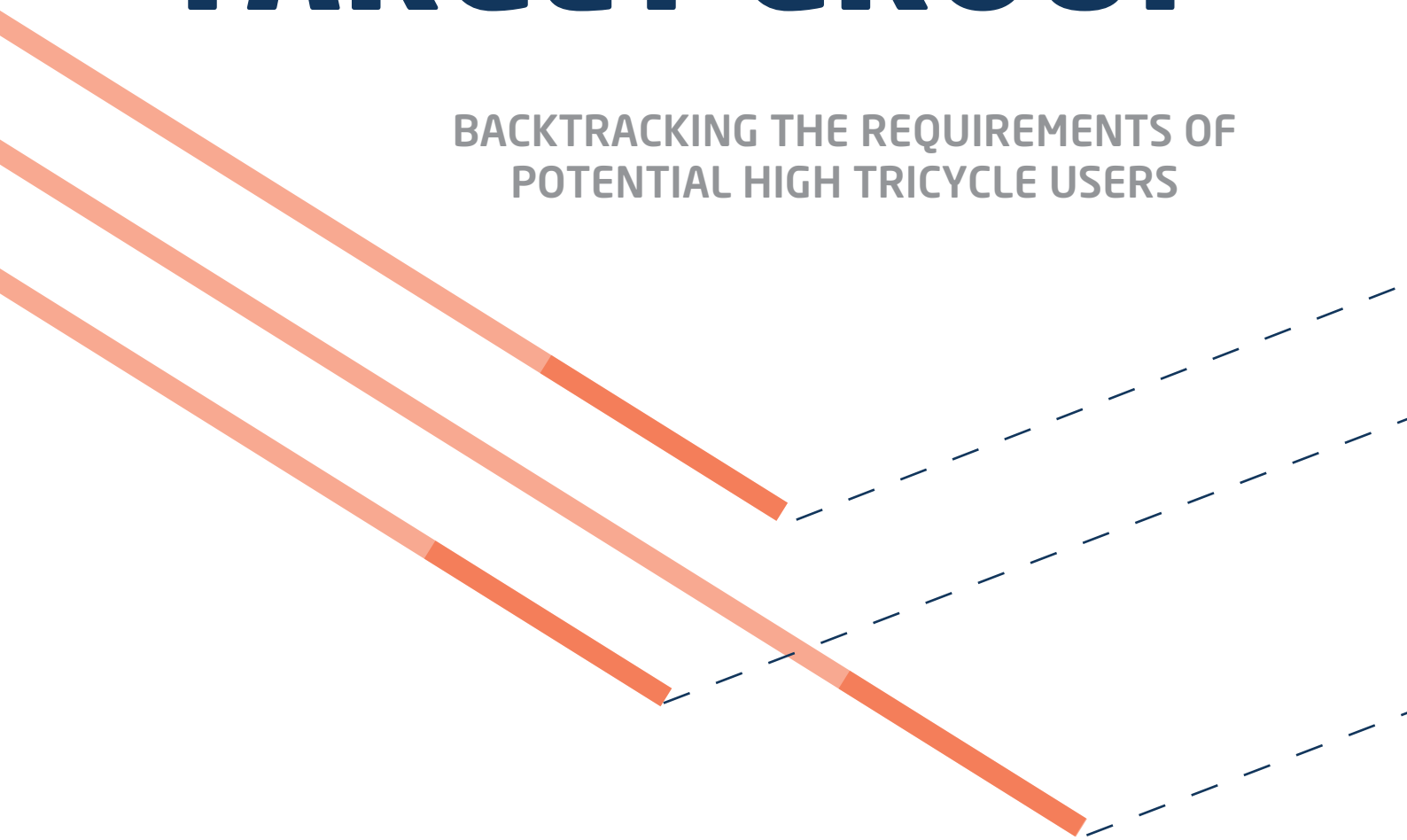
HIGH TRICYCLE TARGET GROUP

BACKTRACKING THE REQUIREMENTS OF POTENTIAL HIGH TRICYCLE USERS



Bachelor thesis Industrial design

Merel Hettinga

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vanraam
Let's all cycle

High tricycle target group, Backtracking the requirements of potential high tricycle users

Merel Elisabeth Maria Hettinga
s1011448

Industrial Design
University of Twente

Van Raam Aalten B.V.
Aaltenseweg 56, Varsseveld, The Netherlands

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Tutor: Carsten Gelgard
Examinator: Eric Lutters
Company supervisor: Jolien Heeman

SUMMARY

Van Raam currently manufacture a high tricycle design dating back to 1998. Efforts to update the design have been unsuccessful. With the goal in mind to offer a new Van Raam model with added value to potential high tricycle users, a design process is started independent from the current high tricycle models. The target group is defined through segmentation of the complete population. Segments who experience too little benefit from owning a high tricycle are eliminated, leaving people with motor disabilities or an IQ between 55 and 70. Motor disabled over 40 years old are by far the most numerous demographic segment. In order to make the target group homogeneous, only people with motor disabilities aged over 40 who do not participate in the workforce are selected as the target group.

A behavioural segmentation is used to segment this target segment into user segments. The variables of this segmentation are sought benefit, distance per use, frequency of use and the influence the weather has on both frequency and use. From this segmentation, two segments are selected, a mobility user and a recreational user.

The mobility user wants to use the tricycle to increase their mobility outside the home, with use mainly restricted to the town of the user. The recreational user uses the tricycle as a tool of recreation by cycling routes through appealing landscapes in the company of bicycle users. In order to specify the requirements the tricycle design has to meet to enable the users in their desired use, several analyses are conducted.

Tasks are analysed to see the interaction between the steps the user needs to take in using a tricycle. These tasks are parking, mounting, cycling and dismounting. If the user chooses to transport load, the tasks of loading, securing and unloading are added. The recreational user wants to cycle longer distances, making the cycling task the most important task to the user. As the mobility user frequently uses the tricycle for short distances, all tasks are equally important.

Scenarios are used to describe different things a user can use the tricycle for, such as getting groceries, going to appointments, visit friends or family and recreational touring. These scenarios combine the tasks with the environments the tasks are preformed in during the scenario. Recreational touring in the main divider of the two segments, as it is the reason for the recreational user to purchase a tricycle and irrelevant to the mobility user.

The information from these analyses are gathered in two separate programs of requirements which will be used as a basis for future product development. The recreational user is a user that is currently unserviced by the Van Raam product portfolio. To satisfy the recreational user, a cycle has to be stable while mounting, but otherwise similar in use experience to a regular bicycle. Low noise levels and operating the vehicle at higher speeds are very important. To enable the desired use, the user does not want to be influences in their seating position if the road cycled on has a cross slope. Prolonged cycling has to be comfortable, otherwise the user will not be satisfied.

The mobility user is able to satisfy a large part of their needs by the current Van Raam product portfolio. Their needs could be satisfied more by a design that offers stability and little changes in the seating position of the user if the wheels of the cycle are at different height levels. Features that needs to be activated by the user need a low force threshold, as well as easy access.

WRITERS NOTE

This thesis, laying before you, is the result of almost four months of new experiences, new insights and new found confidence. Van Raam is a wonderful company to conduct a bachelor assignment. The creative environment is great, the co-workers are helpful and welcoming. It is great to see the cycles being build every morning on your walk from the staff entrance to you working station.

Thanks to Bart Meinen, from Innnovar, and Jolien Heeman for giving me the opportunity to do the assignment of finding the people left out by the current Van Raam product portfolio. For helping me form the assignment into the thesis laying before you. And for having confidence in me and the assignment, even when I had none.

Also thanks to the rest of the Research and Design department of Van Raam for their enthusiastic attitude and willingness to help. Thanks to Oliver, Korinda and Denise for being sparring partners and for just listening if I was unsure about something or simply stuck. And thanks to Ronnie and Maarten for providing lifts which decreased my travel time greatly.

Even though our collaboration was short, thanks to Mr. Martinetti for helping me start my assignment and for providing such positive feedback. Thanks to Mr. Gelhard for taking over from Mr. Martinetti and for giving structure to the assignment.

Thanks to all people who cycled on a tricycle for me in such unfavourable weather conditions. My apologies for doing this research in winter instead of summer. Especially thanks to my grandmother for providing four additional people for observations and interviews besides herself and for giving us a warm place to do the interviews after cycling in the snow.

Last, but not least thanks to my family and friends for understanding my lack of social time. For providing moral support and listening to my endless ranting about cycles, tricycles and people with disabilities.

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1. INTRODUCTION

IMAGE 1: VAN RAAM LOW TRICYCLE

A store selling outdoor gear currently uses the slogan "Nobody is an indoor person", based on the outcome of a research from Wageningen University that two thirds of the Dutch population prefer to be outside, while spending 90% of their time inside. The outdoor store tries to motivate people to go outside more by an advertising campaign showing people enjoying being outside. Cycling is a method to be outside while transporting yourself from one place to another. Normally, people use a bicycle to cycle. A bicycle is an environmentally friendly means of transportation, it takes up little parking space and is easy to manoeuvre through busy streets.

IMAGE 2: VAN RAAM HIGH TRICYCLE

As a two wheeled vehicle, a bicycle needs to be balanced by the cyclist. Cycling involves a learning process in which the user learns at which speed extra support is needed to prevent falling sideways, how to use the imbalance of the bicycle to make turns and the fine balance between the curve path and the speed of the user. Keeping this fine balance takes practise and it takes a fine balance between observing and reacting with the body. The saying 'It's like riding a bicycle' suggests using a bicycle is a skill that will not disappear.

IMAGE 3: BICYCLE

Unfortunately, this saying is not true. People change, bodies change. Not everybody is able to learn the fine balance skills it takes to ride a bicycle. Not everybody is able to execute the needed movement patterns at the right speed. For these people, riding a regular bicycle is impossible. A possible solution is using a tricycle. The third wheel provides an extra contact point, making a tricycle balanced without aid from the user. The task of maintaining balance is completely taken over by the tricycle. All the user has to mount, rotate the pedals and steer at the appropriate time.

Adding the extra wheel has consequences. The process of making a turn on a tricycle is quite different, as the rotation of the front wheel is used to make turns instead of the combination of turning the handlebar and leaning into the turn by shifting the upper body centre of mass. As a result, the user of a tricycle experiences an apparent force, as a person would when taking a turn in a car. If a person expects the behaviour of a bicycle when using a tricycle, this apparent force can feel as if the user is out of balance. An undesirable feeling when searching for added balance. Another disadvantage of the three wheels is the added influence the road has on the position of the tricycle. A cyclist is expected by law to be on the side of the road, where the road is sloped for drainage, resulting in the tricycle being not level in the transversal direction, which is experienced as leaning sideways. Leaning sideways for a prolonged time is exhausting. Cycling on the middle of the road would be a solution if it would not create a highly undesirable traffic situation.

IMAGE 4: A HIGH TRICYCLE ON A CROSS SLOPE

As both the bicycle and the tricycle have pros and cons, a user bases their decisions on the importance of these pros and cons to their personal situation. In this thesis, the persons who give greater weight to the pros of tricycle than the pros of a bicycle are sought out from the general population. The goals these persons want to achieve in using a tricycle are used to differentiate between different user groups. By analysing use scenarios of each use group, including environment, tasks an alternatives for each use group, an use group specific list of requirements is made to use in the development for new models, which will allows a user to use their cycle for their desired goal. This cycle does not have to be a tricycle, as long as it fulfils all the requirements.

2. PROBLEM SITUATION & MOTIVATION

"Tricycles are mostly used by disabled people who have trouble moving and balancing. Most have a spasm, one-sided paralysis or are mental handicapped. Also elderly who have physical (limited excursion) or mental limitations (information exchange) can use tricycles. They are primarily used for enlarging the mobility and for training. All users of tricycles have some loss of balance caused by either cognitive or functional losses. Three categories of aspects are important when user groups are typified: getting on/off, positioning and riding. Up to 1994 the GMD worked on a qualification system for tricycles, now used as guideline for development. Two kinds of grouping were used in different times, depending on the losses and the needs. Its standard performance, the surpluses and the accessories typify a tricycle. Four dimensional categories are used depending on the size and age of the user. Half the user groups do not need surpluses on the tricycle. Most guidance is needed with preparing to cycle."

"Tricycles are meant for people who miss balance to ride on a bicycle. A bicycle is not stable enough for them. For example they might only be able to ride slowly. Because of loss in insight in traffic or disturbed co-ordination in the limbs. Having three fixation point the tricycle is a statistically determinate structure, which gives the stability they need. Tricycles are mostly used by disabled people who have trouble moving. But also elderly and people who need to transport much might benefit from riding a tricycle. Nowadays most tricycle users are not older than 50. Tricycles are primarily used for enlarging the mobility and for training. Although the assignment of the graduation project is to redesign a tricycle for adults, there the entire population of tricycle users will be discussed. "

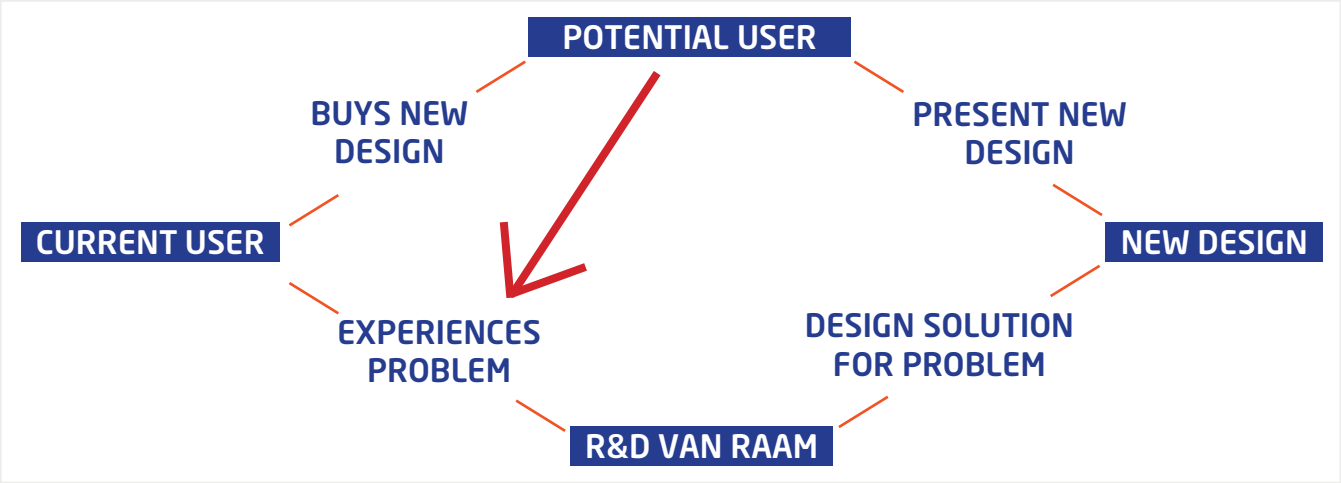
The quotes above are the target group definitions mentioned in the Graduation project thesis of M.I. Melkert in 1998, which led to the current high tricycle model of Van Raam. Efforts have been made to update the model, but the added value of the redesigns have not weighed up to the costs that would have to be made to implement those redesigns. The result is a high tricycle model that has changed little in almost two decades.

These user group definitions show a top-down method of target group definition. The target group is based on the current users, their requirements of the tricycle which are then used to make a new design. After this, the design is offered to potential users, hoping that the design based on current users also suit non-users. When using current users as a base for a redesign, the potential users which are non-users because of inadequacy of the current model are left behind.

IMAGE 5: OLDER MODEL MAXI

IMAGE 6: CURRENT MODEL MAXI

TABLE 1: CURRENT DESIGN METHOD

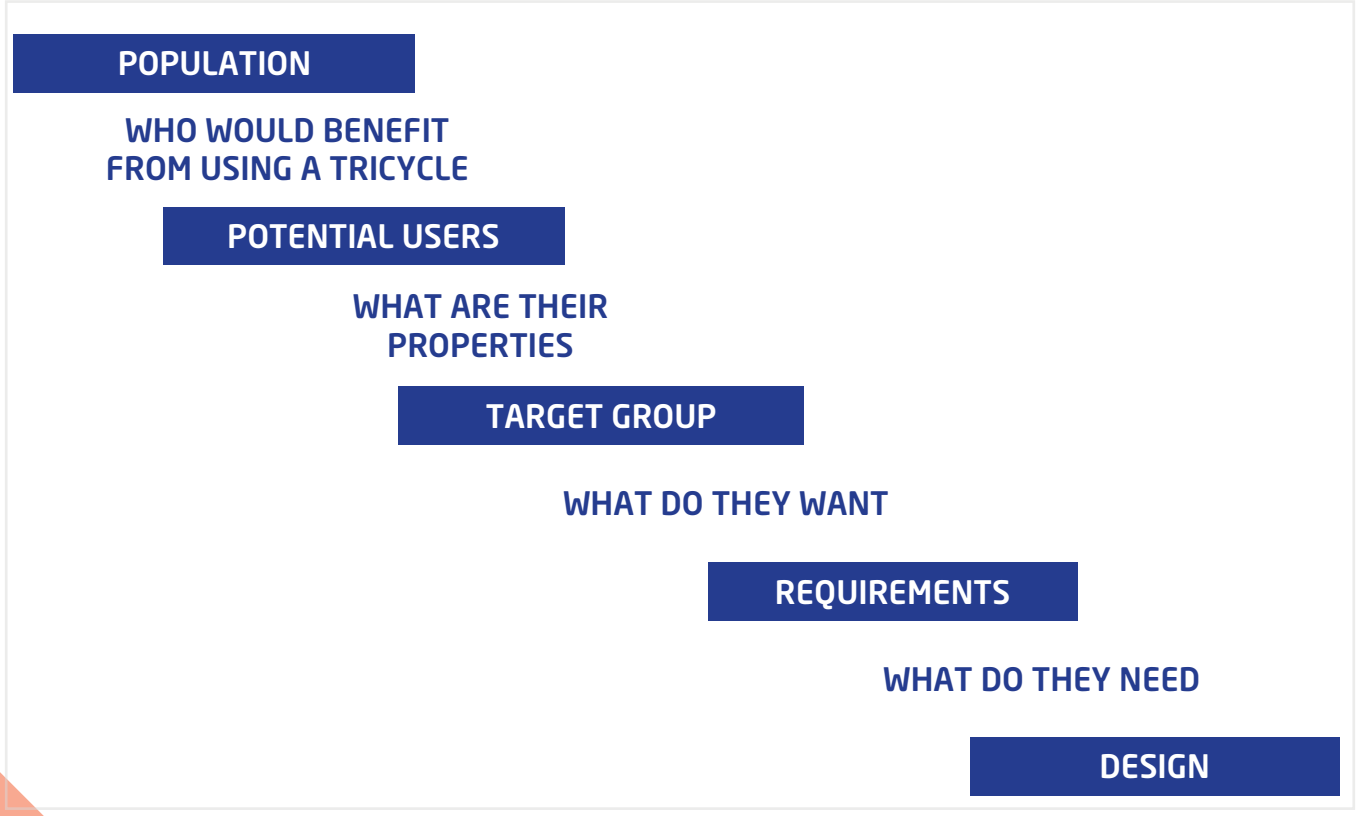


The red arrow in *Table 1* symbolizes the problem in the current design method. A design based on current users is sold to non-users. For a current user, the current model is satisfactory enough to validate purchase. While they might experience problems with the current design, the problems are not large enough for the users to prevent them from using the tricycle. The potential users might experience different problems, which are not taken into account. These problems might prevent them from purchasing the tricycle. To include the non-users who are willing to use a tricycle, but are not able to use the current model, a different design method is necessary.

The design method shown in *Table 2* is based on 'Design for all'. (Bonnema et al., 2008) This method is especially designed to include all potential users, which is the goal of this thesis. To reach the people who are not satisfied by the current Van Raam high tricycle models.

The principle of design for all is to start by taking the whole population as a potential user and skim the groups who can be argued to be non-users. Non- users can be people who have no motivation to use the tricycle, as the gains of acquiring a tricycle do not weigh up to the costs involved with acquiring a tricycle. Another type of non-user is the people who are not able to use a tricycle, due to lack of necessary abilities, such as sight. After this skimming process, a more realistic group of potentials users remains.

TABLE 2: NEW DESIGN METHOD



Through this skimming process, the potential user group includes people that might have not been included in the old target group definition, where target group was defined through looking at the available model and the common properties of the model users.

The goal of this thesis is to conduct the first phases of a design process that strives to achieve one or more cycle designs that meet the requirements of one or more target groups which are not satisfied by the current Van Raam models.

These include the people who currently use a high tricycle and are not satisfied by the model, the people who currently use different Van Raam models due to their inability to operate the current high tricycle model who are not satisfied because their preference still lies with using a high tricycle. It includes the people who have tried the Van Raam models and are not satisfied with any of the models and the people who would benefit from using a high tricycle, who are yet to be convinced that a tricycle is a good option for them.

No analysis of the currently available high tricycle models will be made, to prevent influence by the current models and current users on the result of this thesis. The focus of this design method is the potential users. Within the group of potential users, the most numerous group with largely the same properties will be selected. This will be the target group. This target group will be segmented in target group segments, based on what a potential user would like to be able to do with the tricycle, their main use goal. This whole process is described in the next chapter, target group definition.

After defining the target group segments, the requirements of each segment are defined through several analyses. These analyses are described in the target group analysis. The list of requirements will not be included in this thesis. Instead, it will feature in the advice given to Van Raam, which is included in the confidential appendix.

The reason for excluding the program of requirements is the strong innovation competition between Van Raam and other special needs cycles producers. Van Raam does not sell directly to users, there is always a dealer involved. Van Raam does offer advice to users through fittings, both internally at the showroom and externally at external fittings. These fittings result in an advice for a certain model, along with additional options, such as electric pedal support or one-handed controls for a person who has only one hand that is operational enough to adjust controls. Through these options, Van Raam can adjust their models to suit specific needs of specific users.

Most users acquire a special needs cycle with financial assistance through government funding. In order to receive funding, arguments for the specific special needs cycle choice must be provided. For the government, higher costs must be compensated by higher quality and better functionality. Van Raam operates on the higher quality and better functionality end of the market, they do not want to compete by low pricing. Because of this market strategy, their product becomes a large part in their competitors advantage. This competitors advantage is also the reason why government bodies choose to get contracts with Van Raam, which means that the potential user receives the most funding if a Van Raam cycle is chosen.

To hold this competitive advantage, the Van Raam products must exceed the products of the competitors. The advice resulting from this bachelor assignment can give Van Raam an advantage over their competitors. This is the reason why the advice to Van Raam will not become public.

3. TARGET GROUP DEFINITION

This chapter will include the selection process of the potential users through demographic segmentation. The largest group of these demographically segmented potential users is selected as the target group. As a tricycle is a very versatile product coming to user goals, a second behaviour segmentation is conducted to separate different users from the target group. From these segmented users, two average user groups are selected. The mobility user is the description for the group of users who will restrict the duration of single use to half an hour. The recreation user describes the user group which also use the tricycle for short distances, but mainly want to use the tricycle to cycle for a longer duration.

3.1 THEORETICAL BACKGROUND

As mentioned in Problem situation and motivation, the target group is defined by selecting the potential users from the population. Groups that can be argued to be non-users will be excluded from the target group. Taking the whole population comes from the ergonomic design principle called 'Design for all' (Bonnema et al. 2008). This principle is normally used for designing public spaces of digital platforms, individual use by the whole population is the goal. (Klironomos et al, 2006) (EuCAN, 2003). This includes extreme users, such as people with physical disabilities or mental disabilities.

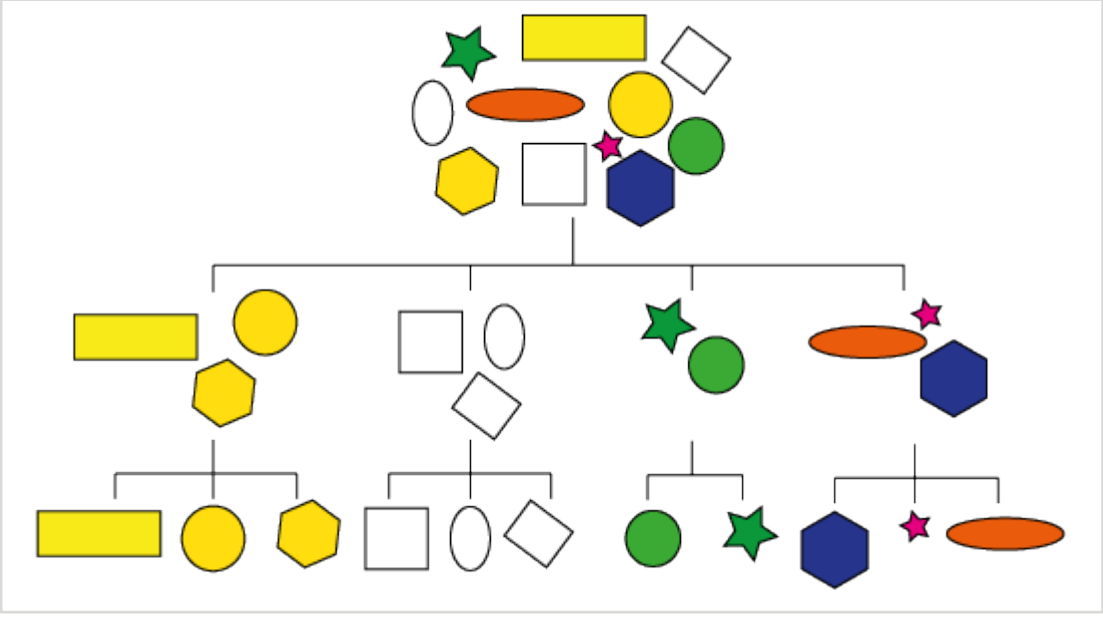
Van Raam uses the slogan 'Let's all cycle', which indicates a desire similar to the motivation behind 'Design for all'. The means with which Van Raam strives to reach 'Design for all' is through their complete product portfolio. Originally, Van Raam made regular bicycles. Since 1986 the product portfolio expanded to special needs cycles. Nowadays, Van Raam is specialized in special needs cycles. In the definition of 'Design for all', van Raam specializes in the extreme users.

Differentiation in the product portfolio has resulted in several product lines, which all focus on a segment of the extreme users. These extreme users are mostly people with a disability which eliminates their ability to use a regular bicycle. If a person has needs that exceed the standard model, options are added to increase the chance of a person being able to use the model.

Within the product portfolio, the tricycle is one of the individually operated cycles. This requires a certain level of awareness of the surroundings and the ability to make responsible decisions in traffic. If a person does not possess both abilities, the person is exempt from the group of potential users. In the principle of 'Design for all', exclusion from the target group is allowed when reasons for exclusion can be provided. The potential users are the people that are left after excluding the people who can be argued to be non-users.

Segmentation is a method to bring structure to this selection process. Segmentation is a technique which divides a larger, heterogeneous, target group into smaller, homogeneous, target groups. This division is made by setting a variable by which people who have one part of this variable in common into one segment, as demonstrated in *Table 3*. *Table 3* uses colour as first variable, segmenting the shapes in yellow coloured shapes, white shapes, green shapes and other coloured shapes. The other coloured shapes are still a heterogeneous group. A second variable, shape differentiates between a white square and a white oval. The result of the second segmentation are eleven homogeneous segments.

TABLE 3: AN VISUALIZATION OF SEGMENTATION WITH COLOUR AS FIRST VARIABLE AND SHAPE AS THE SECOND



Segmentation creates variable homogeneous groups. The selection process of excluding non-users and choosing a target group from the remaining potential users is called targeting. Targeting is focussing on a smaller group with the goal to increase the chance of a success with that smaller group instead of aiming toward a larger group with smaller chances of success. While the target group is more limited, the chances of success per effort are larger. Philip Kotler describes segmentation and targeting in 'Principles of Marketing' as shooting one bullet instead of shooting hail (Kotler, 2006 , p. 346).

Selecting a target group from the potential users eliminates the principle of 'Design for all'. To limit the damage of this loss, the largest variably homogeneous segment is targeted. The elimination of smaller segments will allow a more specific design, which will suit the needs of a large part of the potential users better than a design made for all potential users will. The in-house design and production at Van Raam makes their designs highly adaptable to specific user needs . This allows Van Raam to make special adaptations of the design for potential users who are excluded in the targeting process.

Segmentation and targeting are part of a marketing technique called Segmentation, Targeting, Positioning (STP). Positioning can be divided in product, price, place and promotion. Van Raam is a company that does not sell directly to customers, their focus is mainly on marketing through the product. The product will also be the main focus of this thesis.

The variables used in segmentation are identified in geographic, demographic, psychographic or behaviour variables. Geographic and demographic are general variables which are easily measured without interaction by the user. Geographic variables are variables which describe the location of the user. Demographic variables describe differentiate in age, gender, income, profession, faith, race or nationality. Softer, more intangible variables are used for psychographic and behaviour variables. Psychographic variables describe a persons social class, their lifestyle and personality. These variables are more personal and require interaction with the person to indicate. Behaviour variables describe where and when the user is planning to use the product and their behaviour leading up to the purchase, such as cause, sought advantage, user status, loyalty and attitude towards the product.

The different nature of the segmentation variables categories and the different method of measuring these variables cause them to be used separately in segmentation. In this thesis, the selection of potential users is conducted through demographic segmentation. The largest combinable segments within the potential user will be targeted as the target group.

The second segmentation has behavioural variables. Where secondary sources provided the information needed for the demographic segmentation, primary provide the main sources for behavioural segmentation. Secondary sources will only be used to supplement the results from the primary sources. As conducting interviews is more time consuming than gathering secondary information, two separate segmentation and target processes are used. This limits the amount of people needed for interviews, allowing increased quality over quantity of the information.

Another motivation for choosing two separate segmenting and targeting process is the smaller amount of behavioural variables when targeting a homogeneous demographic group. A child of 12 years old is less likely to be the decision making unit in the purchase process of the tricycle. This child is also more likely to purchase a different tricycle soon, as this person is most likely experiences changing body measurements than a person over 80 years old. The 80 year old potential user will most likely remain a first - time user, as the durability of the tricycle will most likely exceed the life expectancy of the person.

The third motivation for separating demographic and behavioural segmentation are the different differentiation tools. Demographic variables are more excluding than behavioural variables. A person either is aged under 65 or 65 and older. Even though a person might experience several types of disability, the combination is more rare than a person having a combination of health, variety in surroundings and social cycling as sought benefits from using a tricycle.

Behavioural variables influence each other. Weather influences the use frequency and duration of use, as well as the sought benefit. Clustering methods allow representation of the interaction between variables within the segmentation process (Kamakura, 2000). Target segments are formed by selecting areas around within the clustering.

Target group definition contains the S and the T of STP. The requirements for the P part of STP, of the targeted segments which result from this definition, are gathered in the next chapter, Target group analysis.

3.2 RESEARCH DESIGN

The data needed for demographic segmentation is gained through desk research, supplemented with internal Van Raam information. Information on the amount of people with limitations, their lifestyle and their cycling behaviour is researched through reading reports on the subject. This information is cross checked with the information gathered from Van Raam showroom visits over four months. Literature on the lifestyle of different age groups is used to form a complete image of each segment (Bonnema, 2008). Selection variables of the target process are how likely each segment is to benefit from using a tricycle, the size of the segment. A structured interview with an occupational therapist is used as an expert opinion on which people should use a tricycle, which is used to cross check the selection of the chosen segments.

Data gathered in the desk research will also be used for the behavioural segmentation. Structured interviews with the targeted demographic segment, both tricycle users and potential users, are used to determine the segmentation criteria for the behavioural segmentation. To complement the results of the structured interviews with people within the targeted demographic segment, people outside the demographic segment with one different variable which can easily change to them belong to the targeted segment and people who are unlikely to belong to the target demographic, are interviewed to determine the effect belonging to the targeted segment makes on the use properties. The results from these interviews is used in argumentation for the target process of the most realistic and numerous user segments.

3.3 FINDINGS

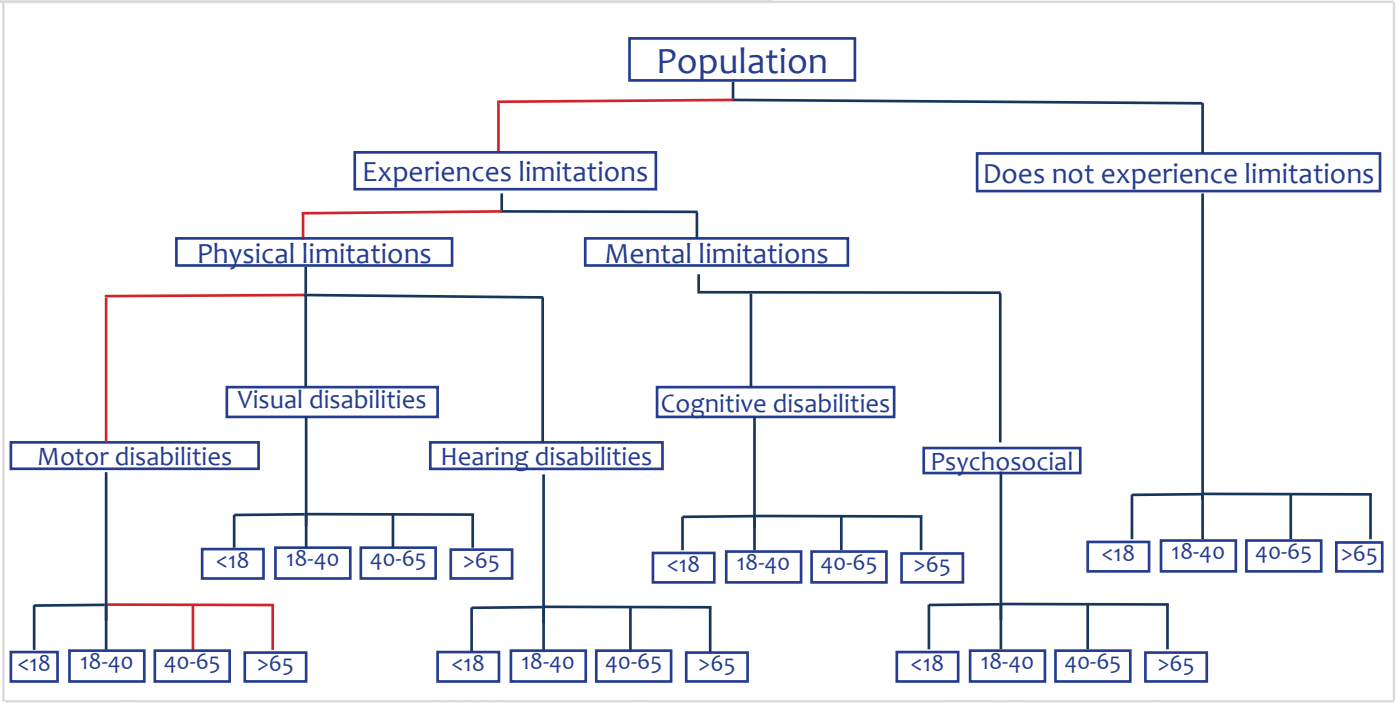
3.3.1 Demographic segmentation

A tricycle is suited for a person if the pros of a tricycle outweigh the pros of a bicycle. When assuming a person prefers a bicycle, the tricycle is only chosen if the bicycle is not an option. Not being able to use a bicycle can be explained as experiencing limitations. The causes of the limitations can be physical or mental. In the segmentation, the commonly used segmentation of disabilities is used, where mental is segmented by the cause of the mental disability and the physical disability in the disabled body function (Heijden von, et al. 2013). Motor disabilities are people that have trouble moving. Motor disabilities are categorized by amputations, brain function, neurology, paraplegia, musculoskeletal disorders, organs and chronic pain and mental disorders. Visual disabilities are characterized by limitation in sight, hearing disabilities manifest in limited hearing.

Mental disabilities are categorized by psychosocial disabilities, which limits a person's ability to interact with other people. Limited intelligence manifests in a person having a lower than average intelligence. The intelligence level is often translated to a development age. The reason for segmenting the disabilities that the source of the disabilities have a varying on a person's cycling abilities.

The age groups are segmented along the line of maturity, 18 years, the line where the number of physically disabled people increases greatly, 40 years, and the retirement age, 65 years.

TABLE 4: DEMOGRAPHIC SEGMENTATION



3.3.2 Targeting a demographic segment

To belong to the potential user group of a tricycle, a person needs to benefit from the extra balance a tricycle offers, while being able to operate the tricycle. As an individually operated vehicle, a person needs to be able to observe traffic situations and judge them correctly. People with a visual disability are likely to experience problems observing traffic situations. A cycle with a co-driver without vision problems would be a better choice for these segments. People with visual disabilities are therefore excluded from the potential group.

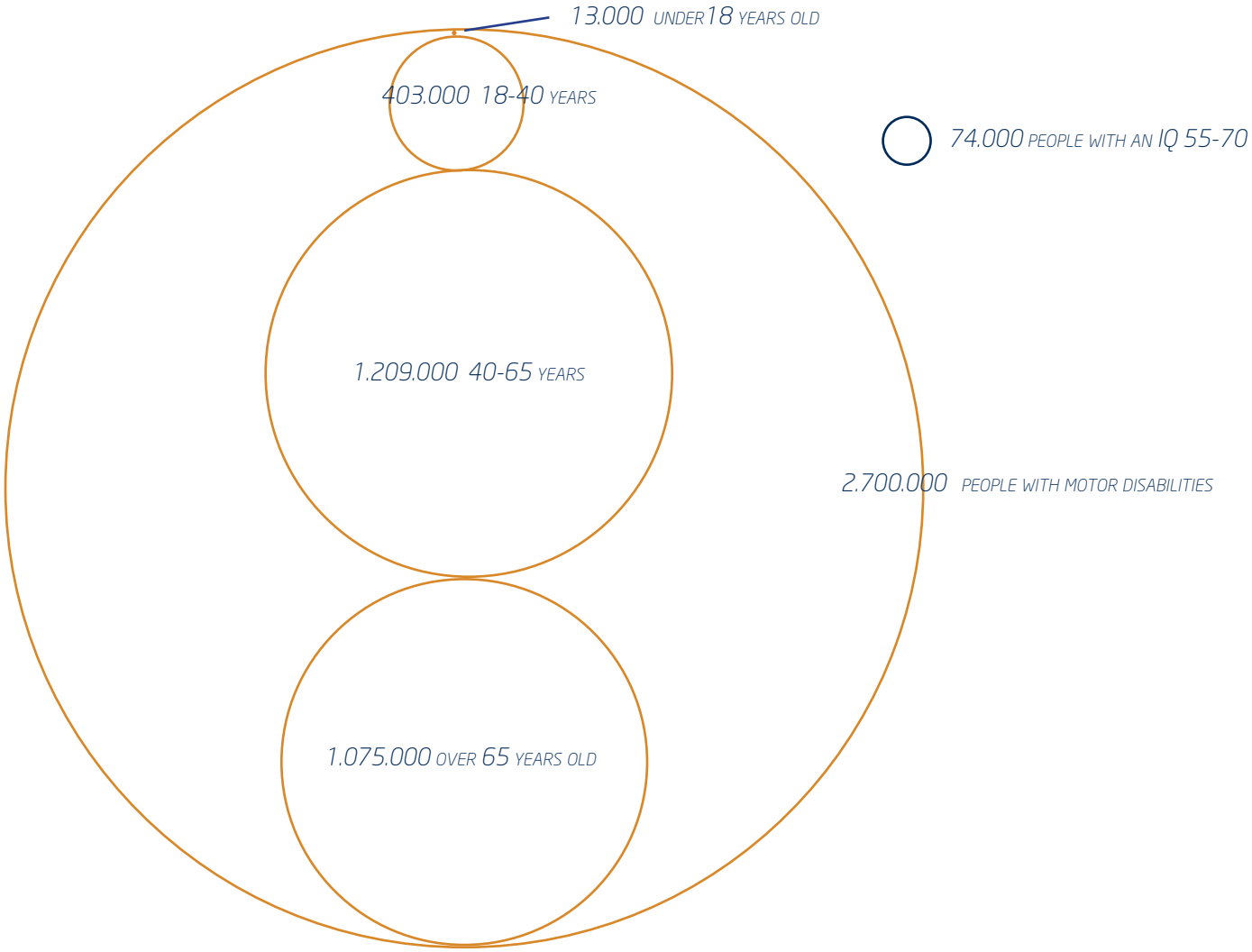
To judge traffic situations correctly, a level of cognitive abilities, comparable to a seven-year-old child, is necessary (SWOV, 2012). This cognitive level corresponds with the border between slightly and moderately cognitively disabled. This argues for exclusion of moderately and severely cognitively disabled people. The eliminated bicycle task of keeping the tricycle balanced makes the tricycle the easier to learn cycle option, which makes a tricycle well suited for people with a slight cognitive disability.

Mental disabilities due to psychosocial reasons are less likely to affect a person's ability to operate a bicycle or a tricycle. If the disability affects their ability to make decisions in traffic, a multi-person cycling option is a superior option for that situation. Both cycling abilities argue for exclusion of psychosocial disabled from the 'design for all' target group.

The largest segments, the segments which do not experience limitations, can also be excluded from the potential users. The lack of limitations make a person unlikely to choose a tricycle over their more likely current bicycle. Hearing disabilities do affect a person's ability to use a cycle as their awareness of the traffic situation is limited due to a lack of insight in the situation outside their vision. A tricycle does allow the user to rotate the body further to look around without it having an effect on the driving direction, but whether that would be such a great advantage that a person would prefer a tricycle over a bicycle, is debatable. Not looking in the direction the person in heading is an undesirable situation when a person has little awareness of the situation outside their line of vision.

Motor disabilities are a large motivator in choosing a tricycle over a bicycle. Easier mounting, the possibility to do tasks slower without toppling and less physical tasks make a tricycle suited for this segment. Through the 'design for all' principle, both physically disabled and slightly limited intelligence remain. This includes people with multiple disabilities, such as a combination of motor and hearing disabilities. This inclusion makes the 'design for all' an ideal tool for designing special needs products.

TABLE 5: ESTIMATION AMOUNT PEOPLE IN EACH CATEGORY IN THE NETHERLANDS



The exclusion of visibility disabled and people with moderately and severe intelligence limitations remain, as having other disabilities do not increase their ability to use a tricycle individually.

The goal of this demographic segmentation is to select the largest possible, homogeneous group. *Table 5* visualizes the segments that can be considered as potential users. If a person has a combination of these two disabilities, this person is represented in both circles. The table shows the large difference in amount of people with motor disabilities and the people with slight cognitive disabilities. The age segments within the slight cognitive disabilities segment are not represented, as the scale used in the table is not fine enough to represent the size of the age segments.

Sources on the estimated amount of cognitive disabled people does not include a differentiation in the severity of the disability (Heijden von, et al. 2013). When assuming the ratio between slightly and more severely disabled is constant between the age groups, the amount of people with a slight cognitive ability can be estimated around 20.000 people under the age of 18, 30.000 aged between 18 and 40, around 21.000 ages 40-65 and 3.000 over 65 years old. In comparison to the population in the respective age groups, the amount of people with a slight cognitive disability decreases as the age increase, with a sharp decline in the amount from age 40, leaving little people with cognitive disabilities over 65 years old. This is due to lower life expectancy.

Where the amount of people with cognitive disability declines with age, the amount of people with motor disabilities increases dramatically after age 40. Around 20% of the Dutch population have motor disabilities compared to the 0,4% who have a slight cognitive disability (Heijden von, et al. 2013)(SCP, 2013). In the age

category above 65, one third of the population experiences limitations in their motor skills (CBS, 2016). The limitations experienced in this age group are more severe, making the target group more likely to need a tricycle.

The segments of motor disabled people aged between 40 and 65 and over 65 years are by far the largest segments within the potential user group. Combined they represent 82% of the potential users. Through targeting these two segments as a target group, the variables of behavioural variables are more narrowed without excluding a large part of the population. Both of the segments are not likely to experience large changes in their measurements, as both segments are mature. Neither of the segments is likely to use their tricycle for pursuing an education.

The main divider between the segments under and over 65 is reaching the retirement age. This divider is less pronounced for these segments, as 71% of the motor disabled people aged between 40 and 65 do not participate in the workforce (Hoogen van den et al. 2010). The definition of workforce participation is having a paid job with a minimum of 12 hours per week. The large amount of available time that comes with not working over 12 hours a week has a large influence in the behaviour variables of the target group. The changes a person goes through from aged 40 to 80 become much more gradual when the factor of work is eliminated.

Elimination of the 29% of the motor disabled aged 40 to 65 results in an aged over 40 target group that covers 70% of the potential customers. The conclusion of this demographic segmentation is this definition of the target group:

People with motor disabilities aged over 40 who do not participate in the workforce

3.3.3 Behavioural segmentation

Behavioural segmentation variables can be based on occasion, sought benefits, user status, use frequency, loyalty, level of willingness and product attitude (Kotler et al, 2006). Concerning the purchase of a personal special needs cycle, the purchase occasion is created through an advice by a medical practitioner to a body of government to grant an allowance from a fund that encourages people to live independently as long as possible. This makes the user not the only decision making unit. The governmental unit stimulates the potential user to choose the most cost effective option. The occupational therapist stimulates the use of the tricycle and therefore the option the user is most likely to use. Loved ones of the user encourage the user in finding a model that fit their needs while considering the budget. Ultimately, the user is the person who decides which model suits their needs best. This is the reason to focus mainly on the user and the usability of the tricycle.

The use occasion can be described as circumstances of use. In case of a tricycle, weather conditions are important as a tricycle is a vehicle that is used outside and the user is exposed to the elements. Favourable weather might increase the duration and frequency of use. Unfavourable weather might cause an user to choose an alternative means of transportation, use might be delayed until the weather is more favourable, the duration might be decreased or it can have no effect. Favourable weather could be described as sunny, dry, low wind speeds and an average temperature (weeronline, 2017). The occasion of social cycling can also increase use, as cycling can be used as an activity on occasions where families come together or a user can partake in a cycling event.

Sought benefits in using a tricycle can be described as health, variety of surroundings, variety in daily patterns, social cycling and burning off excess energy. Sought health benefits are preventing loss of muscle mass and therefore strength, maintaining fitness and reducing fat mass. These health benefits are mentioned as reasons for an occupational therapist to advise using a tricycle to clients. Mental health benefits of cycling are described through variety in daily pattern and variety of surroundings.

Variety in surroundings can also be described as going outside and being outside. Considering the current situation of the targeted segment, experiencing difficulties in venturing outside independently is to be expected. A tricycle could offer an option to venture outside alone. When outside, an user can use the tricycle to cycle trough different landscapes by cycling a longer route or by choosing a route with a high density in landscape alterations.

Variety in daily patterns is a benefit created by the ability to operate a vehicle independently. Instead of having to rely on someone else to chaperone, a tricycle user could go outside alone. A lack of variety of the daily pattern can also be a sought benefit. The tricycle can be used as a replacement for other forms of cycling if using the former cycling method is no longer an option. Through using a tricycle, the person can continue their way of living, which can be experienced as a benefit.

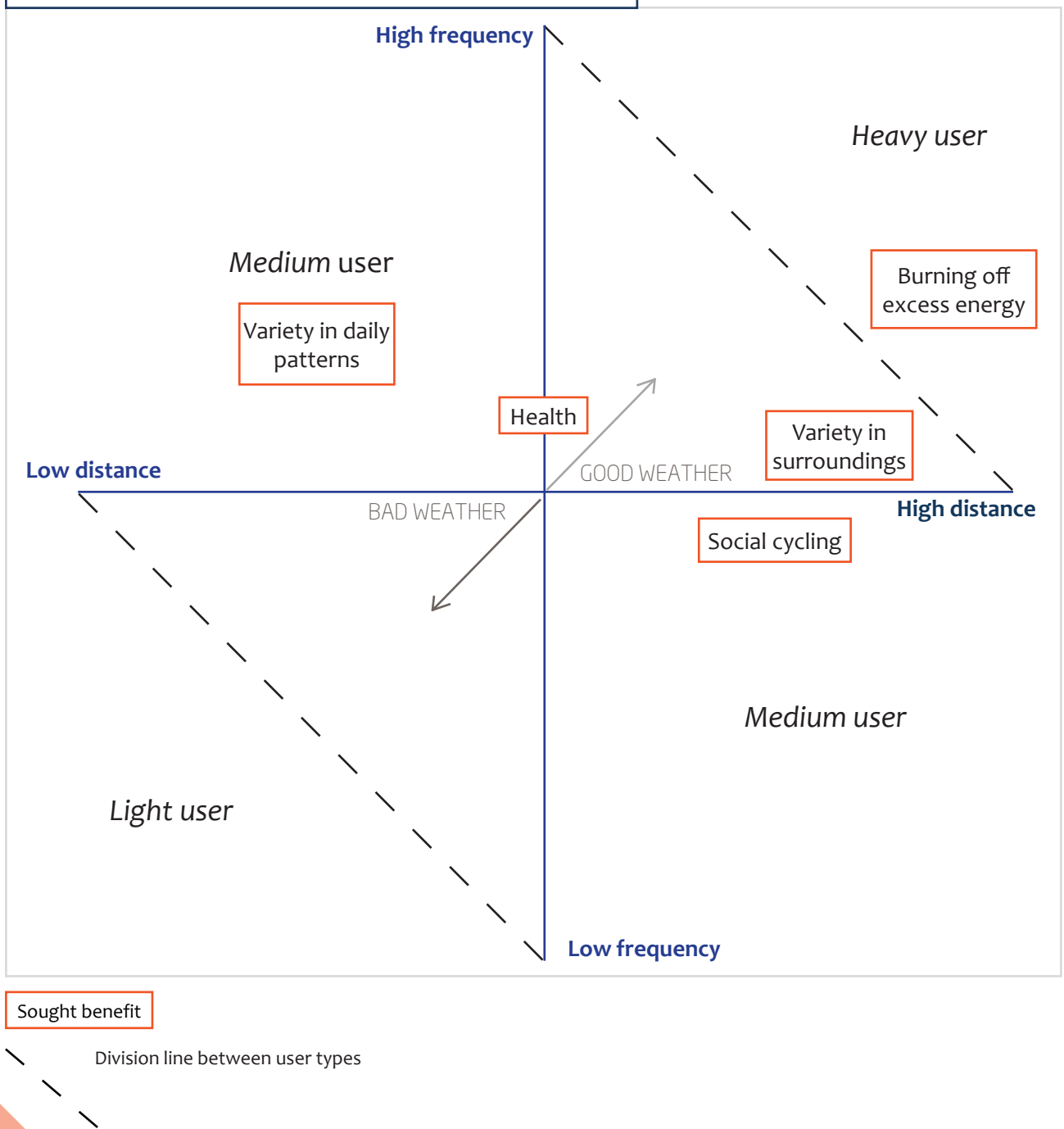
Social cycling involves cycling with others and the social interaction this involves. The sought benefit is being able to be a part of a group without causing difficulties for said group. This involves the user being able to cycle a tempo higher than the minimum cycling tempo of the group, as well as being able to function as well as bicyclist on a tricycle when it comes to speed and ability to make turns. The final sought benefit is burning off excess energy. Not to be confused with losing fat mass. Losing fat mass is a benefit gained over a longer period of time. Burning off excess energy is a benefit in removing restlessness. It can also help a person to maintain a healthy sleeping pattern.

User status segments between non-users, former users, potential users, first-time users and regular users. Former users can be users that have stopped to use a tricycle due to the tricycle not meeting their requirements. Former users that have stopped using the tricycle due to their disabilities becoming too severe are not relevant to the tricycle design. A tricycle is not a consumer product, the average life of a cycle is estimated at thirteen year (RAI, 2017). Considering the remaining life expectancy of a 65 year old being 19 years for males and 21,7 years for females, the chance of half of the targeted segment replacing their tricycle with a new model is small (RIVM, 2014). Therefore, most of the users have the status of first-time users. As explained in the problem definition, the goal of this thesis is to focus on potential user.

As a durable product, use frequency will not be represented strongly in numbers of sales, compared to consumer products. Use frequency is segmented in light, medium and heavy users. Heavy tricycle users cause more wear on the tricycle, making the tricycle more likely to need repairs. This user type values the tricycle a lot and is willing to invest in features to make the use experience more pleasant. This is also the user who will give Van Raam the most public exposure, which aids in the public acceptance process of special needs cycles. Light users might benefit from a cheap, basic model or a tricycle that can be shared between several people, which already happens in care homes. Medium users of tricycles are likely to use the tricycle several times a month, but not daily.

Providing a good alternative to a bicycle is also the method to change product attitude in a positive way. As recognizing the need for a tricycle is a process, people preparing their purchase are in different stages of the process. The tricycle can be seen as a product for disabled people, which the targeted segment might not identify as. Targeting heavy users creates public exposure of the tricycle, changing the general attitude towards a tricycle from 'strange' to 'normal'.

TABLE 6: CLUSTER SEGMENTATION ALONG FREQUENCY AND DISTANCE PER USE



3.4 TARGETING A DEMOGRAPHIC SEGMENT

Table 6 shows the interaction of the frequency and the cycled distance per use and the user status between light, medium and high users. Good weather increases both frequency and distance per use. Bad weather has the opposite effect, as it motivates the user to shorten or delay the use unless the use is absolutely necessary. The sought benefit of health is also affected by the weather, as cycling in bad weather is considered both unpleasant and unhealthy. Health as a sought benefit requires a higher frequency, as cycling several times a week increases the health effects of cycling. (Rietveld et al, 2012). The distance cycled is more dependent on the current health of the user, as cycling longer distances require a higher amount of energy and endurance.

Health is the only sought benefit that is not very distance dependent. Social cycling requires organization between people, it is spending time together cycling. This requires cycling for a longer period, which means a higher distance. When cycling a short distance, the efforts of organizing social cycling do not weigh up to the benefits, as cycling a short distance takes little time. Using the cycle to go to a social gathering at a set location is much more effective when cycling for longer distances is not an option.

The time required per cycle trip decreases the likeliness of a person seeking variety in their daily patterns to cycle a longer distance, as cycling a longer distance takes up a significant portion of the day, leaving less time for other activities. Burning off excess energy, on the other hand, requires cycling longer and therefore further, as cycling a shorter distance does not require enough energy for this benefit to be reached.

The sought benefit of variety of surroundings is the most ambiguous of all the benefits, as in can be interpreted in several ways. The chance of variety in landscape increases as the cycled distance increases. The route chosen affects these chances greatly, but it does require a minimum distance. Fulfilling the sought benefit of variety of surroundings in being indoors or outdoors is done by every type of use. The importance of this benefit increases if a user is not mobile without mobility aids.

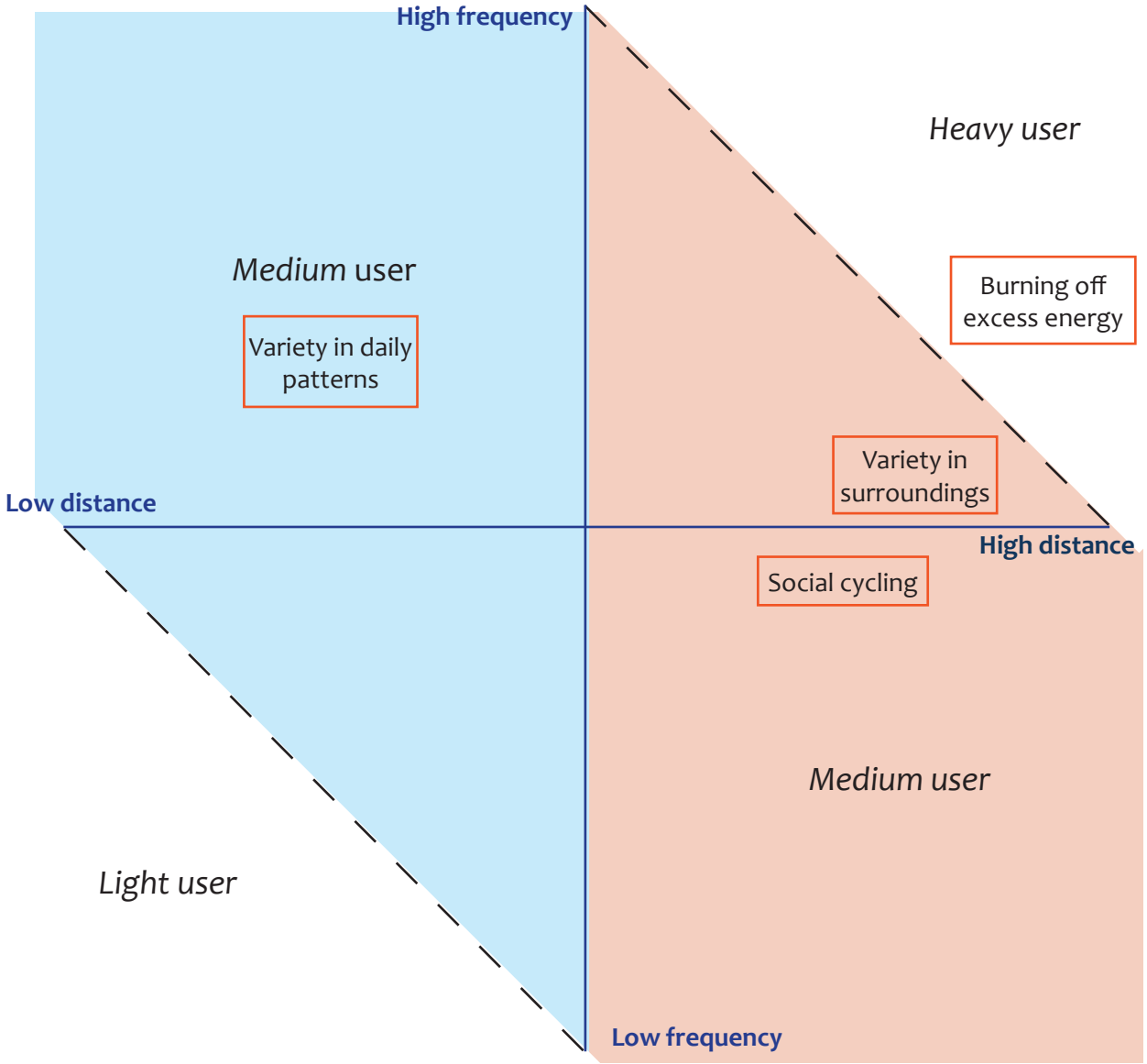
Physical health and motivation are very important factors in the distance cycled. Some uses are universal, as every user might use their tricycle to do groceries, which requires cycling a short distance at least once a week. Using a tricycle to cycle longer distances does not decrease the need for more frequent, shorter cycling trips, as their nature is mostly practical than recreational. The importance of having the option to use a tricycle for a longer distance is the dividing factor within the demographic target group.

Cycling longer distances require the user to stay in the same position longer, the cycle movements put stress on the body of the cyclist and fatigue is a larger factor. Cycling is the main element of using the tricycle. This makes other use elements much less important. Social cycling is an element of cycling further, this requires the user to be able to interact with other cyclist.

With cycling shorter distances, all the other elements that occur with using the tricycle become much more important. When cycling one kilometre, mounting, dismounting and parking the cycle take as much time as the cycling itself. The persons who restrict themselves to cycling only shorter distances do not spend a lot of time on the tricycle per use, but they are likely to use the tricycle more often per day. Feeling safe and comfortable is much more important than being able to keep the cycling position for over an hour without experiencing discomfort or injury.

This is the reason why long distance cycling and shorter distance cycling will be targeted as separate segments, as shown in *Table 7*. The medium user is targeted, as this is the most numerous target group. Light user might benefit from a shared tricycle plan, which enables them to share a tricycle with other, decreasing the costs per use. Shared tricycle in care homes are an example of this. Heavy users are likely small in number, regarding the amount of time necessary to cycle often long distances, as well as the level of fitness necessary for such intense use. This is only possible if the person has a non-health related motor disability, such as an amputation or brain damage. Targeting the heavy users would require a lot of resources for a small amount of people. A tricycle is a durable product, focussing on heavy users does not have the effect as it would with consumer goods (Kotler, 2006). Therefore, heavy user will be regarded as extreme users within the large- distant segment.

TABLE 7: BEHAVIOURAL TARGET SEGMENTS FROM BASED ON TABLE 6



3.5 CONCLUSIONS

The two targeted segments are people over 40 years old who do not participate in the workforce who would like to use a tricycle to cycle high distances and people over 40 years old who do not participate in the workforce who would like to use a tricycle to cycle low distances.

These targeted segments can be illustrated via these personae:

High distance segment: the recreational user

Paul as always been an active person with cycling as one of his favourite activities. Cycling allows him to exercise outside on his own time without putting too much strain on his body. When he was younger, Paul cycled long distances at high speed on his race cycle, but since he started experiencing problems with his health, Paul stopped doing that. Now, recreational cycling with his wife Claudia has his preference. Together, they cycle through their favourite rural areas whenever the weather is nice.

Due to problems with his equilibrium, Paul is no longer able to use a bicycle. He tried to continue cycling despite his problems, until one incident leading to stitches caused his practitioner to forbid Paul the use a bicycle and advised to try a tricycle instead. Paul wants to be able to continue to cycle with Claudia. He likes their trips, he likes the feeling of the wind sweeping through his hair and he does not want to give up their summer trips, when they make surprise visits on their children and grandchildren. Neither does Paul want to slow down his cycling tempo. Claudia uses a bicycle with electric paddle support, which allows her to cycle over twenty kilometres an hour, Paul wants to be able to cycle at the same speed.

When Paul is not making recreational trips, Paul enjoys an active social life. He visits his former neighbour in the towns care home every Monday. On Tuesdays, Paul and Claudia play cards with friends. On Wednesdays, Claudia goes swimming. Paul never cared for swimming. Instead, he does the weekly groceries and brings some fish from the fish stall for lunch. On Fridays, Paul visits the market in the city to get fruit, vegetables and cheese. The weekend is often reserved for visiting the children. Paul likes his life and he will not let his physical limitations hold him back. He stays active and eats healthy to be able to see his grandchildren grow up. If he could find a cycling method that allows him to cycle at a speed of at least twenty kilometres an hour on a distance of at least thirty kilometres and allows him to do groceries on his own, Paul would be happy to buy such a cycle.

Low distance segment: the mobility user

Sporty has never been a description used to describe Claire. Smart, elegant and caring were more often used. She likes to spend her time reading books, doing puzzles and visiting museums. Severe rheumatics have made the latter more of a challenge, but with a walking aid which also functions as a seat and her husband Jakob at her side, she can manage just fine. Cycling is something Claire gave up several years ago. She became too slow to adequately react to the bicycle and she became scared. Jakob has tried to stimulate her into cycling, but she feels too unsafe on such an unstable vehicle. The consequence of her refusal to cycle is that she is not able to be outside often.

Jakob takes care of the groceries, he drives her to where she needs to be and he goes out to walk the dog while Claire remains at home. Sitting on the balcony or asking Jakob to push her around in her wheelchair is always a possibility to get some fresh air and sunlight, but Claire would like to go outside by herself. It would allow her to do some groceries, to buy some of the things Claire likes, but Jakob never buys. Relieving some tasks of Jakob would also be nice. Let her walk the dog for once. She is still able, just not as mobile as she was. If she would be able to get something that would enable her to move around within the town, she would be very happy. It would give her so much more freedom to be able to go out on her own.

Buying a mobility scooter would be a solution, but Claire does not like mobility scooters. A mobility scooter would transform her from sitting inside to sitting outside. While she is not the fittest person out there, she would still like to be able to do some physical activity. No hours of hard, intense exercise, just some low intensity exercise would be nice. It would benefit her blood sugar levels and help her maintain a healthy weight. Because rheumatics or not, looking good is still important to Claire. She would never dream of arriving sweaty and red faced at the weekly tea drinking and gossiping session at her oldest friend's house. When she arrives, she wants her girlfriends to be in awe of the grace in dealing with her personal physical challenges, as the forward thinking, elegant manner she is known for.

4. TARGET GROUP RESEARCH

This chapter will contain the analysis used to transform the choice of target segments to a list of requirements that are necessary to enable the target segment to do what they want with their tricycle.

4.1 THEORETICAL BACKGROUND

Target group research is a tool to translate segment targeting into a program of requirements and wishes for the product. The requirements originate from the user itself, the use, the environment of the use and the law.

For the use analysis, used scenarios are analysed along the questions: whom, why, when, how often, how long and where (Bonnema, 2008)? This scenario based use analysis involves a definition of the user, the user's goal, the circumstances of the use, the frequency , the duration and the location. The user is the segmented target group, the goal the purpose of the scenario. The circumstances describe the conditions of the use, the amount of daylight available, the weather conditions and other special properties. The frequency gives the importance for the user. The duration give the distance travelled and the time the user spend using the tricycle. The location is given through a possible route analysis, which offers the obstacles an user might experience on their routes.

The result of this use analysis will be used to conduct a function and task analysis. Cycling has a set function and a set task sequence. The circumstances of the use can influence each task. The task analysis describes the actions the user has to perform to achieve tricycle use goals. *"Most generally, a task analysis is a way of systematically describing human interaction with a system to understand how to match the demands of the system to human capabilities"* (Wickens, 2004, p 39). A function represents *"general transformations of information and system state that help people achieve their goals but do not specify particular tasks."* (Wickens, 2004, p 39)

The task sequence that results from the function and task analysis can be applied to the scenario's, which combines to a use specific task sequence. These use specific task sequences can be supported by the tricycle design elements. Ranking the use specific task sequences in importance to each target group segment by the relevance of each scenario to that specific segment creates list of design elements which are very important to the segment. This list is used to create the list of wishes and requirements.

An alternative analysis is used to supplement the list of wishes and requirements to increase the value of the tricycle to the user. This analysis considers the scenario's in which the tricycle could replace that alternative. It also sets apart the benefits of using the alternative as well as the negatives of using the alternative. These pros and cons are used to generate ideas for implementing the good elements of the alternative in the tricycle design while avoiding the negative aspects of the alternative.

4.2 RESEARCH DESIGN

The requirements set by the user will be enquired from the interviews. Requirements based on bodily measures will be gathered from online data points with body measurements (DINED, 2004). Desk research will be used to gather information on desired posture. Calculations based on this data will be tested on available colleagues for mayor errors.

The structured interviews with current users, potential users and bicycle users include questions on use as a base for scenarios. These interviews can be found in *appendix B.* This appendix also contains description of the behaviour a person conducts when using a tricycle, as well as the task they preform while using a tricycle. Information on extreme use is gathered at the repair department of Van Raam, as they repair some of the outcome of extreme uses. Desk research on use and causes of accidents are used to supplement and quantify the use.

For the environment analysis, observations along potential user routes are conducted on road conditions, situations and the likeliness the user might encounter these difficulties. These routes and pictures taken along these routes can be found in *Appendix C*. The exact quantifications necessary for forming the program of requirements are sourced in infrastructural design guidelines.

Requirements of the law are sourced from law articles available on the internet. This is mainly the Dutch law, as this is currently the largest sales market which has a law in a language that is understood by the author of this thesis. Earlier conducted research by a bachelor's student for Van Raam shows the Dutch law to be the most extensive law when it comes to the properties of a cycle. Weather this difference is due to the actual laws of other sales market countries or due to the quality of the research conducted is unclear. Therefore, this research is a less favourable source than direct sourcing from publicly available Dutch law articles.

The products for the alternatives analysis are gathered through scanning the catalogue of a large special needs product supplier which also supplies Van Raam products. The product that are potentially relevant to the targeted segments will be taken into account. Alternative means of transportation are gathered to describe the pros and cons using the transportation has to the user. The pros will be considered as an integrated feature for the tricycle, while the tricycle resolves the cons of the transportation method.

4.3 FINDINGS

A tricycle is a multi-purpose vehicle that transports the user, along with cargo attached to the tricycle, though physical effort by the user. While a tricycle can be used for many activities and use goals, the basic function of a tricycle is transportation through physical effort. Providing a seat, providing a the option to steer and providing a method to warn other people are not functions, as they are parts of the tricycle that support the user in the execution of their tasks. Providing entertainment and providing exercise are also not functions, as they are part of the user goals. Neither of these help achieve the user their goal, as a person can do groceries without sitting on the seat, nor steering, nor warning other people.

Therefore, the functions are restricted to transporting the user and transporting load. The reason for separating these tasks is the activeness of the user in the use of the tricycle and the inactiveness of the load. These functions can be executed separately, as a user can cycle without other load. Transportation of load without transportation of the user can occur when the user walks along the tricycle.

The tasks requires of the user for the function 'transport user' are parking, mounting, cycling and dismounting. Depending on the design and the situation, the sequence of parking, mounting and dismounting changes. Parking requires remaining stationary, placing and securing. Becoming stationary, or braking, is a part of cycling. Placing can happen while cycling, if the environment and design allows it. The securing of the tricycle can happen on the tricycle, but is more likely to happen after mounting.

Park is the rest position of the tricycle. It is the state in which the user is most likely to add or remove load. After placing the load and securing the load, the interaction between the load and the user ends. Transportation of the load increase the effort necessary of the user to cycle, but otherwise, it should not affect the user. This is why transporting load is not represented in *Table 8* and *Table 9* as a user task.

TABLE 8: TASK SEQUENCE WHEN PARKING WHILE DISMOUNTED

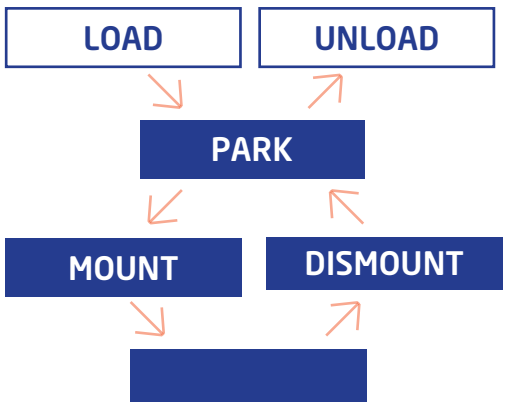


TABLE 9: TASK SEQUENCE WHEN PARKING WHILE MOUNTED

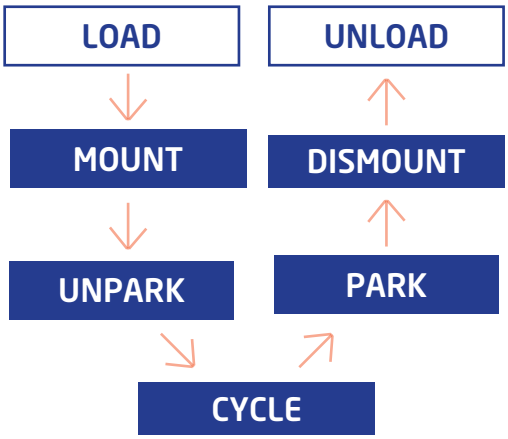


TABLE 10: TASKS AND THEIR SUBTASKS

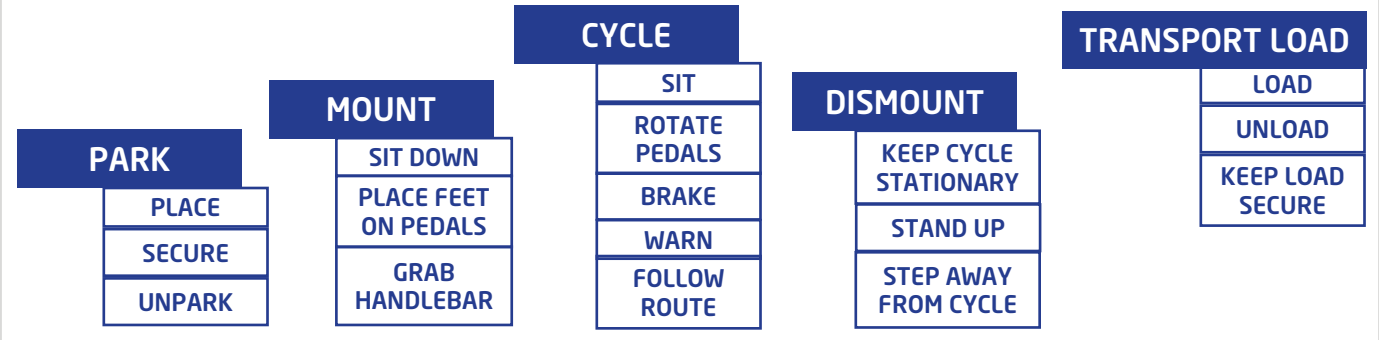


Table 10 shows the subtask that are part of the main tasks. The sequence of these subtasks are situation and user dependent, as is shown in the observations made that can be found in *Appendix B*. Whether 'keep load secure' is a task executed by the user or by the tricycle itself is a matter of the method of securing. The load can be secured by the user to the tricycle, the 'keep load secure' task is only executed during loading and unloading. If the load is held secure by the user, not the tricycle, the 'keep load secure' task is executed along all other tasks. *Appendix D* contains a more elaborate subdivision of tasks to a level of which body parts needs to be moved to which position.

The importance of each task change with each use. The circumstances in which the task is preformed are also use specific, as different uses put the tricycle through different environments. To visualize these influences, the use scenarios, task sequences and environments of the use are combined in the following pages.

Scenario: getting groceries

This scenario involves both segments. Several times a week, within the town where the user lives, the user goes groceries shopping. Bad weather might motivate the user to postpone doing the groceries for a few hours, but the use is relevant in all seasons. This scenario is very important to both user segments, as it involves a necessity of independent living. Alternatives for the user getting groceries is having a caretaker doing the groceries or using a rollator as a mobility aid which allows the user to transport goods without having to carry them. The difference between the segments is the destination decision making factors.

A mobility user is more likely to choose the nearest option, while the recreational user is willing to frequent a less nearby establishment if the establishment has a better offer. This distance difference does not influence the environment properties, as both are likely to take place within the town where the user lives and the surroundings of stores are mostly the same. Namely a designated cycle storage area, parking spaces for cars and a heightened amount of pedestrians. Level changes by having to enter a curb are also likely to occur. Faulty parking is likely to be punished. Getting groceries does not only involve visiting the supermarket, it also involves getting cash and visiting specialized stores. *Images 7 to 10* are examples of the use environment for this scenario.

Tasks	Use specific details	Environment
Mount	Weight distribution is altered by load	Pavement, bicycle storage facility. Possibly little room
Dismount		
Cycle	Low speed. Many impressions	Town centre. Heavy traffic. Obstacle heavy. Changing road
Park	Short-term parking	Wrongful parking can lead to removal of the cycle
Transport load	Groceries. These can be loaded per item or grouped in a container	Level changes between pavement and road

IMAGE 7: SURROUNDINGS SUPERMARKET

Image 8: Cash machine

Image 9: Town centre with cobblestones

Image 10: Town centre with cobblestones and level changes

Scenario: Appointments (non-recreational)

This scenario involves activities that have a set starting time. The user has to be at the appointment at said time. Examples of such appointments are visits are practitioner's appointments, meetings for voluntary work and getting a haircut. The use can not be delayed in case of bad weather, as the party receiving them is waiting. Cancellation is preferred over delayed arrival. This set time adds time pressure to the use.

This scenario is less important to both users than getting groceries. It is more important to the mobility user, as the lower level of health makes medical appointments a regularly occurring reason to use the tricycle. As the recreational user is more likely to have better health, this segment is more likely to have volunteering work engagements as a cause of appointments instead of medical appointments. Both segments will use the tricycle to go to appointments, but the use is not defining the cycle choice for either segment.

The appointment is most likely to happen within the town of the user, maybe one town over if the towns are close together. Again, the recreational user is more likely to cycle further before choosing an alternative means of transportation. Going by car or taking public transport is an alternative to this use. Choosing an alternative will most likely be the option chosen in case of bad weather, especially rain, as the user most likely wants to look presentable at the appointment.

The environment of the use is dependent on the location of the appointment. It might lead through the city centre, represented in images *8, 9 and 10.* As the appointment is likely further removed from the house of the user, the travel environment is more likely to be diverse, as shown in *images 12 to 14.* When having an appointment with a professional, the cycle storage area is less densely designed and closer to the entrance than at a supermarket. In that situation, the user arrives at the time another person leaves, making the storage area more crowded. Faulty parking is more likely to be accepted. Reaching the storage area might be a challenge, as car parking spaces are often situated between the bicycle storage area and the road. Level changes are also likely, as presented in *image 11.*

Tasks	Use specific details	Environment
Mount	Possibly less dexterity due to medication	Obstacle heavy. Possibly little room
Dismount	User might be time pressured	
Cycle	Time pressured. Distraction due to the appointment might be present	Town centre. Heavy traffic
Park	User might be time pressured. Possible crowds due to arriving and leaving at the same moment	Car parking might be near bicycle storage. Parking close often possible.

Image 11: Level changes to reach entrance

Image 12: Road changes

Image 13: Quiet road

Image 14: Roundabout with bike lane

Scenario: Social visits (recreational)

In the scenario of social visits the user uses the tricycle to make social visits to friends or family. The visit can be the only goal of the use, as it is the case for the mobility user. To the mobility user, social visits are very important, because it prevents the user from social isolation. The visits are only within the town, visits outside the town are made by other means of transportation. It is an a weekly returning activity with a possibly higher frequency depending on the activeness of the person's social life.

For the recreational user, social visits are slightly less important, as the social life of this user is less dependent on visits. This is because a lot of the social interaction covered through social cycling, which is included in 'recreational touring'. In winter, when the weather is less favourable, the social visits of this segment are similar to the mobility user. When the weather is good, these social visits can become part of a recreational tour, as a brake.

Both users are dependent on the environment of the receiving party, especially when it comes to parking, The parking can have little room, if the person lives in a building with little cycle storage space. When parking in someone's yard, a change on parking on an unpaved surface is possible. As personal areas do not have to meet government requirements as public spaces have, more extreme storage situations can occur. Sheltered storage during the visit is highly unlikely. For this use, the tricycle needs to be weatherproof and stable enough not to fall over when stalled on an uneven or unpaved surface.

Transport of goods was not relevant for 'appointments'. For this scenario, the load might be gifts for the receiving party. For these gifts, transportation that does not damage fragile load is important. On the way back, it might be dark and the user might have consumed alcohol. The *images* below, *15* to *19*, show the scenario specific environment.

Tasks	Use specific details	Environment
Mount	Distraction by visited party	Often spacious. Uneven surface possible, such as gravel
Dismount		
Cycle	Low speed. Many impressions. Possibly lessened dexterity due to alcohol consumption	Residential area, low traffic intensity, but large change of unexpected changes, such as playing children
Park	Parking for several hours. Situation is very dependent on the living situation of the visited	No official storage facilities. Likely not sheltered. Storage possibly on soft ground
Transport load	Gifts, small loads that have to be transported without damage	Level changes due to speed bumps and curbs.

IMAGE 15: RESIDENTIAL AREA

IMAGE 16: BRIDGE TO HOUSES

IMAGE 17: GARDEN GATE

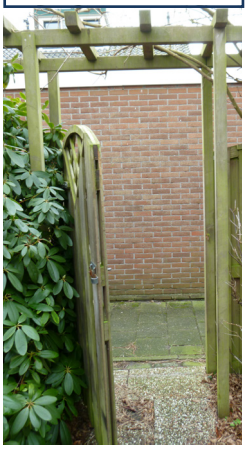


IMAGE 18: PATH TO A BACKYARD

IMAGE 19: ROAD IN RESIDENTIAL AREA

Scenario: Recreational touring

This scenario is essential for the recreational user. To be able to execute this scenario comfortably using the tricycle is the main motivation for the recreational user to use a tricycle. The length and frequency are strongly dependent on the weather, as good weather increases the frequency and the distance. As a form of recreation, the act has to be fun, therefore this scenario is not realistic in very cold or rainy weather. As most tours are made with other people, recreational touring is a social event. The cycle partner is most likely the partner or a friend of the user and a most likely a bicycle user. To communicate comfortably, the tricycle user must be seated at similar height and position of the bicycle user. It is also important that the tricycle itself does not produce a high level of noise during use, as this makes it more difficult to understand the cycle partner.

As the time cycled is very long in comparison to 'getting groceries' and 'appointments', the cycle environment becomes more important. The surroundings are mostly rural with known routes but unknown road conditions. The farther the user is removed from the town they live in, the fewer the knowledge of road conditions become. As the user probably has a lot of routes to choose from, most parts of the tour are not seen often enough to know if any changes have occurred since the last time the user passed this point. This will result in having to cross less favourable road conditions, such as narrow roads, *image 20*, or bad road conditions, shown in *image 21 to 24*.

The tour is broken up by small brakes, where the user eats and drinks, favourably in a beautiful spot, *image 25 and 26*. Food and drink is brought from home, supplemented with snacks that can not be carried, such as an ice cream cone. Eating and drinking while cycling can also occur. For this to be possible, the user needs to be able to control the tricycle with one hand. As this use is quite weather dependent, most tours are quickly planned, less than a day in advance. Pictures of other road situations are presented on the next page.

Recreational touring for the mobility user is a short ride to gain fresh air and generally being outside. This can be done in company of others, especially during good weather at occasions when a larger group is available. The tour is likely to be around half an hour, with brakes at beautiful locations to enjoy the view. Bringing eat and drink is less relevant to this user, as the trips taken are not long enough to require refreshments .

Tasks	Use specific details	Environment
Mount	User might have food or drink in hands	Side of the road, at a picnic facility or bench. Quiet. Possible unpaved surface
Dismount	User might be fatigued by cycling	
Cycle	With others. With brakes and heavy navigating. Fatigue is likely	Route is based on the views, not on pavement properties. Mainly rural surroundings. Busy traffic situations are avoided
Park	Short-term. With other cycles	At picnic facility, bench or side of the road
Transport load	Load is mostly food and drink	Bumpy roads. Large level changes, such as bridges, which cause quick speed changes

Image 20: Narrow path

Image 21: Bad road condition

Image 22: Uneven road and cattle grid

Image 23: Fallen branch

IMAGE 24: CROSS SLOPE CHANGES

IMAGE 25: PICNIC AREA

IMAGE 26: PICNIC AREA

IMAGE 29: DECLINING ROAD

IMAGE 28: BENDED ROAD WITH BRIDGE

IMAGE 27: ROAD WITH SOFT SHOULDER

IMAGE 32: SECONDARY ROAD

IMAGE 31: ROAD CROSSING WITH SLOPE

IMAGE30: CROSSING

IMAGE 35: TRAFFIC LIGHT AND BRIDGE

IMAGE 34: ROAD WITH WATER ALONGSIDE

IMAGE 33: NARROW ROAD AND BRIDGE

IMAGE 38: ROUTES SIGN

IMAGE 37: SLOPED ROAD

IMAGE 36: NARROW SPACE BETWEEN ROAD AND WATER

Extreme scenario's

These scenarios describe scenarios that are less common to the user segments, but relevant to select users. The goal of setting extreme scenario's is exploring the edges of possible use to make a design suited for more diverse uses.

Mobility user: Walking the dog

This scenario is important to people who own a dog, where the tricycle is used as a substitute for walking. The dog is attached to either the user or the tricycle and walks along the tricycle. The distance is under two kilometres and dependent on the dog. It is less likely for the recreational user to walk a dog, as their active lifestyle causes them to be home too little to care for pets. The environment is represented in *images 11 to 19*, as well in *images 39 and 40*.

Tasks	Use specific details	Environment
Mount	Leash must be attached	By the user's house
Dismount	Leash must be detached	
Cycle	Low speed with many stops. Dog walks to the side of the tricycle	Close to the side of the road. Unpaved shoulder
Transport load	Leash must stay attached	Dog walks either between tricycle and the edge of the rod or on the other side

IMAGE 39: SIDEWALK ALONG GRASS

Mobility user: Using the tricycle inside buildings

This scenario is important to people who use the tricycle as a replacement for other mobility aids who have too much trouble walking to walk through larger buildings. A tricycle is generally faster than other mobility aids, which makes it very suited for use in unfavourable weather. It also allows the user to remain stable while using both arms to do other tasks, which is not possible for a rollator or crutches.

IMAGE 40: PATH TO DOG WALKING AREA

Tasks	Use specific details	Environment
Cycle	Very low speed	Very smooth surfaces, little room, many obstacles who absolutely must be avoided
Transport load	Load must be visible to others. Using local carrier devices might be obligatory	

Recreational user: Touring over 50 kilometres

A recreational user who has very good endurance might cycle over 50 kilometres in one day. If the day is a part of a multi-day distance, the user cycles long distances for multiple consecutive days. This can cause great strain on the body, mainly to the points where the user connects with the tricycle, such as hands and seating area. Drinking while cycling becomes important. As it is not likely the long distance is a daily occurrence, this scenario can be important, but not deciding. The environment is the same as regular touring, the amount of unexpected situations is higher.

Tasks	Use specific details	Environment
Cycle	Average to high speeds. The trip might be interrupted by social visits	Exact properties of route unknown. Mainly rural. Paved roads are preferred
Transport load	Clothing, drink and food. Drinking while cycling	Bumpy roads, level changes through speed bumps and slopes. Many speed changes

Recreational user: Cycling through hilly surroundings

This scenario describes a use that would be nice to have as a possibility, but it is not deciding in the choice of the recreational user. The aforementioned hilly surroundings are more than regular hills created by sand dunes or dykes with steep slopes, it is cycling through mountainous areas. This segment is relevant to users on vacation or users who live in a hilly environment, outside the Netherlands. This scenario is currently not very important, but as globalization of the Van Raam market increases, so does the relevance of this scenario.

Tasks	Use specific details	Environment
Mount	Cycle may be sloped	Side of the road, at a bench or picnic area. Low traffic. Possibly little room, unpaved shoulder and sloped road
Dismount	User might be fatigued	
Cycle	Extremely low or extremely high speeds, depending on ascend or descend	Paved paths are preferred. Heavily sloped roads.
Transport load	Transport food and drink	Large elevation changes. Large speed changes

Exteme use scenario recreational user: Cycling on unpaved paths

This scenario describes a use that would be nice to have as a possibility, but it is not deciding in the choice of the recreational user. It would allow the user to cycle paths which would normally be cycled with a mountain bike. Through using a tricycle, the user could come along to mountain bike trips. This scenario was mentioned by a current tricycle user in the younger regions of the target group. Having the option of a tricycle mountain bike would allow her to go along on mountain bike trips with her family. Similar to the 'hilly surroundings' scenario, this scenario becomes more relevant as globalization increases.

Tasks	Use specific details	Environment
Mount	User might have limited range of motion due to protective gear	Side of the road, at the start of a route. Low traffic, unpaved ground
Dismount	User might be fatigued	
Cycle	Average to high speeds. The user seeks challenge in choosing less favourable surroundings	Unpaved paths are preferred. Very uneven ground
Transport load	Transport food and drink	Very bumpy roads. Many sudden level and speed changes

The alternatives analysis compares alternative means of transportation, mobility aids and cycles. The mobility aids are not necessarily a replacement of the tricycle, as some of them are home improvements that allow a user to live independently longer. These mobility aids do possess elements that can support the user which can be integrated in the tricycle design. The main advantage of a tricycle is the compactness, the lack of fuel needed and therefore the environmentally friendly features and the small size of the stability the tricycle offers during dynamic use. Dynamic use is use where the cycle is moving, such as cycling.

Low effort operation, a supported seating position and easy mounting are features that are offered by the alternatives which can be integrated in the tricycle design. A more elaborated version of the alternative analysis can be found in the appendix of *Appendix D*.

4.4 CONCLUSIONS

The program of requirements can be found in the confidential *appendix D*, which is written in Dutch, because this is the communication language at Van Raam.

The conclusion of the target group analysis is the difference in requirements between the user segments. For the recreational user, this is providing support and comfort during prolonged use. Recreational touring sets the two user segments apart on a level that can not be seen with other use scenarios. All the uses desired by the mobility user are also desired by the recreational user. The mobility user requires less in the task of cycling and more on the tasks before and after cycling.

Because of all relevant use scenarios concerning short distances, the tasks of mounting, dismounting, loading and unloading are much more important to the mobility user than to the recreational user. Being able to preform these tasks quickly and efficiently cause a more pleasant use experience to the mobility user, as this saves a lot of effort and time for this user. The recreational user is more likely to accept less comfort in this area if it means a nicer performance in the cycling task, as the time spend cycling is far greater than the time spend on the other tasks.

The mobility user is likely to require more support in maintaining the seating position during use. A comfortable, soft seat would suit this user better than a hard saddle. The position the user is in has to be held with minimum effort. For this, the user is willing to trade in speed. Feeling comfortable, safe and secure is most important to this user. Having predictable reactions by the tricycle can help. The position of the user during use is not very important, as long as the user has enough overview over their surroundings and their position is within the ranges other traffic users expect them.

The recreational user has more strict requirements on the measurements of their tricycle, as the social aspect of recreational touring requires a similar head positions as a regular tricycle. Being able to manoeuvre as fluidly as a regular bicycle at higher speeds is very important to this user, as having to slow down for a turn and having to speed up after costs a lot on energy. The cycle partner is most likely of similar age as the user, the chances of the person having a bicycle with electric paddle support are large. This means a general high speed, which the recreational user also wants to be able to reach. It also means an seating angle that transmits the user's muscle power efficiently into speed. This segment can be expected to be able to keep a seating angle that requires a little more core strength, as the user is likely to train the necessary muscles during the use of the tricycle.

Preventing unnecessary energy loss by other things than the exercise of cycling is also the motivation for the recreational user to require a steady, level seating position. Because of the double wheels in the back, a tricycle is unlevel in the cross section when the wheels are on a cross slope. The user compensates for this unlevelness, resulting in quickened tiredness in the core muscles of the user, making prolonged cycling unpleasant. Compensation by the tricycle instead of the user would be a welcome solution. The seat has to support the recreational user in maintaining the right seating position, as prolonged cycling mean prolonged time on the seat. Therefore, the seat can not be too soft, this will cause problems in the seating area over time.

While not being level might provoke an idea of falling over with the mobility user, being level is not as important to the mobility user as it is to the recreational user. Being able to predict the behaviour of the tricycle is much more important to mobility users. Being able to hear other traffic coming increases is beneficial to the feeling of safety in traffic. The tricycle is not allowed to make enough noise by normal use to drown out the noises of other traffic participants. Being able to keep conversation with the cycle partner is a requirement of the recreational user that lowers the allowed noise level even lower.

Both user segments have to abide to the law, which requires lights and reflecting surfaces on set places. Another uniting requirement is being able to go through a regular sized door, which enables the user to store the tricycle inside. As both segments have the same demographic, the average body measurements are roughly the same. This thesis did not contain enough research to detect differences in height between the two user segments.

5. FINAL CONCLUSIONS

Most of the potential users experience limitations in their motor skills, they are aged over 40 and are not likely to be part of the working force. Within this demographic target group, two main users occur. One group of users mainly wants to use the tricycle as a method to increase their mobility outside the home. The other groups seeks a tricycle to use for recreational purposes, such as social cycling.

The current Van Raam product portfolio caters mostly to the mobility user, mainly by the low tricycle model. This lowered tricycle model offers back support, as well as more stability because of the lowered centre of mass position. The lowered seating position limits the distance the user can see, which might be experienced as unfavourable. While the mobility user might not be completely satisfied with the choices Van Raam currently offers, the current models are likely to be satisfactory enough to motivate a purchase.

The original goal of this thesis is to find the people left out by the current Van Raam product portfolio. The recreational user in one of the potential user groups left out. None of the current Van Raam models suit the needs of the recreational user. To reach this user, a new model must be designed.

The recreational user requires a cycle that can be operated alongside a regular bicycle at higher speeds, similar to the tempo of a bicycle with electric paddle support. It must contain a method to reduce the effect unevenness of the road's surface has on the position of the user. The exact size of this target group is unknown and must be researched. The tolerances of the duration of each cross angle the user is in must be tested in experiments with people that are of the right demographic and preferably potential recreational users. Force thresholds must prevent involuntary steering and braking. The height of these thresholds also need further research.

This research in the physical properties of potential users is essential to make the new design functional. User-level ergonomics are not included in this thesis. The analysis of the user group conducted in this thesis argues for this research, as the user of a tricycle requires a lot of the vehicle in different use environments. Comfort during prolonged use is essential. The seating position is very important for this comfort. The properties of the ideal seating position are unknown and have to be researched.

Further development of a cycle model that is balanced in a stationary position and does not fall over in dynamic use of the recreational user is necessary if Van Raam wants to reach the recreational user segment. . By reaching this user segment, the amount of physically fit people using a tricycle increases. Presenting active people on a tricycle reduces the stigma concerning tricycle of them being meant for severely disabled people. Removing this stigma lowers the emotional entry level for potential users. Motivating potential users to switch from using a bicycle while not being completely able to using a tricycle which suit the abilities of the user better is highly desirable. Switching to a tricycle sooner prevents people from falling and causing injury to themselves.

The mobility user recuirers the tricycle to minimize the effort of each cycling task. Designing a model for the mobility user will probably damage the market for the individual cycle models that cater to less mobile users. This user does not require the tricycle to be as high as a regular bicycle. Research into the physical properties and their ideal seating position would be beneficial. The design for the mobility user can replace more than the current high tricycle model. It would involve all individual cycle models. The result is probably a smaller product portfolio that would cater to more needs of the potential individual special needs cycle group.

When observing people of all ages trying a tricycle for the first time it became apparent that all people need time to get used to the task pattern of the vehicle. The time necessary differed person to person to person. Allowing potential users more time to test a model coming to a showroom would allow the person to get used to the vehicle and discover which problems experiences were due to the different tasks patterns and which problems are experienced after a slightly prolonged use. This can offer a lot of new information to Van Raam, as well as increase the chances of the potential users to choose a model that is right for them. This is a short-term solution, which can be used to increase user satisfaction while the new models are created.

6. DISCUSSION

This research does not involve enough research on the physical properties of the potential user group to use requirements concerning physical measurements to use this as the final list of requirements during when designing a new model. It also does not include the exact amount of people per segment.

The researches used as sources did not use the same standards to decide whether a person was slightly, moderately or severely motor disabled. Therefore, these divisions are not taken into regard in this research. Several of the variables were non-relevant to cycling, as a person who has no ability to walk can have the ability to cycle. As IQ is a variable that is universally accepted and was very relevant to discriminating non-users from potential users, it was used to divide cognitive disabled people into the two respective groups.

The different researches also differentiated their age groups differently. Many researches contained themselves to people aged 12-79, leaving out 16% of the population. To include this 16%, numbers from different researches were necessary, which increases in-accurateness in the numbers. Therefore, the numbers given should be used as an estimation, not as an exact measurement of the number of people. Another factor was the differentiation between the age groups. Some sources differentiated at age 40, some at age 50. All researches presented a sharp increase in the number of people with motor disabilities after that age. Because of the difference in age segments, the increase between 40 and 50 could not be deducted from these sources. As using 40 as a division included more people, the lower age was chosen as a divider.

As mentioned earlier, more test with potential users are necessary. All observations made for this research were conducted in winter, in weather conditions with very low temperatures and either rain or snow. This is very bad cycling weather. The unfavourable weather made for unrealistic use conditions, as none of the observed would have chosen to cycle unless absolutely necessary.

This caused the duration of the cycle use to be very short, as longer use was too uncomfortable. Better observations could have been made during neutral or good cycling weather, as the observer can cycle along the observed through different environments. The cold temperatures made the observed more hesitant to cycle for longer time. They motions were restricted by large amounts of clothing.

Because of the weather, the interviews were conducted indoors, away from the cycle. Most of the observations were made in one day, where people would cycle on the currently available Van Raam high tricycle model while other participants of the observations were standing together talking. This allowed the observed to influence each other, resulting in observed looking for the problems expressed by the people who cycled earlier. The interviews were also conducted in one room, where the subjects could hear the comments of the others. This level of interaction between observed individuals is likely to cause bias. More objective results can be achieved by separating the observed individuals both during the observations and during the interviews.

7. EVALUATION

This thesis has achieved the initial goal of finding groups of people who are not serviced by the currently available Van Raam product portfolio. It has quantified the sizes of the groups of potential users and shown which groups are largest. The interviews with both users, non-users and potential users have delivered insight in the difference of desired uses, which caused the second behavioural segmentation. Giving structure to the second segmentation has been difficult. This is mostly because of the fuzzy nature of the data. They are feelings, expressed by people through structured interviews. Still, they are dependent on the question asked. The concept of recreational cycling means a different duration to different people. This became apparent during the interviews and the structured questions did not include distances. In hindsight, an online questionnaire would have been useful to supplement this information.

Maintaining structure through acquiring fuzzy information has been the largest challenge in this project. A lot of information was available on topics relating to the information needed, just none on the topic needed. An example if this is information on cycling behaviour, segmented by age and bicycle type, leaving tricycles of special needs cycles in the field of 'other', along with numerous non-relevant cycle models. Information on the amount of people with moderate to severe motor disabilities that use cycling for their daily need of physical activity, but none on the distance, time cycled or the type of cycle used. This made desk research a challenge.

Definition of the assignment before starting the execution of the assignment would be desirable. This prevents miscommunication in expected deliverables and changes on the deliverables later. The analysis element of this thesis went according to plan, though the fuzzy nature of the behavioural segmentation did cause some delay. Working on the thesis every Friday was a good idea, but difficult to implement in execution, as Fridays were mostly use to finish things that had to be finished that week and preparing for the things necessary for the next week. Because of this, the thesis had to be assembled from a lot of separate files, causing a lot of delay at the end of the thesis.

The original planning, which can be found in *Appendix A*, reserved a large portion of the assignment to sketching and concept developing and only two days on making the list of requirements and wished. This time estimation of writing a list of requirements that can be used for future design is too short by far. A more elaborated list of requirements was desired, which caused the need for a lot of additional research to quantify the requirements. This time was derived from the concept making. Therefore, the design sketches made are only presented as an example in *Appendix D*. By setting an extensive list of requirement and wishes as one of the main deliverables of this assignment would have saved a lot of time, as quantifying requirements could have been taken into account in the analysis. Because of this, the research on the forces experienced by the user while making a turn could not be included in this thesis, nor properly applied to design sketches in the advice to Van Raam.

For future design projects, planning and sticking to previously agreed deliverables will be the main personal goal. Communication with superiors will be essential, as miscommunication can cause of extra work.

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9. APPENDIX

A. PLAN OF ACTION

B. OBSERVATIONS & INTERVIEWS

C. CYCLED ROUTES FOR ENVIRONMENT ANALYSIS

D. CONFIDENTIAL APPENDIX

Creating added user value to high tricycles

Plan of action

Client Van Raam and other parties

Van Raam is a company located in Varsseveld. It started out as a smithy in Amsterdam, changed to frame production in the 1970's after a relocation to the east of the Netherlands. A takeover in the 80's led to a specialization in the design and production of special need bicycles. The combination of design and production at the same location enables Van Raam to adapt each bicycle to each user's wishes. Their mission statement is "Let's all cycle".

Van Raam describes itself as "Van Raam produces uniquely special needs bicycles and specializes in tricycles, scooterbikes, wheelchair bikes, tandem bikes, double rider bikes, and low step trough bikes (also known as comfortbikes). Each model is also available as an electric bike (Pedelec)." [1]

Besides being a recognized training company, Van Raam initiated an innovation hub called Innovar. Together with companies from the same region, Contour Advanced Systems and Waterkracht, Van Raam offers internships to students through Innovar in an effort to keep highly educated students in the area known as 'Achterhoek' [2]. The advise resulting from this bachelor's assignment will be used as a basis for another Innovar student.

The products of Van Raam are sold through several channels. Partnered dealers offer (some) demo models, other channels require the potential user to visit the Varsseveld showroom to try a bicycle. Van Raam bicycles can also be rented, at rental locations throughout Europe [3]. It is important to these channels that a new model in the Van Raam product line has an added value larger than the costs connected to the introduction of a new model.

Dealers can be either bicycle dealers, special need products dealers or healthcare facilities. The first two mentioned sell bicycles directly to the user, they care of service and warranty. Healthcare facilities have different operation methods. Some healthcare facilities purchase Van Raam products in large batches, these product are leased to the user. Other healthcare facilities enable the user to choose a Van Raam model, which is purchased though the facility.

Users of Van Raam products usually use some kind of benefits to finance their special needs bicycle. These benefits come from schemes such as Wmo or Wlz. The municipality assigns though these laws a personal budget, known as PGB, which can be used to finance the Van Raam bicycle. The bicycle must provide enough support to answer for the costs to the municipality, as well as the user. The bicycle will improve the mobility of the user. Increased mobility is known to improve psychological health. The physical activity needed to operate the bicycle is also beneficial to the user. Better health of the user can decrease costs for the whole community, repaying the investment of public funds.

Incentive

Van Raam has different models to suit users with different demands. These models are updated regularly. The result is several product lines with a modern, up to date feel. These models suggest an active lifestyle, despite the limitations experienced by the target group. The high tricycle line (HT) have been left behind in this innovation process. The product line looks outdated compared to the other Van Raam models. The HT has been designed in 1999 and has not altered since. Past efforts to redesign HT have proved to be futile. The costs of producing a renewed model have not weighted up to the added value of the redesigns. Van Raam suspects these failures are due to an oversized focus on the current model in the redesign process. By disregarding the current models and competitors and focussing on the target group and their demands, Van Raam hopes to receive new, inventive ideas for their HT that set the HT apart from all other special needs bicycles.

The HT is designed for people who experience problems with their stability. Other Van Raam models also cater to people with stability problems. These models are designed to service specific segments within the general target group. The HT is not segment specific. The HT target group is unclear and the decision motivators are unclear. Van Raam wants more knowledge on the wishes and demands of the target group to be able to determine underserviced segments and missed opportunities.

Goal

Van Raam is looking for a way to differentiate the HT to service specific segments within the general target group of people with stability problems, with the goal to increase the value of using a HT to a user.

This goal shall be reached through segmentation, targeting and positioning (STP). Segmentation will be conducted through an analysis of the larger target group. This data will be used to quantify the total target group of tricycles. This analysis focuses on the possibilities and limitations of the users, what makes a person suited or unsuited for using a HT. Observations will be made of people trying a Van Raam tricycle to monitor their specific situation that leads them to a Van Raam tricycle. Their behaviour and decision making process will be used to form personas to describe the segments.

Other stakeholders will be analysed to discover their impact on the HT. These stakeholders will be caretakers of the end users, the owners of the HT if the owner is not the end user and the selling channels, as these can have a very diverse effect of distributing the HT to the end users.

As a part of targeting, the alternative means of transportation will be analysed to find elements that would benefit a HT design. After a function and task analysis of a HT, the program of requirements and wishes will be made.

Positioning is a combination of the four P's product, price, place and promotion. This assignment will only focus on the product part of positioning. The outcomes of the function analysis will be used to make a morphologic matrix to assist in the design process. The design process will lead to at least three visual concepts that will be implemented into an strategic advice for the further redesign of the HT of Van Raam.

Research questions

Main question

How can design increase the value of using a high to a currently by Van Raam underserviced segment within the larger target of people with problems with stability?

Sub questions

What are the characteristics of the target group?
What makes a person belong to the target group?
What problems does the target group experience that force them to need a tricycle? IE
What are other physical problems the target groups experiences? IE
Which other special need products does the target group use? IEF
What are the demographics of the target group? IE
What segments can be formed within the target group? D
Which segments are underserviced by the current Van Raam models? D

Which stakeholders influence the target group?
Who are the stakeholders? IEF
What is their influence in the decision making process? FD
Which demands and wishes do the stakeholders have that should be included to service the target group segments? D

What are the properties of the alternatives to a HT?
What makes the HT the best option for the target group?
Which benefits are specific to a HT? ID
Which cons are specific to the HT? ID
Which elements of the HT make it the best option? D

Which alternatives to the HT are used by the target group?
Which alternative means of transportation? IE
Which alternative means of action? IE
Why would the target group currently choose these alternatives? IEF
What are the pros of these alternatives? EF
What are the cons of these alternatives? EF
Which of these pros can also be represented in HT? ID
Which cons of alternatives can be absent using a HT? ID
How can the pros of alternative means of transportation be implemented in the tricycle design? D

What parts do a HT need for its functions?
What are the functions of the HT?
What functions of the tricycle are demanded by the users? DF
What functions are wished by the users? DF
How do these functions interact? D

What parts make the function possible?
What is needed to enable the functions in 2.1? D
What parts can be used to these functions? ID

Strategy

	Type	Resources	Expected outcome	Which part of STP
Data collection	Desk research	Internal knowledge at Van Raam	Segmentation tree, contact information of persons to interview	Segmentation
		Internet	Knowledge on abilities and disabilities of target group	
	Unstructured interviews	Showroom visitors at Van Raam	Insight in potential use, requirements of end users and the influence and demands and wishes of caretakers	
		Potential buyers visited by extern salesperson		
	Structured interviews	Stakeholders	Stakeholder's demands and wishes for HT	
Data processing	Function analysis	Structured interviews	Task and function tree	Targeting
		Current Van Raam models		
		Alternatives	Ideas for design	Product
	Summary	Knowledge from data collection	List of demands and wishes for HT	
Designing	Drawing	Creativity	Idea sketches	
	Selection	Idea sketches	Segmented sketches	
	Drawing	Segmented sketches	Concept sketches	
	Selection	Concept sketches	Design concepts	
Advising	Design concept	Sketches	An advice for further steps to successfully redesign the HT	

This assignment contains a thorough research of different sizes target groups. Van Raam has a lot of knowledge about their target groups. Figures, user details and market group researches. Internal sources will be the main sources for the target group analysis. The test process of several potential HT owners will be observed, combined with an unstructured interview of the tester or the caretaker in case of the user not being able to represent themselves. This in order to get a detailed idea of the behaviour of end users and the influence the caretaker has on the end user. These observations will be made when testers visit the showroom and by joining a external sales person on his trips along several potential HT buyers throughout the Netherlands at least one day.

Owners of several HT models who aren't end users will be interviewed structurally by telephone, up to a number of ten. The selling channels will be categorized by healthcare schemes, dealers specialized in special needs products and bicycle dealers. Each of the categories will be structurally interviewed, preferably by telephone. At least 10 selling channels will be contacted.

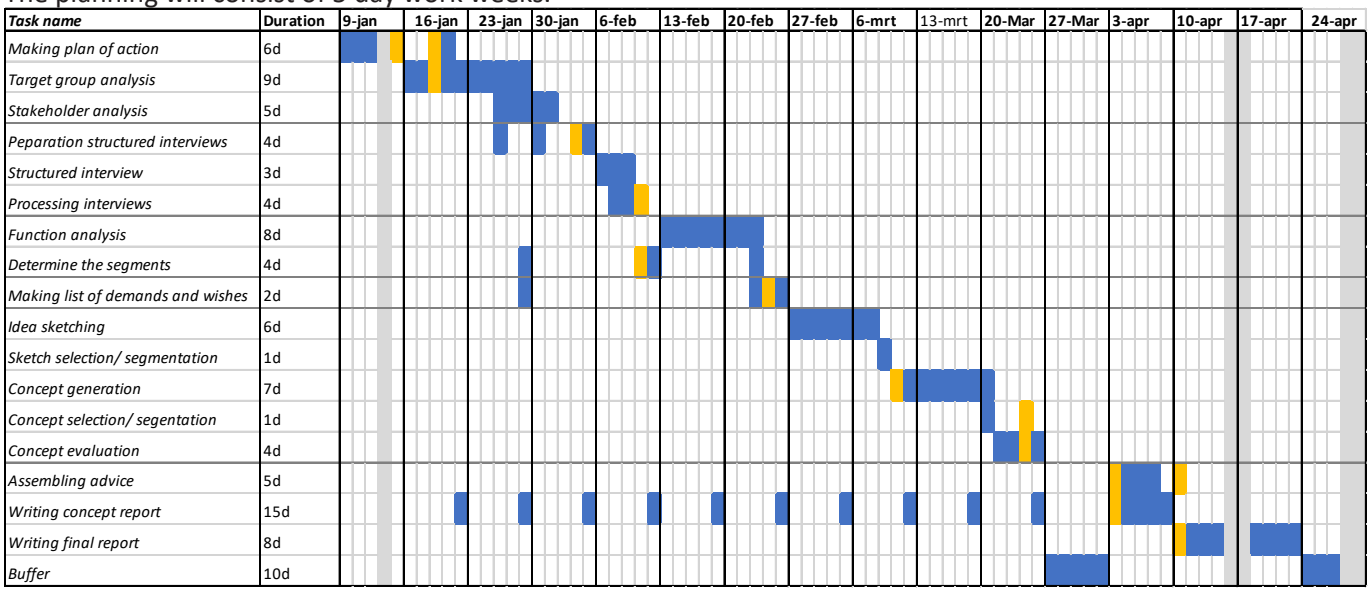
The functions will be analysed by using research models [4,5,6,7] like tasks and function trees, to visualise the interaction between user, tricycle elements and environment. Definitive segments are determined from the information of the aforementioned analysis.

The capital letters at the research questions are code for the information sources to answer the research question:

I- internal sources: Information available at Van Raam from experts or past researches
E - external sources: Information is to be gathered from external sources
F - fieldwork: information is to be gathered from fieldwork
D- deduction: information deduced from already gathered information

Planning

The planning will consist of 5 day work weeks.



Task name	Duration
Making plan of action	6d
Target group analysis	9d
Stakeholder analysis	5d
Peparation structured interviews	4d
Structured interview	3d
Processing interviews	4d
Function analysis	8d
Determine the segments	4d
Making list of demands and wishes	2d
Idea sketching	6d
Sketch selection/ segmentation	1d
Concept generation	7d
Concept selection/ segentation	1d
Concept evaluation	4d
Assembling advice	5d
Writing concept report	15d
Writing final report	8d
Buffer	10d

@ Van Raam
@ University of Twente/ other
Day off

Due to long travel times, the days with meetings at the university of Twente will not be spend at Van Raam. These days will be used to search for research tools thought throughout the subjects of Industrial Design.

Bottlenecks

Not all information might be readily available, which might cause bottlenecks in the process of the design.
If information is not available internally at Van Raam, relevant research information will be sought online.
If field research can't be executed due to time or available stakeholders/ users/ target group members, internal knowledge about the channels at Van Raam and internet research will be used.
If several segments appear to be underserviced, the sketching and concepts will be adapted to suit one or several segments.
If it is not possible to service all segments by an individual design advice, a selection of segments to service will be made.

Glossary

High tricycle line (HT) : The Van Raam models 'Maxi', 'Mini', 'Mini' and "Husky". This assignment focuses on the 'Maxi', a model for an adult target group.

Wmo: Wet maarschappelijke ondersteuning, translates as 'law social support'. It is a municipal support system to enable people with special needs to live by themselves. [8]

Wlz: Wet langdurige zorg, translates as 'law long-term care' [9,10,11,12]

PGB: Persoons Gebonden Budget [8]

Sources

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B. OBSERVATIONS & INTERVIEWS

Interview with an occupational therapist

Specialization: Elderly

Own decription: Adults, she Works a lot with people with Parkinson's Disease

Experience with tricycle users:
Yes, she has visited the Van Raam showroom with three clients times in the past four months.
They always choose the low tricycle, only once has she experiences someone choosing another model once. She also has experience with people who already use a tricycle.

What motivates you to advise a person to use a tricycle?
It varies a lot. Mostly aging people, it is dependent on the issues the person has and the prognosis. If a person has Parkinson's Decease and their balance decreases, they firstly move to a low entry level bicycle with electric paddle support. When this causes danger, they might choose a tricycle or a mobility scooter. As long as the client is still able to move, the therapist prefers the tricycle.

If a client is younger, in their 50's or 60's, and is still using a bicycle, they first look into a tricycle. If the client is older and hasn't cycled for a long time, she would advise a mobility scooter. Still, the therapist tries to stay open to both options.

What advice do you give to stimulate clients in using a tricycle?
People come to her for more than mobility issues. Mostly transportation outside the home. Together with the client, the therapist looks which option is best, this includes a tricycle. In the end, she can only advice, the user makes the decision.

Which client properties would cause you to advise them to use a tricycle?
If a person is still Young and has always cycled and for some reason using a bicycle is no longer an option, she would absolutely advise a tricycle. She also meets a lot of severely overweight people who hardly exercise who can't use a bicycle because their can't mount the bicycle or are scared of falling.

Also people with brain damage or Parkinson's Disease, if a low entry level bicycle really not an option and there's no other option but a tricycle. And a client has to be motivated, the therapist can advise, but the client has to be willing. Sometimes people are ashamed and don't use the tricycle or the client has tried, but it turns out they can't handle a tricycle.

Wich client properties would cause you to discourage using a tricycle?
Chronic Obstructive Pulmonary Disease (COPD), if they don't have the ability to cycle due to health reasons or if during a fitting it turns out they are not able to operate a tricycle, they should use a mobility scooter. Sometimes people are very clear on their refusal to use a tricycle and their preference for a mobility scooter.

Where do you draw the line?
The hard line is difficult to pinpoint. Some people don't have the ability to judge traffic situations anymore, they can't execute all the tasks or the mounting and dismounting is too dangerous. If the movements require too much force or if the client can't handle the tricycle.

Do you support people in learning to use a tricycle?
Yes, she visits people. She gives people lessons in getting used to the cycle and be a part of traffic.

What makes a tricycle suited for the people who you advice the use of a tricycle to?

- Stability (mounting)
- Stability (cycling)
- Being able to stand still without the feet touching the ground
- Having the freedom to look around
- Easy to learn

Answer:

Both stability during mounting and dismounting and during cycling are important. It starts with mounting and dismounting, this is the first thing people experience trouble with using a bicycle. Especially in unexpected situations, the clients can't brake and dismount fast enough and neither mount fast enough after. Not being able to mount and dismount fast enough are the first problem people encounter this is where people fall. Falling mainly occurs when people have to brake suddenly and unexpectedly. If they can see traffic lights far ahead, they can prepare, but a car coming from the right (priority), that causes problems. This is when people first start to realize they should not use a bicycle anymore. Besides that, people can have stability issues.

She is amazed how long people can stay in denial and continue to use a bicycle. Even after several falls, they get back on their bicycle. Only after a serious injury, such as breaking an arm or a hip, when family members start to discourage bicycle use by giving voice to their displeasure because the situation is too dangerous. So people postpone using a tricycle for very long.

Sometimes, money is a reason not to use a tricycle, it is a very expensive commodity. Clients need to make a mandatory contribution to the government, which can be very little or quite steep depending on their income.

What properties does a tricycle need to have to be approved by you?

The handlebar needs to be adjustable to the correct position and the seat, basically the whole tricycle. She notices that Van Raam has a lot of options for people with specific disabilities, for example it someone can't keep their feet on the paddles and Van Raam offers an option which secures the feet to the paddles.

She thinks the parking brake is essential. It makes a great difference with mounting and dismounting. The low entry level is very nice on the Maxi comfort, it's incredibly useful.

What would you like to see in a tricycle design?

If a client tries a high tricycle, they want to cycle as you would on a bicycle, which causes them to start balancing. On a low tricycle, the client has a very different posture, which causes them not to refer to a bicycle. That is the difference between the tricycle models. People like the back support the low tricycle offers, it creates a sensation of safety. That is what she hears from the clients.

She does not miss any design feature, it feels as if everything is well thought out. For every problem, a solution is found. In her opinion, the Van Raam products are already very well developed. The therapist asked her colleagues and they were not able to think of anything missing. In general, the low tricycle is very big, very long, which sometimes causes problems with storage, that is the only complaint.

Observation and interview Segment O1: people who already use a tricycle

Age: 67 **Sex:** M

Model used:
Maxi-2, with floating pedal and electric paddle support. User has made own alterations to the tricycle, as seen on pictures.

Reason for choosing a tricycle:
User has an amputated right leg due to a infection in his knee replacement. User does have a prosthesis, but doesn't use it at the moment due to a recent operation. The user has always been a cycling enthusiast and wanted to continue that habit after the amputation. The Easy Rider caused the prosthesis to fall off due to the forward leg being position.

Years of bicycle use: 50+ years, from youth until amputation
Years of tricycle use: 5 years, of which 2 years a previous Maxi model
Living situation:
Independently, with wife
Caregivers:
Wife, user is mainly independent.

Actions:
Approaching tricycle:
User uses crutches to go to the tricycle. He stand on one leg and uses the tricycle as support. The user hops to the back of the tricycle, puts the crutches in the holder and hops back to the saddle.
Getting tricycle out of storage
Does not apply
Mounting tricycle
User hops on one leg to the left side of the saddle. He slides his behind on the saddle from a standing position. When seated, the user puts his stump on the add-on. If the stump isn't placed on the add-on, the phantom leg gets numb. The user assed Styrofoam on his add-on to prevent the stump from cooling down. The other leg in placed in the other paddle.
Using tricycle
The user admits that he experienced a learning curve starting to ride a high tricycle. He notes that most people start leaning as they would on a bicycle, worsening the situation. The user has experience riding a motorcycle and riding sidecar, which he reckons helped him in learning the balance movements of the tricycle.

Goal/ use:
Heavy use. Used while doing groceries, both to the supermarket as in the supermarket, as the user is not able to grab or carry groceries while walking on crutches. The user is also a fanatic recreational cyclist, together with his wife.
Distance:
The distance the user can cycle is limited by the battery of the electric paddle support. The user would like to cycle further, but the battery life doesn't allow that. Using the tricycle without the electric paddle support is not an option.
Frequency: daily use, in all weathers.
Baggage: Groceries, picnic equipment in summer.
Traffic obstacles (roundabouts/ crossings/ traffic lights/ speed bumps/ brick roads/ turns)
Does not apply
Dismounting tricycle
User hops off by moving entire body to the left. Stands on his leg and uses the tricycle as support.
Store tricycle
Does not apply

Other actions

Can lock tricycle by standing on his leg and leaning forward. Uses the frame as extra support while bending the knee. Lock is operated with both hands.

Opinion of experience:

The user is very positive about the Maxi. He likes the tricycle and is very happy to cycle. He is very happy with the parking brake feature, as his last tricycle rolled in a body of water due to lack of such brake option.

Points of improvement:

The user likes to cycle further distances. His last tricycle had two batteries, which enlarged his cycle range. The battery takes five hours to recharge, so the user doesn't want to recharge the battery elsewhere but home.

The adjustments made on the tricycle by the user are due to inconvenience and the user wanting to solve it. These adjustment could be adapted into an option for other users. The user likes to tweak his tricycle to his own needs, as his crutch holder proves, as an official crutch holder exist as an option.

When asked for an improvement suggestion, the user mentions the suspension that a lot of modern bicycles have, but misses on the Maxi. Suspension would decrease the impact uneven roads have on an user's back.

Image 41 : Basket with cycle basket on the back and a PVC pipe to hold the user's crutches. Soft saddle cover and floating paddle ad-on to support the user's amputated leg during use.

Image 42: Floating paddle add-on can be removed when the user uses his prosthesis.

Image 43: Elastic band to help user pull the other paddle from 12 and 6 o'clock

Observation and interview Segment O1: people who already use a tricycle

Age: 49 **Sex:** F

Model used:
Maxi, basic model. User also has a Travara for use on holiday.

Reason for choosing a tricycle:
User has brain damage due to a traffic accident in 1992. This resulted in lessened coordination. Using a lowered bicycle is also possible, but a tricycle is easier to use. It makes her disability more visible, so people take it into regard.

Years of bicycle use: young until 1992, aged 24
Years of tricycle use: since 1992, 25 years
Living situation:
Lives independently with her two teenage children, 13y and 16y, partner and dog.
Caregivers:
Does not really need help. Children and partner assist when necessary. Tire defects are solved by the partner, other tricycle defects are solved by the healthcare facility.

Actions:
Approaching tricycle
Walks to tricycle
Getting tricycle out of storage
The tricycle stands in a small garage. In-between use the tricycle remains outside on the driveway during the day.
Mounting tricycle
Steps through the frame first, then stands on one paddle to lift herself onto the saddle.
Using tricycle

Goal/ use
Mostly doing groceries and going to volunteering work. The user hasn't got a driving license, so she uses it as her main mean of transportation.
Distance
Mostly within village. Sporadic further distances than 10 km, but only in summer. For traffic outside the village, a car is preferred.
Frequency
Daily, more than once a day
Baggage
The user has crate on back the back of the tricycle. In the case of rain, the user always has a towel in a plastic bag in the crate to be able to dry the saddle. When the user walks the dog, the dog walks next to the tricycle.
Traffic obstacles (roundabouts/ crossings/ traffic lights/ speed bumps/ brick roads/ turns)
User says to be quite un careful about the tricycle. She more than once hit a pole or otherwise damaged her tricycle. The user contributes this partly to her lack of coordination. Roundabouts and such do not form a problem. When starting up from zero speed, the user makes sure that the paddles are in a position than allows her an easy push. An normal curb is too high to bump up. The user will cycle off the curb, but has to be careful to go perpendicular to the edge, otherwise, she will fall. She can cycle onto a lowered curb and can even ride off the curb backwards.

Dismounting tricycle
User stops the tricycle, puts one foot on the ground, slides behind off the saddle and takes her other leg over the frame in the process.

Store tricycle
In-between use the tricycle remains outside on the driveway during the day. The tricycle is put inside after dark.

Other actions
The tricycle is also used to walk the dog at least once a day, as the user isn't able to walk well enough to do it on foot. The user attaches the leash to the handlebar

Opinion of experience:
Using the tricycle is described as nice and satisfactory. The user feels safer on a tricycle than on a bicycle, because the user can only cycle if she can touch the ground with her feet.

Points of improvement:
The user can think of no improvements. As the user has a lot of experience with using a tricycle, she has passed the learning process long ago. "It was like riding a tricycle as a child". The mother of the user has tried the tricycle and found the experience scary, as it induced a feeling of falling. Because of the low age the user started using a tricycle, she finds it a shame that riding a mountain bike or a road bike isn't an option, as she still remembers how to do it, but her coordination doesn't allow it.

IMAGE 44: STORED TRAVARA

IMAGE 45: STORED TRICYCLE

Observation and interview Segment O1: people who already use a tricycle

Age: 79 **Sex:** M

Model used:
Nijland Singly (a low tricycle model) with electric paddle support and walking stick holder.

Reason for choosing a tricycle:
The user has had a cerebral haemorrhage 11 years ago. He used a bicycle with electric pedal control, until his general practitioner forbid him to use a bicycle after several falling incidents.

Years of bicycle use: From youth until aged 76
Years of tricycle use: almost 2 years, March 2015
Living situation:
Independently with partner
Caregivers:
Partner

Actions:
Approaching tricycle
Walks to tricycle
Getting tricycle out of storage
The user mounts the tricycle while it stands in storage. A self-made ramp is laid for the door of the shed, over which the user cycles the tricycle out of the shed. He stops at the threshold, stands up to push the back wheels over the threshold and sits down while riding down the ramp onto the patio.
Mounting tricycle
User stands to the left of the tricycle, pulls the front of the tricycle slightly to the left, away from the wall and puts his left leg over the frame. With both feet on either side of the frame, the user sits down on the saddle.
Using tricycle

Goal/ use
The user tries to walk as much as possible. For distances further than one kilometre, the tricycle is used. Getting groceries and visiting the market are the main uses of the tricycle. In summer, the tricycle is used recreationally to visit family along the way.
Distance
Usually for small distances up to five kilometres. In summer, the distances cycled increase to more than ten kilometers.
Frequency
In winter, one or twice a week. In summer three to four days a week. For bigger distances the user uses the car, he still has a licence, or the train.
Baggage
Groceries, carried in a basket on the back. The user has a safety vest draped over the back rest of the saddle, in order to make the tricycle more visible.
Traffic obstacles (roundabouts/ crossings/ traffic lights/ speed bumps/ brick roads/ turns)
Roundabouts and tight turns are no problems. The user tries to avoid steep descents of curbs, as it gives him too much speeds when coming onto the road. The user searches for level descends and will cycle further is necessary. Crossings where the user has to start from standing still which have an incline do form a problem. The user solves this by stopping farther from the crossing, to give the user more distance to gain speed. The partner of the user finds it scary if the user has to pass a pole, but the user says he has no problems with those. The tricycle salesman noted that the width of the tricycle is similar to the width of his elbows while cycling. This was a good tip.

When a cyclist flyover was build close to where the user lives, he had to try to cross it, which was no problem. The user just needs to use a lower gear.

Dismounting tricycle
The user first puts both legs on the same side of the tricycle and grips the handlebar while extending the knees until standing position. He lets go of the handlebar after rising.

Store tricycle
The user cycles through the gate onto the patio. He dismounts and grabs the front of the frame to push the tricycle backward. As the back wheels are positioned in front of the entrance of the storage area, the user uses the front of the frame to steer the tricycle 90 degrees, so the tricycle can be pushed up the ramp into the storage area, back wheels first. The user walks along the tricycle, pushing it backwards until in the correct position. Corrections are made by dragging the front wheel. Parking brake is not used.

Other actions
When braking during recreational cycle trips, the user doesn't need a bench to brake, he remains seated on the tricycle.

Opinion of experience:
Having the tricycle is very useful, as it allows the user to easy get groceries. It makes the user more mobile and he likes the cycling allows movement, as other mobility aids wouldn't. The user has recently increased the speed of the electric paddle support up to 20 km/h, which he finds is quite a high speed.

Points of improvement:
Does not apply.

IMAGE 45: MENTIONED EXPAMPLE OF STEEP CYCLIST FLYOVER

IMAGE 46: MENTIONED EXPAMPLE OF INCLINE BEFORE CYCLE CROSSING

Observation and interview Segment O2: people want to use a tricycle (MIDI)

Age: 73 **Sex:** F

Current situation:
The user walks with a walking aid or by leaning on someone. The user's partner drives the user in their car. She wants to try a tricycle, but doesn't know how to arrange a test. The user is scared to cycle. The user does use an exercise bicycle.

Reason for wanting a tricycle:
The user is rheumatic, has a worn knee, a recently replaced hip and she can't rotate her neck. Especially the knee makes mounting a bicycle difficult. Initiating the cycling movement is also a problem. A tricycle allows the user to start cycling from a stationary position, which would be useful.

Years of bicycle use: youth until 71
Years of since bicycle use: 1,5 years
Living situation:
Independently with partner
Caregivers:
Partner

Actions:
Approaching tricycle
The user walks to the tricycle, supported by het partner.
Mounting tricycle
The user holds the handlebar while trying to put the paddles in a certain position with one foot. When this isn't satisfactory, she positions the paddles by hand, still using the handlebar for balance. The paddles are placed horizontally, so they form to obstacle for the user to move one foot over the frame. The user puts this foot directly onto the paddle and stands on this paddle to lift herself onto the saddle. The user asks for assurance that 'nothing can happen'.
Using tricycle
After mounting, the user rotates the paddles backwards, to test the height. When the parking brake is disabled, the user asks for reassurance that 'nothing can happen'. The user tries to cycle forward, but lacks strength. The road makes it that she rolls slightly backwards. The user needs a push to go forward, which immediately results in the handlebar turning to the right. The user pulls the handlebar straight, but when pushed, the front wheel diverts again to the right, where the pusher is positioned. The user does not rotate paddles. The user demands to be held, to prevent falling. Even when not pushed, the front wheel turns right. As the tricycle turns right, the user has a feeling that she falls. The second attempt, the user has less problems keeping the handlebar straight, but the divergence to the right remains. During the whole testing process, the brakes are not used.
Traffic obstacles (roundabouts/ crossings/ traffic lights/ speed bumps/ brick roads/ turns)
Does not apply, as the user is not able to cycle on her own.
Dismounting tricycle
The user puts the paddles horizontally and stands up while balancing the paddles in this position. She leans heavily on the handlebar while putting one leg off the paddle onto the ground. The other foot follows. The second attempt, the paddles are placed vertically, with the dismounting side on top.
Store tricycle
Does not apply

Opinion of experience:
The user is deeply ashamed for her scared behaviour during the testing process. She was very scared and felt she had a problem steering. The user did find the tricycle to cycle fluidly.

Points of improvement:
The user had the sensation that the handlebar turned to the right by itself, which made the user feel as if she would fall.

Observation and interview Segment O2: people want to use a tricycle (MAXI)

Age: 82 **Sex:** M

Current situation:
Drives a car and walks. The tester is very active and has no problems with his fitness. The tester has balance problems due to a brain tumour, which also causes hearing loss. An operation is scheduled and the tester has great hopes for improvement. He has had an Easy Rider of Van Raam, but he put the tricycle away due to unforeseen fatigue when using the tricycle.

Reason for wanting a tricycle:
A loss of balance causes the user to fall over using a bicycle. The tester wants to cycle with his partner, which uses a bicycle with electric paddle support

Years of bicycle use: youth until 80
Years of since bicycle use: 2 years
Living situation:
Independently with partner
Caregivers:
Partner

Actions:
Approaching tricycle
Walks to tricycle
Mounting tricycle
The user grabs saddle and handlebar to balance himself when putting the leg over the frame. He puts this leg on the paddle and lifts himself onto the saddle, placing his other foot on the other paddle in the process.
Using tricycle

Goal/ use
To cycle recreationally with partner. They both like to cycle a lot.
Distance
Above 10 km
Traffic obstacles (roundabouts/ crossings/ traffic lights/ speed bumps/ brick roads/ turns)
The user makes a wide turn when turning around, but is able to make tight corners. Cycling down a descend forms to problem. The tester can brake easily within a meter of the descend.

Points of improvement:
The tester seems to cycle perfectly on the tricycle, but he feels that he keeps shaking from left to right, which mentally exhausts him within three kilometres. The tester blames this on the tricycle having three wheels, as he doesn't experience this on a bicycle, but experience this also in a car.

When the user wants to cycle with his partner, they want to cycle next to each other, which feels unsafe on the narrowness of many bicycle paths. As she needs speed to maintain balance on her electric paddle support bicycle, the tester wants to be able to cycle at a speed above 20 km/ h.

Observation and interview Segment O3: people who use a bicycle

Age: 74 **Sex:** M

Current bicycle:
Tester uses a regular bicycle, cycles a lot

What would motivate you to consider a tricycle:
To still get physical exercise. The tester does not see himself using a tricycle

Years of bicycle use: Entire life, from youth
Living situation: Independently with partner
Caregivers:
Does not apply

Actions:
Approaching tricycle
Walking
Mounting tricycle
Stands to the left of the tricycle, grabs handlebar with left hand and saddle with the right hand. The tester leans to the left with his upper body while lifting his right leg over the frame. In the this movement, the right foot is put on the right paddle. He sits himself down while keeping his left foot on the ground.
Using tricycle
The tester pushes the right paddle forward and lifts his left foot to the left paddle in the movement. He cycles forward and proceeds into making a left turn. When he turns the handlebar further, he puts his feet immediately on the ground. He uses his feet to roll himself a little further while still seated. He puts at least one foot on the ground while standing still. He turns the handlebar back and forth and cycles on. No right turns are made.
Dismounting tricycle
The tester puts his left foot towards the ground before standing still. He shifts his weight onto his left foot and slides off the saddle in the movement. The right foot is lifted up high, so the right buttock completely loses contact with the saddle. He pulls the right leg in, slightly hitting the frame with his right foot. This does not cause hindrance and the right foot is placed next to the left foot on the ground.
Other actions
The tester is very curious to find the cause of discomfort of another tester. He tests the effect the handlebar has on the direction of the front wheel extensively, when standing on the ground. When testing this while moving forward, the tester immediately puts his feet from the paddles onto the ground. After testing, he lowers the saddle for a different tester. This does not cause any problems and the tester does not ask for assistance or explanation.

Opinion of experience;
The tester find using a tricycle strange at first, especially steering. He feels that the handlebar pulls to one side. He reckons a person could get used to a tricycle. The tester hopes that he will never need a tricycle.

Points of improvement:
Steering should be easier.

Observation and interview Segment O3: people who use a bicycle

Age: 78 **Sex:** F

Current bicycle:
An bicycle with electric paddle support. She does have several bicycles, but she prefers to use only one, as changing bicycles had become more difficult as het age increased. The tester cycles a lot, 50 kilometres a day is normal, although not cycled daily. Her electric paddle support allows her to cycle up to 100 kilometres. She cycles with people with an age similar to her, who also have electric paddle support. When cycling she cycles fast.

What would motivate you to consider a tricycle:
If she gets equilibrium problems or if she gets dizzy.

Years of bicycle use: From the age of ten until now
Living situation: Independently in a semidetached house. No partner.
Caregivers:
Does not apply

Actions:
Approaching tricycle
Walking
Mounting tricyle
The tester stands on the left side of the tricycle. She holds the handlebar with both hands and lifts her left foot onto the left paddle. The left knee is extended, which gives the tester the elevation needed to lift herself onto the saddle. The right leg is moved between the frame and the left leg to the other side of the frame during the extension of the left knee. After mounting, she lifts the parking brake herself.
Using tricycle
The tester starts out slowly and makes a sound of surprise. The tester speeds up and cycles straight for around 50 metres. The tester steers slightly to the left and continues a straight path in that direction. The user steers mildly to the right, so the initial direction is continued. When asked to turn around, the tester turns the handlebar more and immediately jumps of the saddle to put both feet on the ground. She makes the rest of the turn while walking along the tricycle. After the turn, the tester mounts the tricycle the same as earlier and cycles further. When instructed to turn by turning the handlebar, the tester comments that ‘she goes all over the place’. When attempting to make another sharp turn, she jumps off the tricycle, as done before.
Dismounting tricycle
After jumping off the saddle, the right foot is lifted over the frame while keeping both hands on the handlebar. The upper body remains upright.
Store tricycle
The tricycle is pulled back to the starting location with the left hand on the handlebar and the right hand on the back of the saddle. Turning the tricycle while not mounted forms no problem for the tester.

Opinion of experience:
The tester found cycling on the tricycle difficult and unusual. She hoped it would go better. She feels she wants to have control over her direction, which the tricycle does not allow. Stepping up while standing still is convenient, it also feels strange to start cycling from a stationary position, as she is used to mount a bicycle after giving it some forward momentum.

Points of improvement:
The tester thinks some cycling lessons when starting to use a tricycle would be useful. Steering was stiff.

Observation and interview Segment Y2: people who use a bicycle

Age: 19 **Sex:** F

Model used: MAXI

Current cycling situation:
Uses a bicycle daily, to go to school, work or training

Living situation:
With parents and three brothers

Actions:
Approaching tricycle
Walking. The tester is slightly hesitant. Stept to the left side of the tricycle.
Mounting tricycle
The tester puts one hand on the handlebar, one hand on the seat and puts her light leg over the frame. The right foot is placed on the paddle, which is pushes backwards to the lowest position. In the process, the body weight is shifted to this right foot, which brings the tester towards the seat. Left foot is placed on the left paddle. The user needs a little time to find the handle of the parking brake and is aided before request.
Using tricycle
Cycles away easily in a straight line. Makes a large U-turn and cycles back in a straight line towards the starting point with a large, smooth curve at the end.
Dismounting tricycle
The user brakes to a stop. Puts the left foot on the ground, which the tester can reach with the tiptoes from the seat. The tester shifts her weight to the left, increasing the amount of the foot that is on the ground. In the process, the right foot is moved over the frame.

Opinion of experience:
It feels strange, like the tricycle controls the user instead of the other way around.

Points of improvement:
The tester has the feeling that the front wheel is gone, side wheels would be easier. She does dot experience troubles with steering, although taking turns is less easy as with a bicycle. The tester was not aware of diverging to the right.

Observation and interview Segment Y2: people who use a bicycle

Age: 15 Sex: M

Model used: MIDI

Current cycling situation:
Uses a bicycle daily, to go to school or training. Cycling to school is 7 kilometres

Living situation:
With parents, two brothers and a sister

Actions:
Approaching tricycle
Walking to the left side of the tricycle.
Mounting tricycle
The tester grabs the seat with the right hand before putting the left hand on the handlebar. He walks the tricycle back a few paces before standing on his left leg and swinging his right leg over the back of the tricycle, as would be done with a bicycle for men. The tester lets go of the seat as his right thigh touches the seat. The right foot is placed on the ground on the right side of the frame and the tester touches the package that is attached to the test tricycle. After making sure the package is ok, both hands are places on the handlebar and the right foot is places on the right paddle. The user sits down, as the height of the seat does not require an elevation to sit. In the process of sitting down, the left foot is placed on the left paddle.
Using tricycle
The tester cycles off without any hesitance, moving to the right side of the road. When turning the tricycle in the length of the street, the tester makes a wider turn than expected, ending up very close to the right border. As correction is made. The tester continues to have a slight zigzag movement while riding forwards. When asked to turn around, the tester steers right before turning left, taking the entire width of the road to turn. After the turn, the tester avoids obstacles without any difficulties. The zigzag movement returns after resuming a straight course, but much less severe than before the turn. The second U-turn begins also with steering to the opposite side of the turn before turning, In the turn, the user leans to the inside of the turn heavily while keeping the paddles stationary.
Dismounting tricycle
The tester brakes and puts his feet down before the tricycle is entirely stationary, which causes him to leave the seat. The right foot is moved over the frame, this time using the entry. Both hand are kept om the handlebar in this process. The right handle is let go after stepping away one step. Finally, the left hand also removed from the handlebar.

Opinion of experience:
Cycling was more difficult in the beginning than at the end. The tester had the feeling that “it is not so bad”, as if cycling wouldn’t be so hard as the other testers said (this user tested after hearing the opinions of the other testers). The typical bicycle turn feeling was missing, he had to focus on his hands. The vibrations due to the brick road weren’t bad.

Points of improvement:
“You have no idea where the steering wheel is turned too”

C. CYCLED ROUTES FOR ENVIRONMENT ANALYSIS

IMAGE 48: ROUTE CYCLED THROUGH VARSSEVELD

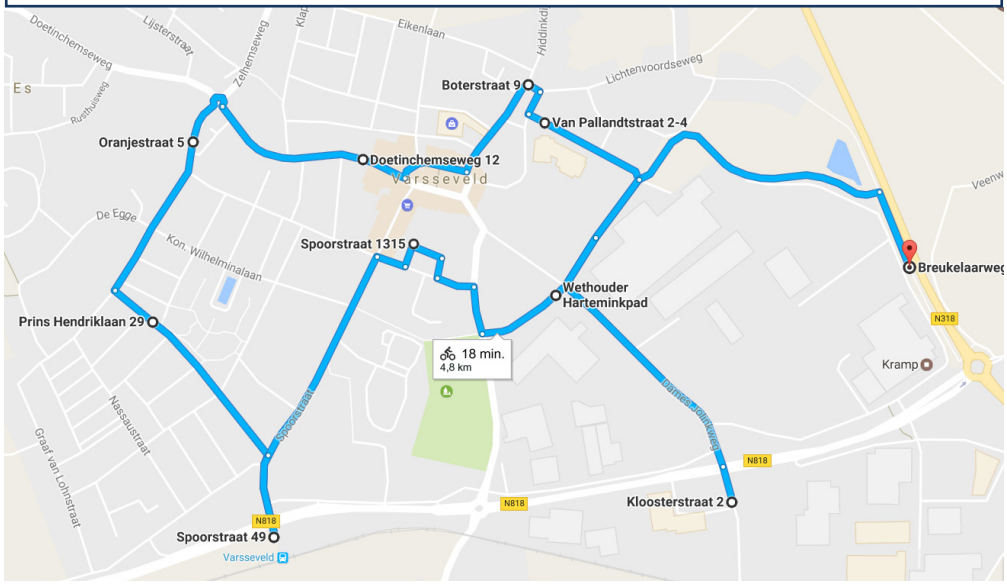

IMAGE 49: ROUTE CYCLED AROUND NIEUWVEEN