with the facilities WAB often visits. These facilities could maybe also provide materials in order to produce the wraps which would decrease the costs for WAB.

## 6. Easy assembling and disassembling of the design onto the stretcher

Through the evaluation with WAB volunteers, it became clear that the steps which need to be undertaken in order for the volunteers to assemble and disassemble the design from the stretcher were not as intuitive as was intended. This could cause problems for, for example, volunteers who did not execute a wish ride in quite a while, and who need to use the design.

Therefore, the steps in order to assemble or disassemble the design should be more intuitive. The WAB volunteers who participated in the evaluation session came up with interesting solutions to tackle this problem.

As a designer, the color coding solution (figure 6.22) was deemed the most promising (low-stake) solution as this does not affect other desirable features of the design such as not having the belts visible for the patient, or low costs.

However, during the final evaluation WAB has mentioned that costs are less of an issue when there are relevant advantages for the wish requester to be gained. Therefore, solutions regarding click-on-the-stretcher systems could also be explored (figure 6.22).

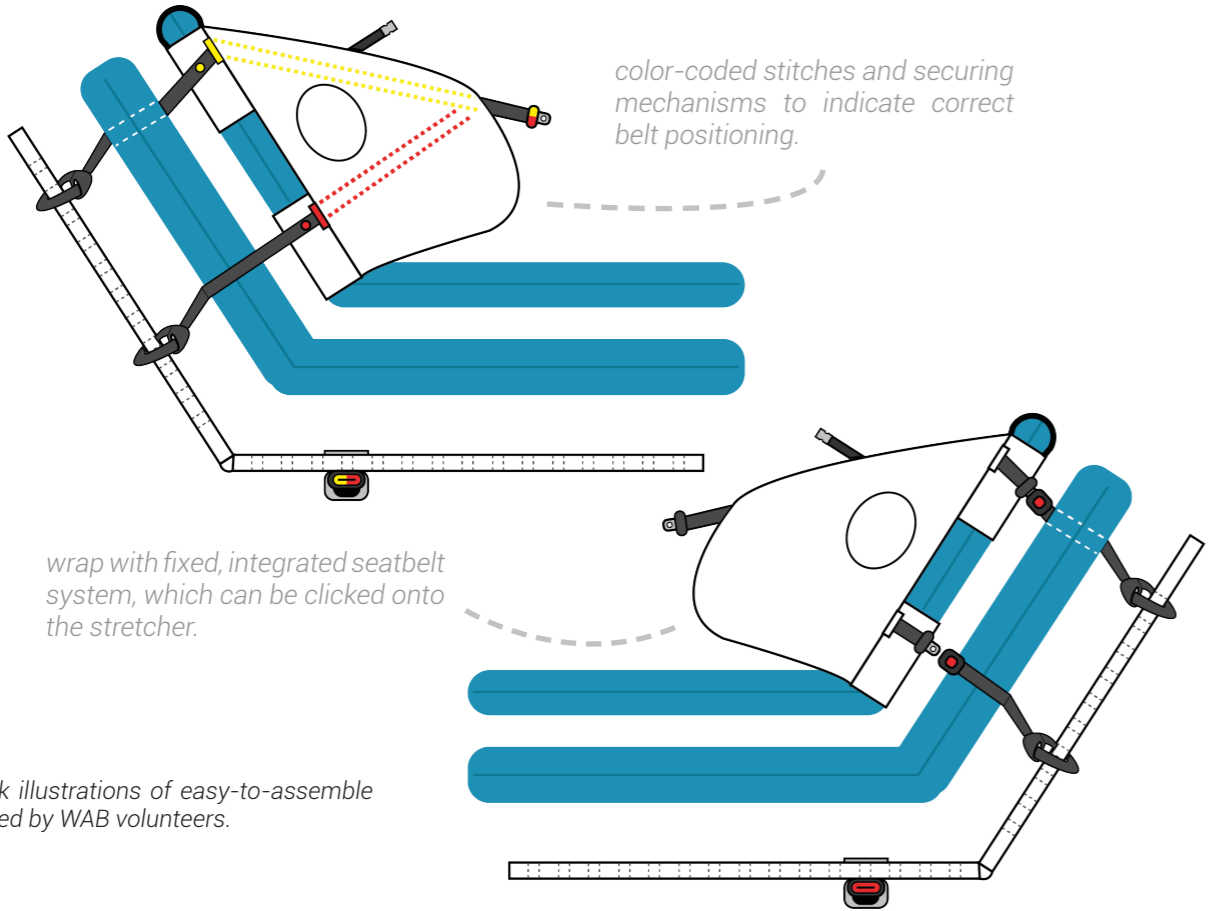


Figure 6.22 Quick illustrations of easy-to-assemble solutions proposed by WAB volunteers.

This graduation project started out with the goal to improve the wish ride experience for terminally ill patients, their loved ones and the volunteers of WensAmbulance Brabant, facilitated by WensAmbulance Brabant. Effort is put in providing the patients and their loved ones a pleasant journey towards that one special place they are enabled to visit for one more time.

Through an extensive user- and context analysis, a comprehensive example of a memory-oriented wish ride was created and a Patient Journey Map could be established. From this Patient Journey Map, four design search areas could be extracted, ranging from comfort improvement to the facilitation of a travel experience.

Combining the core elements of these design search areas, resulted in the goal to design a patient seatbelt system that optimizes patient safety- and comfort during a memory-oriented wish ride, whilst simultaneously providing terminally ill patients a feeling of security and re-assurance.

This optimization addressed the core goal of WensAmbulance Brabant which is to fulfill one last wish. Being able to provide someone a comfortable and pleasant experience, and make them feel more re-assured during the wish ride was envisioned to enable patients to go the extra mile and fulfill their wish goals. Ultimately, decreasing the chance that wish rides are aborted halfway due to restrictive symptoms such as fatigue whilst safety of both the patient and volunteer is not compromised.

The prototype of the proposed solution, the Patient Wrap, delivered proof of concept that the idea is feasible and addressed various patient-, family- and volunteer needs. The design decreases the patient's anxiety prior to engaging in the wish ride and when the first goodbyes are being said, is envisioned to improve the patient's ability to rest or even sleep during the wish ride as point pressures are removed and sufficient freedom to move is enabled, and provides an accessible solution for WensAmbulance Brabant to ensure patient- and volunteer safety.

During this emotional event in which prevention of anxiety and fatigue are essential in order to ensure the fulfillment of someone's last wish, the Patient Wrap could make the difference. It is envisioned to contribute to the unique travel experience which is facilitated by WensAmbulance Brabant, place the accent on the joy (of being together) and closure rather than the hardships, and gives a feeling of being hugged and protected during ...

*Your one last wish.* 

This graduation project, and the graduation period in general, was a time full of challenges and moments of gratitude. Not only did the project challenged me as a designer, it also challenged me as a human being.

Complying with the great variety of stakeholder needs and wishes, and integrating this in one consist design was very challenging, as well as working in the emotional context regarding the fulfillment of someone's final wish. In order to come to a positive end result, I needed to autonomously plan and execute a design project within 20 weeks, in which I needed to show I can effectively collect, analyze and integrate knowledge required for the project in which meaningful insights needed to be extracted in order to deliver a relevant project outcome desired by- and beneficial to the different project stakeholders. In addition, effective and clear communication was needed to adequately keep every stakeholder up to date about the advancement of the project, and to retain valuable feedback.

I went into the project with my go-getter approach, focusing on making sure that in the end something useful would be there to present to my supervisory team and company clients. This personal trait was very beneficial during multiple phases of the project, but I learned that it can also hold you back as a designer.

I learned that sometimes it is needed to let go of the structure and "what should already be there" for a bit, and distance yourself from the project in order to gain an overview of what is there, and deciding on how to tackle the next step. My supervisory team and I talked about this now and then, but I think it started to take effect just after having finalized my final evaluations.

*"During the project I was so busy in pursuing my goal, that I sometimes struggled to see the bigger perspective."*

I think exactly this distancing was the most challenging for me during the project, and would have benefitted the quality of my work the most when implemented earlier on in the project.

All my capabilities, good and bad, were required to make the project a success, taking up my full attention span. Whilst in a design team roles are, in my experience, divided in a natural way, in which your weak suits are outweighed by someone else's strong suits, and together you make it a success. I should have put more effort in allowing myself to distance from the project by e.g. facilitating a creative session with other designers during ideation.

During my master, I became more and more aware that project management, team functioning and planning were part of my strong suits, whereas during the project I learned that I still need to work on dealing with phases which are not as structured as I prefer them to be.

Although the hardships were definitely there, I look back at graduation as a time to be treasured. I did achieve what I wanted in the end when looking back at the personal ambitions I set out prior to starting the project, and at the end result: a desirable contribute to what could be someone's last journey.

I am forever honored and grateful to have gotten the possibility to design for such a kind, humble and generous initiative. This project reflected me perfectly as a designer, and if I were to continue to pursue my career as in design, my own wish would be to continue working on projects like these, where I am given the possibility to provide people with a little moment of happiness, and make the world a better place, in my own way.

## REFERENCES

- Ambulancezorg Nederland (2018). *Ambulancezorg*. Retrieved from <https://www.ambulancezorg.nl/ambulancezorg>
- Bocattery (2018). *The difference between velour and terry*. Retrieved from <https://www.hunker.com/13411370/difference-between-terry-cloth-fleece>
- CBS (2018). *Bevolking; geslacht, leeftijd, burgerlijke staat en regio, 1 januari*. Retrieved from <http://statline.cbs.nl/StatWeb/publication/?PA=03759ned>
- Chaudhry SI, Murphy TE, Gahbauer E, Sussman LS, Allore HG, Gill TM. *Restricting Symptoms in the Last Year of Life; A Prospective Cohort Study*. JAMA Intern Med. 2013;173(16):1534–1540. doi:10.1001/jamainternmed.2013.8732. Retrieved from <https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/1710124#full-text-tab>
- Clothpadshop (2018). *Understanding fabrics*. Retrieved from <http://www.clothpadshop.com/main/article-04/>
- De Monitor (2017). *Feiten en cijfers over ouderen die langer thuis wonen*. Retrieved from <https://demonitor.kro-ncrv.nl/artikelen/feiten-en-cijfers-over-ouderen-die-langer-thuis-wonen>
- DifferenceBetween.net (2018) *Difference between knitting and weaving*. Retrieved from <http://www.differencebetween.net/miscellaneous/difference-between-knitting-and-weaving/>
- DINED (2018), *1D Database; Dutch elderly geron1998 and gdvv1984*. Retrieved from <https://dined.io.tudelft.nl/en/database/tool>
- Direct textile store (2018). *Healthcare blankets | Hospital blankets (filter: 100 % fleece)*. Retrieved from <https://directtextilestore.com/healthcare-blankets&filter=153>
- Direct textile store (2018). *Healthcare blankets | Hospital blankets (filter: cotton blend)*. Retrieved from <https://directtextilestore.com/healthcare-blankets&filter=206>
- Eburn, M. (2014). *Ambulance, driving and road rules; seat belts in an ambulance – Victoria*. Retrieved from <https://emergencylaw.wordpress.com/2014/09/17/seat-belts-in-an-ambulance-victoria/>
- Gerhardts, A. (2016). *Textiles used in hospitals and medical offices – germs don't stand a chance*. Retrieved from [https://www.medica-tradefair.com/cgi-bin/md\\_medica/lib/pub/tt.cgi/Textiles\\_used\\_in\\_hospitals\\_and\\_medical\\_offices\\_%E2%80%93\\_germs\\_don%E2%80%99t\\_stand\\_a\\_chance.html?oid=79642&lang=2&ticket=g\\_u\\_e\\_s\\_t](https://www.medica-tradefair.com/cgi-bin/md_medica/lib/pub/tt.cgi/Textiles_used_in_hospitals_and_medical_offices_%E2%80%93_germs_don%E2%80%99t_stand_a_chance.html?oid=79642&lang=2&ticket=g_u_e_s_t)
- Goossens, R. (2018). *Design in Healthcare: Using Patient Journey Mapping*. Retrieved from <https://courses.edx.org/courses/course-v1:DelftX+MED01x+1T2018/course/>
- Graciousstyle (2018). *What is terry cloth?* Retrieved from <https://www.graciousstyle.com/blogs/terry-cloth/>
- Green, J. (2013). *Collaborative development of ambulance crash safety standards: A progress report*. Retrieved from <https://www.nasemso.org/Meetings/Annual/Presentations2013/documents/Ambulance-Standards-James-Green-NIOSH.pdf>
- Grossman, M. (2018) *What is velour and how does it differ from velvet*. Retrieved from <https://www.conrado.co.uk/blog/what-is-velour/>
- Herculite (2018). *Antimicrobial fabrics in the medical textile industry*. Retrieved from <http://www.herculite.com/blog/antimicrobial-fabrics-in-the-medical-textiles-industry>
- Hunker (2018). *Difference between terry cloth & fleece*. Retrieved from <https://www.hunker.com/13411370/difference-between-terry-cloth-fleece>
- Ijzershop (2018). *Plaat RVS 1000x500x2 mm*. Retrieved from <https://www.ijzershop.nl/461-plaat-roestvrijstaal>
- Ijzerwarenwebshop.nl (2018). *Gespsluiting 20 mm*. Retrieved from [https://ijzerwarenwebshop.nl/gespsluiting-20-2-pom/?gclid=EAIaIQobChMI\\_4qmnvjm2wIVhvdRCh2mlAMBbEAQYASABEgIko\\_D\\_BwE](https://ijzerwarenwebshop.nl/gespsluiting-20-2-pom/?gclid=EAIaIQobChMI_4qmnvjm2wIVhvdRCh2mlAMBbEAQYASABEgIko_D_BwE)
- IKEA (2018). *Tilkört*. Retrieved from <https://www.ikea.com/nl/nl/catalog/products/40271853/>
- Joan's comfortschuim (2018). *4mm rits optilon zwart*. Retrieved from [https://www.schuimrubberbetaalbaar.nl/ritsen-en-schuivers\\_33/4-mm-rits-optilon-zwart\\_583.html?gclid=EAIaIQobChMI77SY9vjm2wIVSSOZCh0VRwdLEAKYCiABEgLM-vD\\_BwE](https://www.schuimrubberbetaalbaar.nl/ritsen-en-schuivers_33/4-mm-rits-optilon-zwart_583.html?gclid=EAIaIQobChMI77SY9vjm2wIVSSOZCh0VRwdLEAKYCiABEgLM-vD_BwE)
- Kessler (2018). *The five stages of grief*. Retrieved from <https://grief.com/the-five-stages-of-grief/>
- Kollies parts (2018). *Moer M8 RVS*. Retrieved from [https://www.kolliesparts.nl/nl/moer-m8.l?source=googlebase&gclid=EAIaIQobChMIxrSs4Pnm2wIVAV8ZCh3w7gF\\_EAkYBSABEgJMc\\_D\\_BwE](https://www.kolliesparts.nl/nl/moer-m8.l?source=googlebase&gclid=EAIaIQobChMIxrSs4Pnm2wIVAV8ZCh3w7gF_EAkYBSABEgJMc_D_BwE)
- Loscalzo, M.J. (2008). *Palliative Care: A Historical Perspective*. ASH Education Book. 2008:1(465). Retrieved from <http://asheducationbook.hematologylibrary.org/content/2008/1/465.full>
- Mountain warehouse (2018). *Sleeping bag guide*, Retrieved from <https://www.mountainwarehouse.com/expert-advice/sleeping-bag-guide/#temperature-ratings>
- Nannen, P. (2014). *Improving the experience of lumbar puncture for children*. Retrieved from <https://repository.tudelft.nl/islandora/object/uuid%3A89f358da-cc93-4744-94d7-50860bb64e9a?collection=education>
- Microban (2018) *Silvershield*. Retrieved from <https://www.microban.com/odor-control/technologies/silvershield>
- Minerva crafts (2018). *Polycotton fabric*. Retrieved from <https://www.minervacrafts.com/shop/fabric/dress-fabrics&type=Polycotton>
- Naaiplezier.nl (2018). *Bandelastiek 25mm zwart*. Retrieved from [https://www.naaiplezier.nl/elastiek-25-mm-effen/bandelastiek-25mm-zwart.html?gclid=EAIaIQobChMIkurvk\\_zm2wIVAKTTCh2YMgzfEAKYDiABEgLRofD\\_BwE](https://www.naaiplezier.nl/elastiek-25-mm-effen/bandelastiek-25mm-zwart.html?gclid=EAIaIQobChMIkurvk_zm2wIVAKTTCh2YMgzfEAKYDiABEgLRofD_BwE)
- National Hospice and Palliative Care Organization (NHPCO) (2018). *History of Hospice Care*. Retrieved from <https://www.nhpc.org/history-hospice-care>
- National Institute on Aging (NIH) (2018). *Providing comfort at the End of Life*. Retrieved from <https://www.nia.nih.gov/health/providing-comfort-end-life>
- National Institute on Aging (NIH) (2018). *What are palliative care and hospice care?* Retrieved from <https://www.nia.nih.gov/health/what-are-palliative-care-and-hospice-care>
- Nicassio, P.M., Moxham, E.G., Schuman, C.E., Gervirtz, R.N. (2002). *The contribution of pain, reported sleep quality, and depressive symptoms to fatigue in fibromyalgia*. Ovid. 2002:100(3):271-279. Retrieved from <http://ovidsp.tx.ovid.com/sp-3.28.0a/ovidweb.cgi?QS2=434f4e1a73d37e8ca9c2ed569e2a6bcb5f013a40bf31846c1c9ca23a7f756dc50a486f461b4cf1c565772823fa1da5daca0a6e97592bbe8518a97fb666cd486859197a51c2e7fc23c0a86b77b6376e-de5a301831f8a3a9436c21cca48f027f797ec0b0c3e-7989d51e56f2077b05f44c29eb67e90fcc99508a9d16f0a0e-1c5b2f0783f82408c73b630f7db67f4246042fb13b37301f-5b66c4858a2e4d450d6544253489ae5a61688785a9fc8d-b204f1435f10aba1cdce1b24d7be1d07d6e769ad637ddf-3d7e7e5e933a432357af0d3f2891bd0906fa54b826c038b-042434989528041f1a8eece555676c7fb6487e283e6>
- Palliatieve zorg (2018). *Historie*. Retrieved from [http://www.palliatievezorg.nl/page\\_895.html](http://www.palliatievezorg.nl/page_895.html)
- Payscale (2018). *Seamstress salary*. Retrieved from [https://www.payscale.com/research/US/Job=Seamstress/Hourly\\_Rate](https://www.payscale.com/research/US/Job=Seamstress/Hourly_Rate)
- Radbruch, L., Strasser, F., Elsner, F., Ferraz Goncalves, J., loge, J. Kaasa, S. Nauck, D., Stone, P. (2008) *Fatigue in palliative care patients – an EAPC approach*. Palliative Medicine. 2008: 22: 13-32. Retrieved from <http://www.eapcnet.eu/LinkClick.aspx?fileticket=afqAmAG2hul%3D>
- REI (2018). *How to choose sleeping bags for backpacking*. Retrieved from <https://www.rei.com/learn/expert-advice/sleeping-bag-backpacking.html>
- Rijksoverheid (2016). *Van Rijn trekt 2 miljoen extra uit voor vrijwilligers palliatieve zorg*. Retrieved from <https://www.rijksoverheid.nl/actueel/nieuws/2016/05/20/van-rijn-trekt-2-miljoen-extra-uit-voor-vrijwilligers-palliatieve-zorg>
- Rijksoverheid (2018). *Wanneer moet ik de autogordel gebruiken?* Retrieved from <https://www.rijksoverheid.nl/onderwerpen/verkeersveiligheid/vraag-en-antwoord/wanneer-moet-ik-de-autogordel-gebruiken>
- Rijs textiles (2018). *Terry fabric cotton*. Retrieved from <https://www.rijstextiles.com/en/deco-fabrics/terry-fabric-cotton/>
- Shishir, M.H. (2014) *Effect of finishing on knit fabrics*. Retrieved from <https://www.slideshare.net/sheshir/project-2011-38519283>
- Sonneveld, M.H., Schifferstein, H.N.J. (2008). *The tactual experience of objects*. Retrieved from <https://www.sciencedirect.com/topics/neuroscience/texture-perception>
- Staal, J.E. (2018). *Autogordelband 50 mm*. Retrieved from <https://www.touw-staalkabel.nl/a-42343834/autogordel-band-en-spanbanden/autogordel-band-50-mm/>
- Steinbush, V., Hellinga, A.S., van der Made, A., Karele, J. (2000). *Waarom is de band van een autogordel altijd zwart?* Retrieved from [http://io.home.tudelft.nl/fileadmin/Faculteit/IO/Samenwerken/Stagiair\\_of\\_afgestudeerde/Projectonderwijs/Avanced\\_Products/Projecten/2000/doc/artikel200028.pdf](http://io.home.tudelft.nl/fileadmin/Faculteit/IO/Samenwerken/Stagiair_of_afgestudeerde/Projectonderwijs/Avanced_Products/Projecten/2000/doc/artikel200028.pdf)
- Steinhauser KE, Christakis NA, Clipp EC, McNeilly M, McIntyre L, Tulsky JA. *Factors Considered Important at the End of Life by Patients, Family, Physicians, and Other Care Providers*. JAMA. 2000;284(19):2476–2482. doi:10.1001/jama.284.19.2476. Retrieved from <https://jamanetwork.com/journals/jama/fullarticle/193279>
- Tass International (2018). *About us*. Retrieved from <https://tass.plm.automation.siemens.com/>
- Tass International (2018). *Interview with Herman Tavenier (domain expert)*.
- Wensambulace (2018). *Wensambulances in Nederland*. Retrieved from <http://www.wensambulace.nl/wensambulances-in-nederland.html>
- WensAmbulace Brabant (2018). *Wensverslagen*. Retrieved from <https://www.wensambulacebrabant.nl/wensverslagen/>

Zorg voor beter (2017). *Cijfers: vergrijzing en toenemende zorg*. Retrieved from <https://www.zorgvoorbeter.nl/veranderingen-langdurige-zorg/cijfers-vergrijzing>

National Institute on Aging (NIH) (2018). Providing comfort at the End of Life. Retrieved from <https://www.nia.nih.gov/health/providing-comfort-end-life>

Van Boeijen, A.G.C., Daalhuizen, J.J., Zijlstra, J.J.M, van der Schoor, R.S.A. (2013). *Delft Design Guide*.

Van der Zwaag, M. Dijksterhuis, C., de Waard, D., Mulder, B.L.J.M., Westerink, J.H.D.M., Brookhuis, K.A. (2011). *The influence of music on mood and performance while driving*. Retrieved from <https://www.tandfonline.com/doi/abs/10.1080/00140139.2011.638403>

Veerbeek, L. (2008). *Care and Quality of Life in Dying Phase: The contribution of Liverpool Care Pathway for the Dying Patient*. Erasmus University Rotterdam. Retrieved from <http://hdl.handle.net/1765/13429>

Vicair (2018). *Vicair technology*. Retrieved from [https://vicair.com/vicair\\_technology/](https://vicair.com/vicair_technology/)

Winparts auto onderdelen (2018). *Veiligheidsgordel 2-punts automatisch*. Retrieved from <https://www.winparts.nl/interieur-bekleding/autogordels-universeel/c546/veiligheidsgordel-2-punts-automatisch/p107843.html>

World Health Organization (WHO) (2004). *Palliative care: The solid facts*. Retrieved from [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0003/98418/E82931.pdf](http://www.euro.who.int/__data/assets/pdf_file/0003/98418/E82931.pdf)