

The Upp Cycle of Greentom

G.B. Braanker - Oktober 2013

Faculty of
Industrial Design Engineering





Delft University of Technology
Faculty of Industrial Design Engineering
Design for Interaction

Under the authority of:

GREENTOM

Supervisory team:

Ir. R.J.H.G. van Heur (chair)

Dr.ir. S. Silvester (mentor)

B. Bost (company mentor)

Gijs Bert Braanker

January - October 2013

Preface

This project would never have taken place if my wonderful aunt had not taken me toward the baby product exhibition where she was one of the speakers that day. Therefor I would like to start this project by thanking you Carin.

Secondly I want to thank Greentom for offering me this opportunity and guiding me through the project. I enjoyed working for a company with such a great vision. But also de Fietsfabriek and Nijland for believing in this project and me. The material support and the brainstorm were essential. And of course Ruud and Sacha for coaching the project.

I would like to apologize to my friends, study colleagues, family, neighbors and random people I met in the park for all the endless questions, ideas and suggestions I had. Nevertheless without your insights this project would never have been a success.

Last I want to thank you, mum and dad for always supporting me financially and mentally throughout my whole study! With some late nights and early mornings it was sometimes tough. But especially during these late hours a cup of soup would help me pull through. And Dad thanks for making this report readable. Overall it was a great experience and a great preparation for what to come.

Gijs
October 2013

Table of content

Preface	iii
Summary	vi
Introduction	vii
 1. Problem analysis	 2
1.1. Problem definition.....	2
1.2. Design goal	3
1.3. Function tree.....	4
 2. Product analysis	 5
2.1. Product description	5
2.2. Usability	7
 3. Market analysis	 9
3.1. Internal analysis	9
3.2. External analysis	13
3.3. Trends and developments analysis	16
 4. Search fields	 18
4.1. Life analysis	18
4.2. ViP workshop.....	19
4.3. SWOT – Harris workshop	20
4.4. Evaluation, user study	22
4.5. Cycle system development	23
 5. Product Selection	 25
5.1. Five products.....	25
5.2. Decision making session	28
5.3. Product direction	30
5.4. Three concepts.....	33
5.5. Positioning	35
5.6. Unique selling points	36

 6. New approach.....	 38
6.1. New product cycle.....	38
6.2. New problem definition.....	41
6.3. List of requirements:	42
6.4. Priority list decision-making.....	43
 7. Product development	 44
7.1. Challenges	44
7.2. Context mapping	45
7.3. Upload mechanism.....	45
7.4. Prototyping	51
7.5. User test.....	52
 8. Second product development	 54
8.1. Deluxe-version	54
8.2. Basic-version	54
8.3. One-way-turn-version.....	55
8.4. Deluxe-adaptable-version.....	56
8.5. Evaluation	56
8.6. Ergonomics.....	57
8.7. Production	58
 9. Business plan.....	 59
9.1. The customer	59
9.2. Problem.....	59
9.3. Solution	59
9.4. Key partners.....	59
9.5. Product Life cycle	59
9.6. Aftersales	60
9.7. Pricing	61
9.8. Future vision.....	61
 10. Evaluation and conclusions	 62
10.1. Product	62
10.2. Project.....	62
10.3. Self-evaluation	63

Sources	64
Definitions	66
APPENDIX I. User study - Appearance	68
APPENDIX II. User test - Usability	69
APPENDIX III. Inspiration by great leader	70
APPENDIX IV. Strategy wheel	71
APPENDIX V. Trends and developments	72
APPENDIX VI. ViP Session	74
APPENDIX VII. Interview target group	82
APPENDIX VIII. User study - Product selection.....	84
APPENDIX IX. Comparable products	85
APPENDIX X. Bike trailers	86
APPENDIX XI. Decision making session	87
APPENDIX XII. Greentom development line	91
APPENDIX XIII. Sketches.....	92
APPENDIX XIV. Concepts	93
APPENDIX XV. Questionnaire - Concepts	96
APPENDIX XVI. Questionnaire - Positions.....	100
APPENDIX XVII. Headsets.....	101
APPENDIX XVIII. Cargo bike	102
APPENDIX XIX. Eye sight	103
APPENDIX XX. Context Mapping	104
APPENDIX XXI. Sketches	106
APPENDIX XXII. Uploading the stroller	107
APPENDIX XXIII. Turning part development.....	112
APPENDIX XXIV. Prototype	113
APPENDIX XXV. Product details	116
APPENDIX XXVI. Force limits	117

Summary

Greentom is a company new in the stroller market. They plan to expand their product portfolio with a vision; their customers should be able to re-use their product by giving it a second function. This project searched for widening the product line within a green product cycle.

The project worked following the basic steps, like market and product analysis and search field brainstorming. At the end several possibilities were presented, however none of them were innovative enough.

Therefore a new project start was made by throwing away all assumptions. From this bottom line the idea was born for *Greentom* to join the transport branch. In this combination the transport of children was the question to be answered. Therefore the bike could be the green follow up after the stroller.

The first stage provided in a line of special bikes to transport children. One of these models was chosen for its luminous simplicity: an existing Cargo bike and *Greentom's* stroller. The missing link in this combination was a solid connection. That connection became the project goal. A partner for the cargo bike was found in *de Fietsfabriek*.

Via numerous consumertests and interviews with professionals the specifications for the connector were defined. The evaluation of a successful prototype led to a complete redesign.

Besides of this great product opportunity, a lifecycle was created by introducing the lease-concept. In this concept several products can be exchanged during a lease period of about 9 years. This is the cycle *Greentom* was looking for.

Introduction

Through life we grow, we use and we produce. Over 7 billion people are doing just that right now. Our ecological footprint is not equally divided in this world. Where Americans use up to 9,6 global hectare per capita, people in Cuba only use 1,9 HpC

- and we still want more
- and we believe that this is fair
- because by consuming you stimulate the economy.

As Jack Johnson once stated, “we got to reduce, re-use and recycle”. Everybody knows it. But it seems companies are doing little about it.

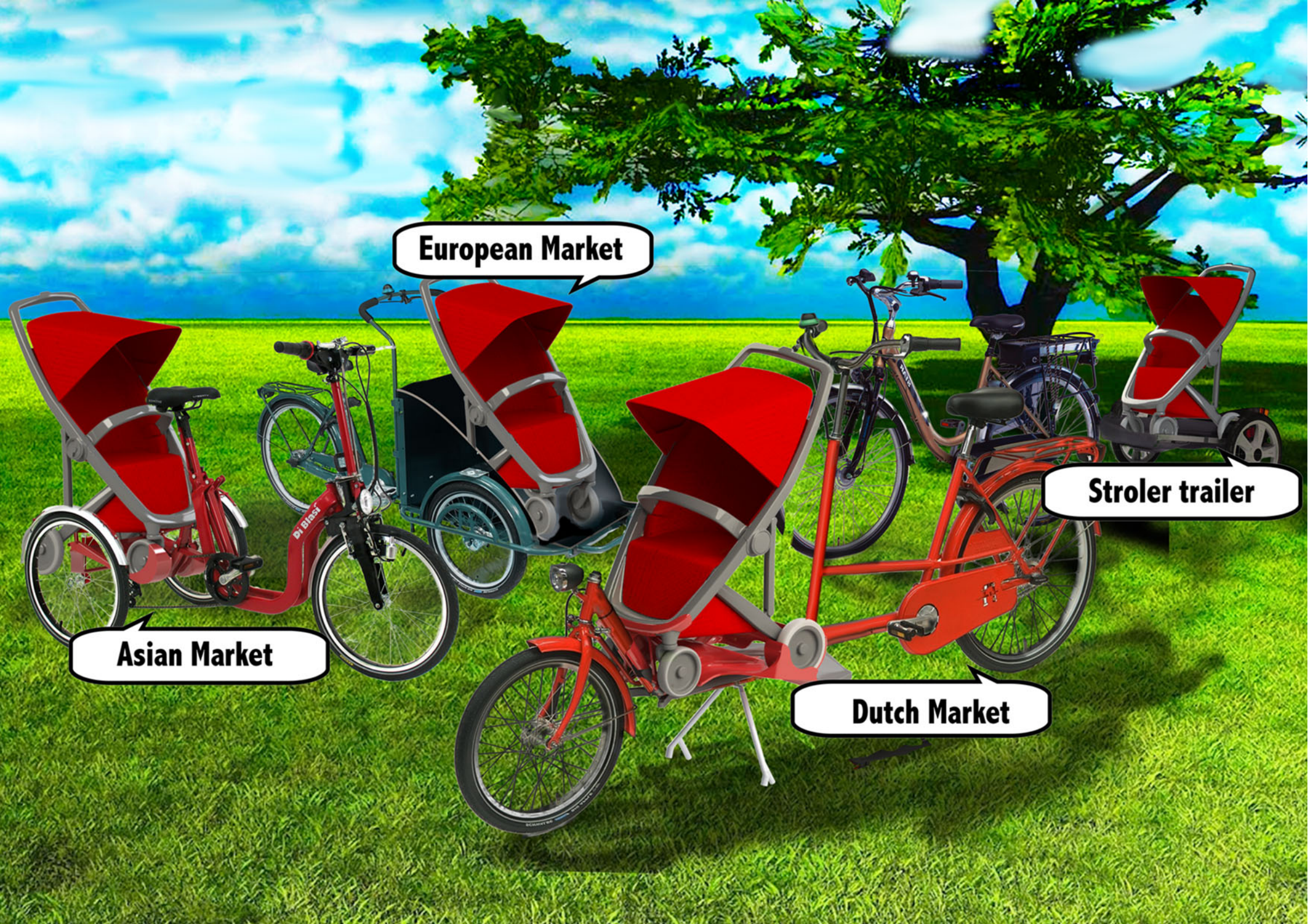
And then there is *Greentom*.

Greentom believes that a product fulfills a function in a specific period. After this the products are just unused materials. *Greentom* wants an ecologic product system that is able to transform these unused materials into a new product, with a new function. This way, no one will use more materials in life than given.

Even better would be by with recycled materials. And where better to begin than in one of the first products you encounter life in, your stroller. *Greentom* is now launching their green stroller, the Upp. A product made of recycled materials and fits for re-use afterwards. By doing this, *Greentom* is changing the nowadays view on durable productivity.

But this is just the beginning. *Greentom* wants to launch a complete development cycle of re-usable components for a life-time support product-line. This project will show the feasibility of this concept and will provide in guidance for the second product to come.

Next page shows one of the end results of this project.

The image shows four different models of bicycle strollers parked on a green lawn under a blue sky with clouds and a large tree in the background. The models are: 1. Asian Market: A red frame with a red seat and a black basket on the front. 2. European Market: A red frame with a red seat and a black basket on the front. 3. Dutch Market: A red frame with a red seat and a black basket on the front. 4. Stroller trailer: A red frame with a red seat and a black basket on the front.

European Market

Asian Market

Dutch Market

Stroller trailer

1. Problem analysis

To define a design goal and the related design specifications, it first should be clear what the exact problem or challenge is.

1.1. Problem definition

Products, using an amount of material, lose their primary function too fast. The consumer has a couple of options for not letting these materials go to waste, like giving it away to a family member. But there is no simple way allowing the consumer to re-use the materials for something else.

What is the problem?

When the children grow out of *Greentom*'s stroller the family has no use and need for it anymore. Their options are now limited to giving it away, trying to sell it, putting it in storage and throwing it in the dumpster. There is no option the family can still make use of it in some way, therefore they lose value.

Who has the problem?

The main problem is that the parents "lose" the need for a product and therefore they are the problem owners. Some consumers won't mind giving the stroller to for instance a family member, for them this problem is less appealing. Others don't like to throw things away and keep everything; especially their children baby products. Even more cause parents have grown a special connection with the product that kept their child safe for over 3 years. They might not want to get rid of the stroller cause there is an emotional connection. In chapter 4.1.3 the target group will be more elaborated.

What are the goals?

The goal is to design a re-usable system where *Greentom* benefits from a more cradle-to-cradle image and the consumer is able to buy a green product that has a discount because they return their product to create a cycle of product (materials).

What are the avoidable side effects?

Some effects that could be created by this system have to be avoided. Ideal would be trying to re-use parts of the stroller yet this should not be the only focus of the project. If so a possible side effect could be that the reassembled product would look inferior, compared to other products of that same product range. Also, the new product may not generate the same feeling as the stroller.

Last the vision of creating a cycle should not cause extra more (useless) parts, or unnecessarily difficulty. This could be result when trying to hard for making other products or parts fit.

Which ways of action are available in the beginning?

In the first stage there will be a large analysis, of the company, their product and their market.

1.2. Design goal

A design goal from the original aim of *Greentom* was formulated:

I want to explore the possibilities, for Greentom, of new products, which are able to cycle in a re-usable system. I want to know if these products are feasible, what products will offer the best opportunities and how to set up this service.

This project aims at exploring the possibilities of creating a re-usable product system with *Greentom* as market leader. They will provide the consumer with new products when the old ones are no longer needed. The possibility of working with exchangeable modules will be examined. Whether this will be feasible with the current product of *Greentom* has been evaluated during the analysis phase. Else the project will show other opportunities to set up a similar system. Either way this project should enhance the cradle-to-cradle value/image of the company.

Even more specified this design goal focuses around 3 main questions. In order of importance these questions are:

1. What follow-up product will be most desired by the consumer?
2. How can the stroller be returned and re-used within the cycle?
3. How can this re-use service be turned into a strong market proposition for *Greentom*?

These questions will be answered in the final decision phase. The project is graphical mapped, in figure 2, and shows how the answers to these three questions combined will make the Upp-cycle of *Greentom*.

The inner cycle of the picture shows the lifeline of the family, the lines around it connecting to *Greentom* shows what products they will offer and how this might grow.

1.2.1 Design specifications

The main benefit for *Greentom* of this project is to be able to show their customers a simple way to re-use their products in an

effective way. The design specifications are yet still vague because the type of product is not determined yet. What is clear now is that the product should be made partially from elements of the original product. The system should be clear and the new product design needs to be equal in quality as its competitors.

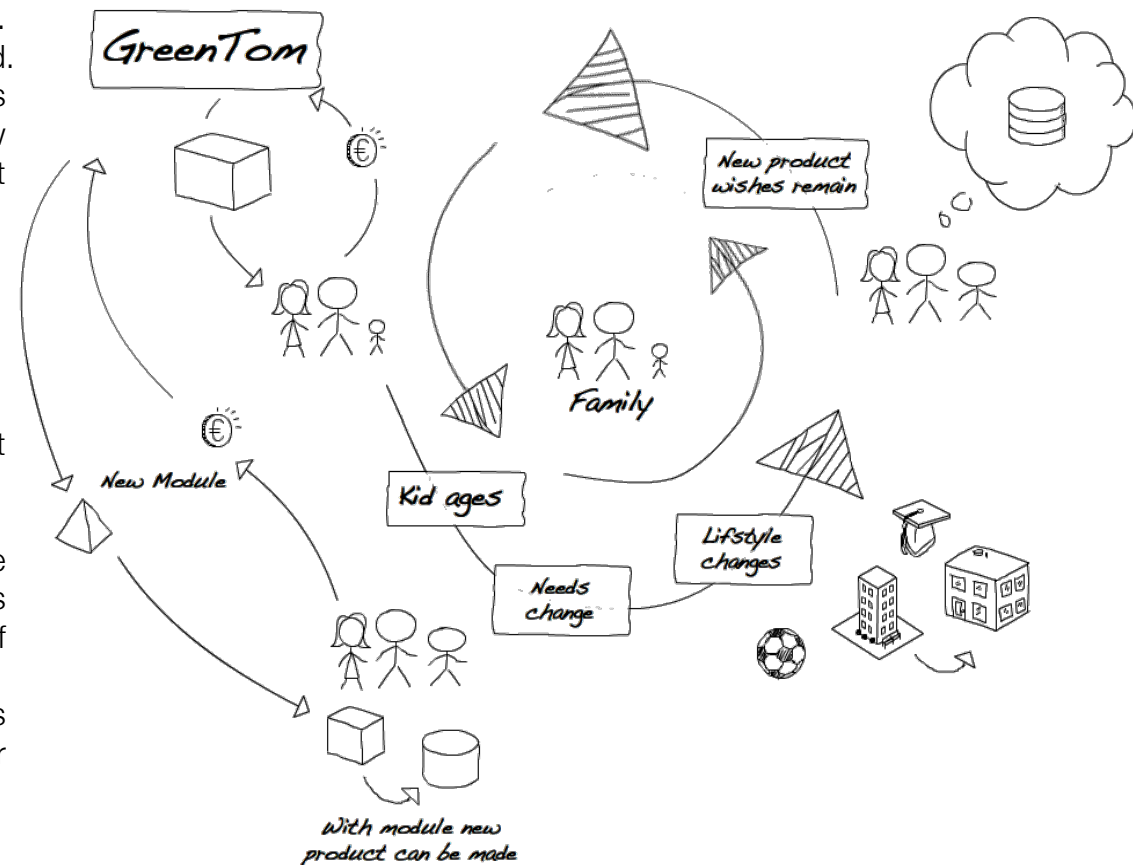


Figure 2: Life cycle

1.3. Function tree

Greentom currently shows a function tree, as in figure 2, of the relation toward the consumer and how he will use the product until it has become unneeded.

Figure 3 was created in collaboration with *Greentom* to show the opportunity the Upp-cycle system can offer. This table also shows the first step how they should interact with their consumer. The origin and spread of the product is left out of the future situation, this makes the difference more clear.

Conclusion

In the first few years the service of *Greentom* has little to offer as replacement because the consumer will use the stroller for at least 3 years. This could be seen as a thread because the consumer will lose contact with the company. An add-on product could offer an opportunity in this situation. Depending on the product outcome it will be important for *Greentom* to know when to contact the consumer again. It is needed for the service to know the consumer. In that way they can provide the best suggestions of products that are most suitable by that consumer. The main reason for the consumer to come back to *Greentom* will be there great support and the discount by recycling or re-using some of the initial parts.

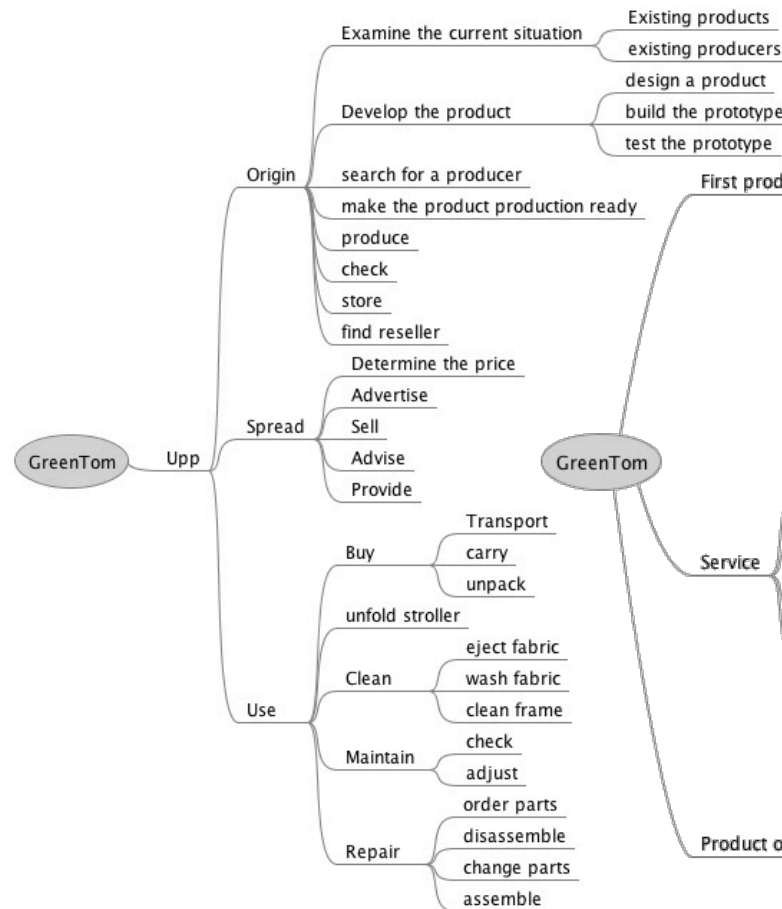


Figure 3: Current function tree

A threat for this idea can be that parts will be used longer than they were designed for and that they will be entirely worn. *Greentom* needs to realize that they will need a replacement service. This should be a reassurance to purchase the second product for the consumer.

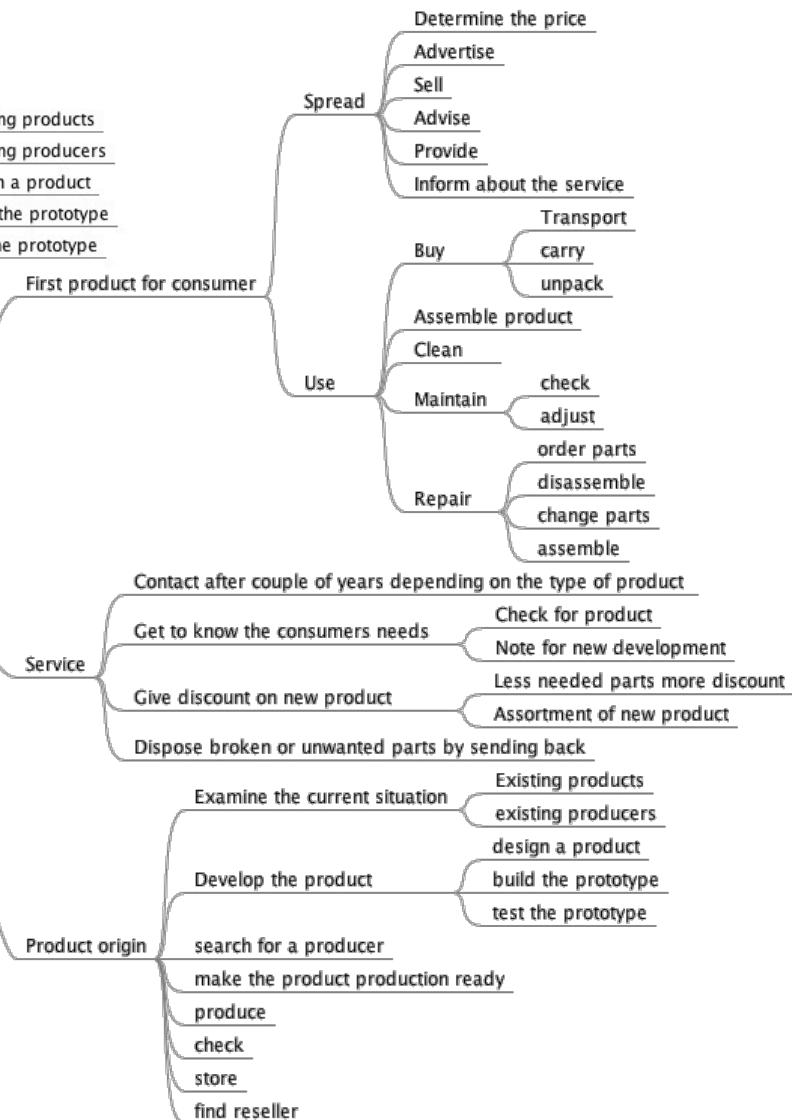


Figure 4: Possible future function tree

2. Product analysis

In this first part the actual product, the Upp, is analyzed. The goal for this step is to get familiar with the product and to find opportunities as follow up product.

2.1. Product description

Stroll·er [stroh-ler], A light chair like carriage with three or four wheels for transporting small children.¹

Greentom is the producer of the Upp, a stroller with an innovative design. The frame is made entirely of recycled and bio-based PP, 5.7 kg. The upholstery is made entirely from recycled 62 PET bottles. In addition, there were 6 bearings added 4 wheels and 2 in the swivels. Together with 4 springs in the buttons these are the only metal parts. The tires are made from EVA, but in the short term it will also be made of a PP-based TPV. The entire stroller weights only 7 kg.

The use of only three different materials makes separation very easy. This makes the Upp very suitable for recycling. But the re-use of parts would be even better, because there will be less energy needed for production of new parts.

In addition to separating the different materials easily, the carriage is designed so that it is very easy to assemble. A different stroller type takes 30 to 60 minutes assemble time. The Upp is assembled within 6 minutes. This will give *Greentom* the freedom for global production and thus reduce transport time and costs.²

2.1.1 Parts and modules

The frame is composed of 16 different parts (Fabric basket, seat and shading, springs, screws etc. neglected). The parts are able to assemble into 4 modules; the bottom-, rear-, top- frame module and wheelmodule. This leaves only the bumper part and the two rods of the stroller see figure 4 and 5 for total overview.

Conclusions

The advantage of the parts and modules in a re-use system is that they are made of a simple form and easy to assemble. It will be necessary to use new parts, like a coupling piece, for making the parts able to change direction. The parts are designed in such a way they can only fit in one direction.

By removing some parts like the fabric seating and the footrest, you get a frame with open snap connections easy to use for other parts that can change the function of the product. New parts can be added on the frame by using the old connections or snapped onto the frame with a new connection.

¹ <http://www.thefreedictionary.com/stroller>

² Source: Greentom

Front view



Fabric sitting
Fabric Hood
Fabric basket

Back view



C Top frame module
Bumperbar part
Break system

D Wheel module

Exploded



Bottom frame module A
Rod
Rear frame module B

A Bottom frame module

B Rear frame module

C Top frame module

D Wheel module

Bumperbar part

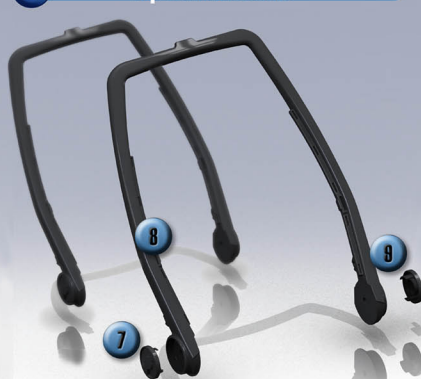
Rod



1 Footrest
2 Frame Bottem



3 Back wheel rim
4 Frame Rear
5 Breakstrip
6 Brakepedal



7 Hinge Button R (Turn)
8 Frame Top
9 Hinge Button L (Push)



10 Swifel (Only at the front)
11 Tire
12 Rim (Version for front/back)
13 Wheel cap



14 Bumper part
15 Rod

Figure 5: Product, modules, parts

2.1.2 Price

The production price of the stroller is currently around €62,- and is now being introduced for a price of €250,- in stores like BabyPark. *Greentom* hopes for a sale around 20.000 to 30,000 per year. They will probably sell most of their products in Europe.

2.1.3 Appearance, user study

A quick quantitative research was done among 16 participants, to determine what type of feeling the appearance of the product stimulates. They had to express the first emotions they feel by seeing the product for the first time. The result of this were keywords like easy to use, stable and safe but also bulky and some found the wheels very ugly. Figure 6 shows an overview of the results. Larger words were multiple times used so are more important (The complete user test and its results can be found in appendix I).



Figure 6: Appearance

2.2. Usability

As earlier stated the stroller only weights 7 kg, making it easy to transport and use. Besides this lightweight construction the Upp is extremely manageable and movable.

A simple turn of the two buttons on each side makes the stroller collapsible so it will only take as little space as possible for storage or transportation, see figure 7.



Figure 7: Product size

The stroller doesn't have any suspension in form of springs. This is unnecessary because the entire frame is made of PP. The suspension of PP is large enough to absorb normal forces in the frame itself. Just like some strollers are able to lock the front wheels from turning, *Greentom* decided to leave these functions out of their stroller. According to them consumer don't use these options. See chapter

2.2.1 User study

Qualitative studies were conducted with three young couples (two with

children and one expecting). All three couples were confronted with the Upp without any background information. So the participants were unaware that the stroller was made of recycled plastic.

The first remarks showed that the stroller is extremely comfortable in use. Besides that the first impression was about the great color was.

Both parents immediately wanted to know if there was a possibility for lowering the back. Beside the possibility of adjusting the seat with a cord in the back they believe the carrycot will be essential for this product.

*"It's amazing to feel how simple it is to turn or steer.
I can even control him with one finger."*

One of the participants thought the tires were made of rubber. Making the stroller user-friendlier because it will damp every bounce. This while the material is made from a foam version of EVA.

After the first impressions it was explained that the stroller was made from recycled plastic, the participants were a little surprised. They thought it would count as added value for the product and stated that it could be one of the reasons to choose for this stroller.

The luggage space of the Upp is still very limited according to the participants. Because of the round corners there is no possibility to hang (shopping) bags. The size of the stroller itself is great and one of the reasons it's probably so simple to use but it made it look a little bit basic as well.

The hood showed a folding line in the middle. This could be improved by adding a second rib inside the fabric hood.

Also the strap closure in the seating (locking all three bands) would probably get old and break of at some point according to one participant (The complete user test and its results can be found in appendix II).

3. Market analysis

In this part the company Greentom it was analyzed, including its market and investigated the trends related to their market.

3.1. Internal analysis

Greentom is a new company that recently launched their first product, the Upp. A 100% green stroller and almost completely (93%) made from recycled materials, see chapter 1.1 for a detailed description. The Upp made his official launch at the “kind + juchend fair, Trade Show for Kids' First Years” from 19-09 till 22-09 2012.

Already big resellers as “Babypark” signed up as supplier for the consumer. The Upp is being perceived as an innovative stroller in market. The designers were able to achieve this because they started from nothing with a vision. *Greentom* believes a product should be good in what it should do and nothing else. According to this principle they build their product as green as possible, see chapter 3.1.2 for more about their vision. As result a new kind of stroller cleverly designed by for example combining lots of parts together.

3.1.1 History

Greentom's current market position is located within the stroller branch. Their plans for the future are to expand to other product markets. Starting in the stroller branch seems a logical choice for the owner. The owner has spent many years designing strollers for big companies like Maxi-Cosi. Resulting into a vision how products should be made. With his experience it is logical starting in this market Green products have a history prejudices. With this new product *Greentom* wants people to realize those prejudices aren't always true:

- Green products don't have nice designs.
- They are not as good as normal products.
- Green products are more expensive?

3.1.2 Vision and mission

Their product is great but it is the idea on which it is based what will make a company successful. *Greentom* wants to prove that the concept of, green, efficient and design can go hand in hand.



Figure 8: Greentom image

To reach this goal they followed their vision a product should be good in what it should do nothing else. Their other product goals are:

- Environmental friendly
- User friendly
- Comfortable
- Price competitive

Greentom doesn't want to stop here and wants to explore other markets. They want to build a cycle, which will let the consumer return the stroller and replacing it for a new product.

First steps with other products can be made within the same industry, nursery or transportation. With this vision *Greentom* believes the company will grow beyond this industry.

What other branches can Greentom grow to

Simon Sinek explains in a TED talk “How great leaders inspire action”³ by using the golden circle; why, how and what, based on cognitive science. This explains why *Greentom* will be able to grow to other branches (A full explanation about the theory and the link to *Greentom* can be found in appendix III).

The future needs of a young family (*Greentom*’s target group see 3.1.4) will point out the possible branches. This will be done with methods like the VIP method (see chapter 4.1), and a SWOT analysis (see chapter 4.2).

3.1.3 Brand perception

The unique selling points of *Greentom* are clear, they try to be as green as possible. Nevertheless they are new to the market and their brand name is unknown to the consumer. Their product portfolio is still very small, but this gives them also opportunities: Focus and freedom of expanding in other markets. Their vision should always be leading and become the brand image of *Greentom*.

First impressions of the brand in a first user test showed that the brand image is perceived with the following keywords, larger words were multiple times used so are more important:



Figure 9: Brand perception

This shows that the brand is able to evoke an emotion such as loyalty. That will make the customers bound for a longer period, if they are truly satisfied with the product of course (The complete user test and its results can be found in appendix I).

3.1.4 Target group

The target group of *Greentom* are young parents expecting or with a possible firstborn child (else they will use the stroller of their older child). These are obviously the people who feel the need of having a stroller. Environmental friendly, user friendly (lightweight, easy control etc.), simplistic design and yet very innovative, are all arguments to make the parents *Greentom* customers.

Because they are more thinking about the earth and their future they are more aware. Their intelligence can probably be seen as above average, because they are future aware.

Potential buyers can therefor be described with the following characteristics (concluded in collaboration with *Greentom*):

- Young happy parents
- Desired pregnancy
- Eco aware
- Above average income
- Thinking/planning for the future
- Economical
- Educated

This means that consumers who bought the Upp are interested in better sustainable ways and even more if they can save money on it. They are still young, average couples get their firstborn around their thirties (man 32 years old, woman 29 years old). Parents are now in a stage of their life where a newborn has joined their family so they will look toward the future, for themselves, the baby and for the earth. This will give them an open mind for a possible new service of *Greentom*.

³ http://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action.html

After three years the child will be older and the stroller won't be needed anymore, their child is able to walk around without help. This makes parents even more aware of possible dangers and how the world works. Therefor they will favorably receive a suggestion from *Greentom* for a new green product, by re-using parts.

In the Netherlands the average number of children per woman is 1,8.⁴ There are a lot of women without any children; the consumers of *Greentom* probably will grow toward a family with more than 1 child (60%).⁵ This conclusion shows that to make the service work, the project requires a bigger understanding about how a family will grow and change over time (see chapter 4.1)

Persona

A persona shows what a typical customer for *Greentom* can be like. Benefits from using this method are: Getting more into the context of the problem and to evaluate the product in a later stadium. This will also be used in chapter 4 for the life analysis.

Figure 10 shows the outcome of the persona. Parents and child are figurative and non-existing. The figures were created as *Greentom* describes their standard customer, and added with background information for creating a basic household (based on CBS^{8 en 9}).

⁴ Centraal Bureau voor de Statistiek, <http://www.cbs.nl/nl-NL/menu/themas/bevolking/faq/specifiek/faq-hoeveel-kinderen.htm>

⁵ Centraal Bureau voor de Statistiek, Demografie van gezinnen, Maarten Alders, 2004



Names: Marleen van der Broek (28 years)
Wouter van der Broek (30 years)

Children: First daughter Elize

Likes: Doing yoga, drinking wine with friends, going to the beach

Wouter and Marleen have been happily married for 3 years now. They both used to have a job but since they their first daughter, Elize, the mother has taken some time of maybe in a couple of years she is going to start working part time again. Wouter is a journalist for the NRC Next. They live in Utrecht and in their spare time they love to go for a walk in the nearby forrest or park. Elize always goes with them to the beach and loves it there; they take her in their stroller from GreenTom.

Some evenings they spent with their friends to eat something with a glass of wine. They have a busy social life and until Marleen got pregnant they went each year on a skiing trip with her friends. In five years she definitely wants to go again and maybe Elize will get her first ski lessons. In the weekends they love to spend time with their family. They often visit their relatives or walk on the beach. If it is rainy they like to watch a movie and listen to the raindrops tapping on the roof.

Marleens' grandparents are still in their early fifties but Wouter parents are already in their late sixties

In a couple of years they will want another child and three years later they won't have need for the stroller anymore. At this moment they will be 33 and 35 years old and their grandparents in their late fifties and mid seventies.



Figure 10: Persona.

3.2. External analysis

After the internal analysis it is interesting to see how *Greentom* fits into the market around her. Therefore the external market has been analyzed starting with the Porter's five to see which side of the market has the most control over the market.

3.2.1. Porter's five forces analysis

To investigate the competitive rivalry within the stroller industry a Porter's five forces analysis will be discussed in this subchapter.⁶



Figure 11: Porter's five forces

The influence of each force will be described by an indication of high medium or low. Argued by some arguments this indication shows what side of the market has the most impact, meaning what chances they have and where their focus should be.

Bargaining power of suppliers

From the perspective of the industry there is a medium bargaining power of suppliers. This is neither positive nor negative for both the industry itself and the customers. As stated in chapter 3.1, there are a couple of big players in this market and they compete with each other. The power of suppliers is low at after sales, because the products are not exclusively for sale and largely being offered. This is positive for the consumer who is able to get a sharp price. For more general like broken parts, the consumers can return to their supplier or contact the producer itself who can deliver these services and products. Often the service is included with the purchase of the product.

Bargaining power of buyers

There is a large range of bargaining powers of the buyers. The stroller market is widely spread; generally speaking there is a high-end market and a basic market. *Greentom* chose to compete with the basic market offering good value for money. Yet the bargaining power at this end is high, this has several reasons. The strollers are largely offered at the market while the products show little differential. Therefore the buyers are benefiting from the competition in the market. The power that the resellers do have is that demand of the products is large as well.

The high-end market is different. It shows some extraordinary strollers with special features. The companies try to differentiate more. Therefore their target group will less likely change their preference. This makes the bargaining power of the buyers at the high end lower.

⁶ http://www.mindtools.com/pages/article/newTMC_08.htm

Treat of new entrants

In this market the treat of new entrants is medium/low. This is because the brands on the market are established and well known by their products- and service-quality. Meaning that the best-known producer will probably be the market leader.

It requires large amounts of capital and knowledge to start in this market. However people who are working in this field and who have connections and knowledge can easily start manufacturing a single product. Which may be resulting into a revolutionary idea.

Treat of substitutes products

If you define the function of the product to transport your infant/toddler, there are multiple substitutes products available in the market, such like baby sling (strap cloth around the chest). Nevertheless while there are certain things that parents require when taking care of a baby and while a baby stroller is not completely necessary, it is definitely a convenience.⁷ Meaning that the stroller may change over time but will probably stay in the market for a long time. Therefor the power of substitute products is low.

Category Rivalry

There is big competition in this market. Products are little differentiated because all the stroller producers use more or less the same style and technique in their products, resulting in a slow growing market because of the re-use of old strollers. The strollers can mostly go for a second lifetime and differentiate little from the new ones. Nevertheless there is always a demand for lower priced and better quality products. For *Greentom* this is an interesting market. If they keep delivering good quality products and high service they profit from the medium bargaining power of suppliers and the high bargaining power of buyers. There is no big threat of new entrants but existing competition is keeping a sharp eye on its competition.

3.2.2 Competitors

As stated in the chapter above the competition in the stroller market is big and the competitors keep a close watch on each other. In this market *Greentom* works according to a couple of principles:

1. A product should be good in what it suppose to, nothing else.
2. A product should be made Green from recycled materials
3. A product made the same but lighter is better
4. A product should be easily recyclable
5. A product should be as small as possible
6. A green product should not be more expensive than non-green products.
7. A product's usability is important to their customers
8. A green product should not be (negative) distinguished in aesthetics appeal to a non-green product.

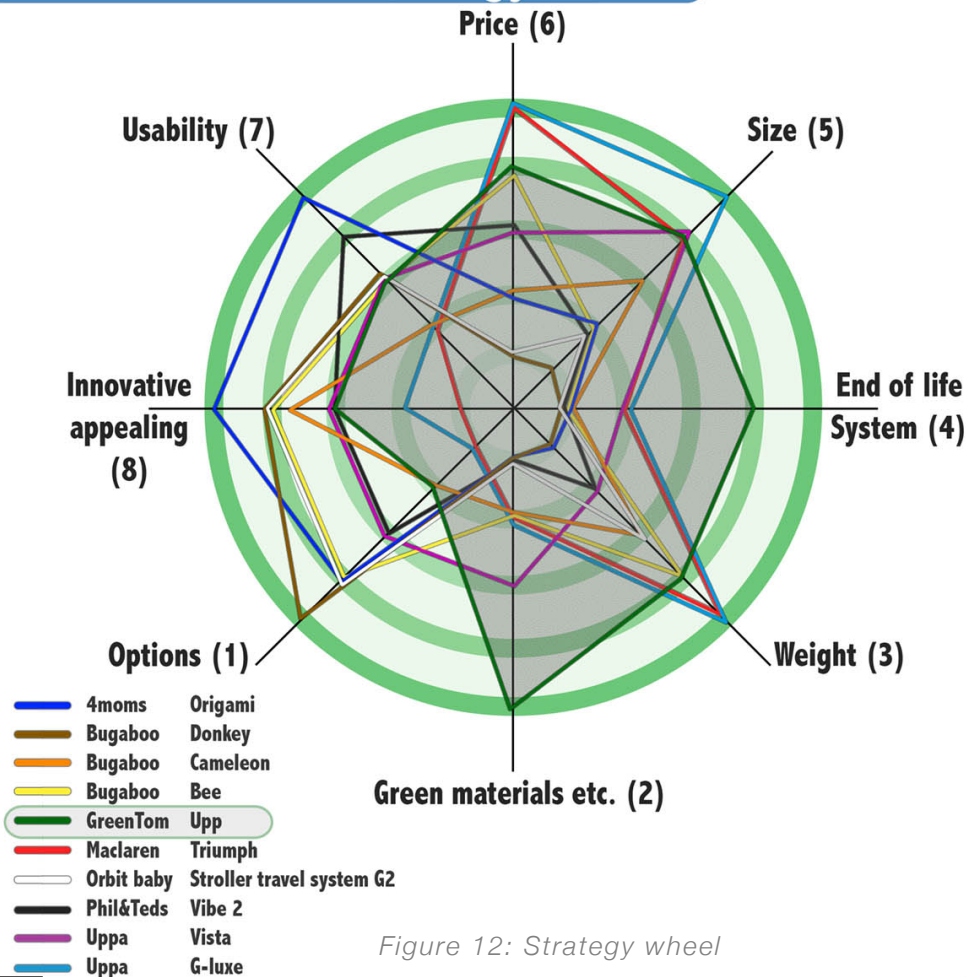
This project focuses on a market related to re-using products, that's why it is not interesting to do an extensive background research on all of the stroller companies who can be seen as a competitor. In the next chapter only the main competitors has been examined to find out what their unique selling points are. But more interesting is to check how the product of *Greentom* scores on a number of topics.

Therefor figure 12 shows a strategy wheel with the 8 principles; Options (1), Green materials (2), Weight (3), End of life system (4), Size (5), Price (6) Usability (7), Innovative appeal (8). The remaining two weight and size resulted from the first usability test.

⁷ <http://www.parentalguide.org/babystroller.html>

Ten strollers, including the Upp, are scored on each principle on a scale of 1-5. These strollers were selected by inhabitots.com who made a top 8 buggies list.⁸ The 2 extra are the Upp and the newest version of Uppa Baby, the G-Luxe. The G-Luxe was added because it shows great resemblance in price, size and weight with *Greentom*.

Strategy Wheel



This graph shows what properties of a sequel product satisfy to fit within the product portfolio of *Greentom*. Most principles could objectively be scaled like Weight, Green materials, Size, Price and Options. Others were ranked by arranging pictures, supported by video, by two of the three couples used in the first user test (A complete overview of used numbers can be found in appendix IV).

It can be seen that *Greentom* is the only one making use of recycled materials and planning to make an end of life system. This differentiates *Greentom* from their competitors.

The Upp doesn't score below average besides with the Options principle. Only the G-luxe and Origami exceed *Greentom* in three principles. Like *Greentom* scored the G-luxe well at the same points, while Origami is totally focused on the other side of the strategy wheel. *This makes the G-luxe indeed Greentom most similar competitor.*

The Origami scores much higher in options yet this can be explained by their first principle, which focuses them as low as possible. Making it therefor into a unique selling point. Therefor the Origami by 4moms follows a total different strategy; their number one principle is "everything matters".⁹ While *Greentom* focuses on the main function they embrace everything. *Making the Origami of 4moms is the totally opposite competitor of Greentom.*

⁸ http://www.inhabitots.com/top-strollers-for-green-babies/vibe_2_toddlers/?extend=1

⁹ 4moms, Vision and values, pg 12 http://www.4moms.com/about_us,

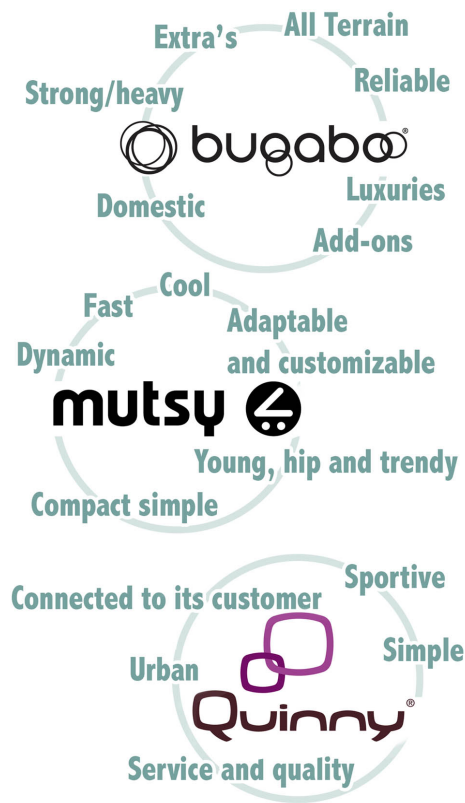


Figure 13: Competitors

3.2.3 Main competitors

As stated in the Porters five (3.2.1) the best-known stroller company is the strongest competitor. In the first user test 8 out of 16 participants named Bugaboo the best-known stroller company.

Greentom states Mutsy as one of the best-known companies in the market and compares their product to Zapp made by Quinny. Other participants named them likewise, making them one of the better-known companies as well.

It is important to understand what their unique selling points are. To see how *Greentom* locates them into this market. Therefore a short analysis on what these companies want to communicate toward their consumer (based on their website¹⁰) resulted into figure 13.

3.3. Trends and developments analysis

In this market a lot of products are being influenced by trends and developments. Therefore the external analyze should include insights into these relevant trends and developments. Only the most important ones will be discussed here. They will come back in chapter 4.2 in the ViP method.

¹⁰ <http://www.bugaboo.com/overview>, <http://muttsy.nl/nl/about-muttsy/>
<http://www.quinny.nl/nl-nl/kinderwagens-buggy/zapp/>

3.3.1 Trends

Other trends more related toward the vision of *Greentom* are the growing market of green products, incensement in desire for locally produced products and a growing artisan market.

Consumers are showing changes as well: They are trying to live a more healthy life and social media is taking a more important place in life. Both aspects offer new opportunities for companies. The social media also provokes more user centered brands and products. With everything online and being shared a company should honest without hidden problems and become more open about their flaws.

Furthermore there is a new growing demand for customizable products as a smart phone and the available apps. Consumers want to be able to choose what their product should do best and adapt to the current situation.

Last the market is changing by new regulations. Safety and health should be pushed to the ultimate to ensure the consumer that all is checked (A larger explanation and sources can be found in appendix V).

3.3.2 Developments

Developments can be spotted through time. For instance the baby boomers after the Second World War are now becoming 65+ and starting to retire. Giving a huge shift in the market and demand for other products.

There are also a couple developments showing interaction with the stroller market. The need for efficiency has been developed over a long period, nowadays in almost half of the families (49%) both parents work of which at least one fulltime.¹¹ This demands for more daycare but also more efficient transportation for instance.

¹¹ CBS, 2002. <http://www.cbs.nl/nl-NL/menu/themas/arbeid-sociale-zekerheid/publicaties/artikelen/archief/2003/2003-1198-wm.htm>

Furthermore premium products in every form and size enter this market. Not only for the wealthiest consumers but there is a growing demand among the average user for premium products.

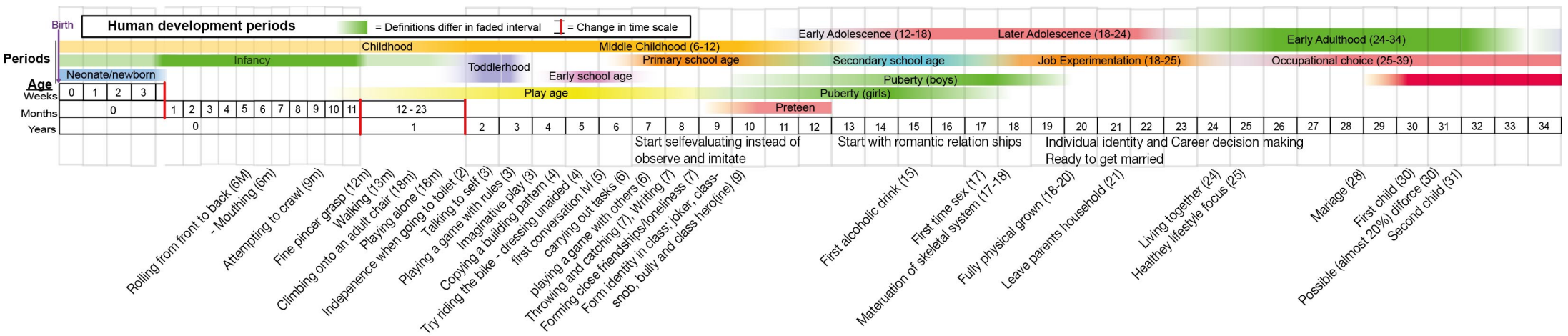
When we look at the economy it focus shifts from western society to the BRIC countries¹² (Brazil, Russia, India and China), but also Mexico and other Asian countries are becoming economic powers. Where consumer markets are expanding and new production processes are created (A larger explanation and sources can be found in appendix V).

3.3.3 Conclusion

This shows for *Greentom* that their vision is based on the current trends, green products, locally. Hopefully this will continue to develop but for now their timing is perfect for entering this market. Yet the options of the Upp are very limited, therefor the product is not very adaptable in every situation. Meaning that not everybody will prefer this stroller, which was to be expected.

The BRIC development might be a negative thing for *Greentom*, because their main focus will start in the Benelux. For now they still produce in China so the take advantage of cheap wages, but this is about to change as well. Yet the advantages of local production out weight these cons, especially for a green companies image.

¹² Trend Report 2012, 2011, www.Trendwatching.com



4. Search fields

This chapter will show how the search fields were chosen and formed. First the project focuses on the lifeline of the consumer and his family. Second search fields were formed through a ViP Workshop.

4.1. Life analysis

This project focuses on a long-term vision. Therefore it is needed to be able to see what kind of development a family, who buys the Upp at some point, in life undertakes. This background research will show information that can be translated into search fields for the next phase and into requirements for the service and product. Further it can be used to make sure the product cycle won't leave any gaps. This would mean *Greentom* would be unable to provide the family with a product at a certain point in time. This should be prevented cause then the family might lose interest in *Greentom* or get rid of their product.¹³

The average way of living

The psychosocial study by Newman and Newman, in "Development Through Life" made it possible to discover the following interesting fields linked toward *Greentom*:

- Healthcare products
- Child development products
- Transporting products, moving
- Transporting people
- Recreation products
- Sporting equipment

Conclusions

The life analysis required a general approach and resulted into an average way of living. The answers may seem obvious but this line will fit for everyone. Therefore figure 14 shows a clear line how a family develops.

In the next phase it will help design the cycle service for *Greentom* with background information for context mapping. Because the table shows what kind of information is needed from the family at which moment.

¹³ Newman, B.M. and Newman, P.R. 2006. Development Through life: A psychosocial approach 9th ed.

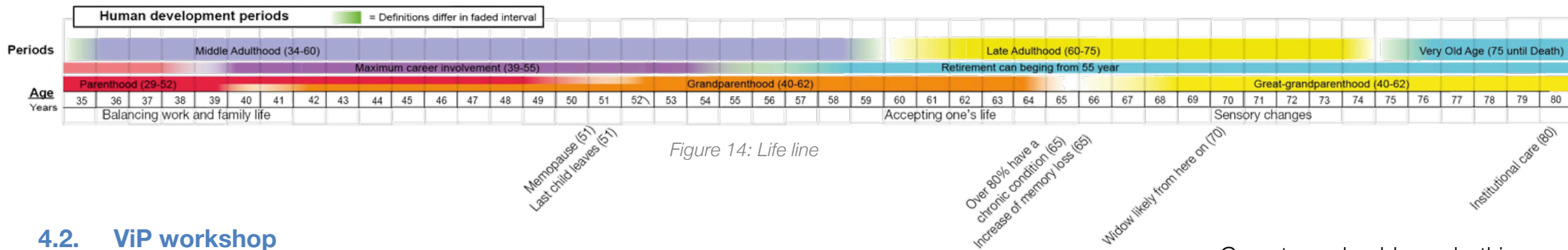


Figure 14: Life line

4.2. ViP workshop

For developing and exploring more search fields and product directions a ViP workshop was held (vision in product¹⁴). A group of participants was facilitated during a number of steps ending with a brainstorm. Four adults and one daughter were participating. Their first target was determining what *Greentom* goal should be and secondly how the company should reach that goal. As final target they determined what fields would be promising for *Greentom* to reach the set goal (For a full report what steps were taken and all the results see appendix VI).

Results

At the first phase the participants decided that *Greentom* should grow toward a green line of product always able to provide their customer with new products. A statement, resulted from a large amount of context factors was created as first part of the vision:

Goal: Greentom should always be able to offer their proud customer options for new added value.

Greentom should reach this goal by bounding the consumer with durable products. The second part the group had to communicate the goal and the way in a metaphor. A metaphor with a guide dog is used to describe what the interaction with *Greentom* should be like. Appendix VI shows the reasoning and results of this comparison. The third part was a brainstorming session, first with words what the qualities of interaction should be. Guided by those interactions a search field brainstorm was done (the search field of the life analysis were included as well).



Figure 15: ViP test

¹⁴ van Dijk, M. Hekkert, P. 2011. "ViP Vision in Design", isbn: 978-90-6369-205-6

Results

Besides the future vision how *Greentom* should grow to their goal. The group delivered in the third part an enormous amount of ideas. From these ideas the participants selected all ideas that seemed valuable. These ideas can be found with their linked search fields in the following diagram.

Ideas	Searchfields		
Baby crawling wagon	People transport	Baby product	Educational toy
Baby parts on a bicycle	People transport	Baby product	
Balance bike	People transport	Baby product	Educational toy
Bike child trailer	People transport		
Children trailer	People transport	Baby product	
Cleaning/maintenance trolley	Product transport		
Coffin	End of life products		
Collect them all toy, step by step			Toy
Elderly walker	People transport	Nursing products	End of life products
Golf Cart	Product transport	Sporting products	Toy
Health car products		Nursing products	
Shopping trolley	Product transport		
Skelter	People transport		Toy
Sled	People transport	Sporting products	Toy
Sporting equipment		Sporting products	
Step	People transport	Sporting products	Toy
Stroller for 2 children	People transport	Baby product	
Suitcases	Product transport	Sporting products	
Toy car	People transport	Baby product	Toy
Toy collection box	Product transport		Toy
(Stuffed) Toy			Toy
Trailer	People transport		
Tricycle (2-4 yr)	People transport	Baby product	Educational toy
Trolley	Product transport		

Figure 16: Brainstorm results

4.3. SWOT – Harris workshop

The next step was to analyze all found search fields by using a SWOT technique. This technique lists all internal Strengths and Weaknesses of *Greentom* and all external Opportunities and Threats of the market in a SWOT matrix. The first thing done was listing all S,W,O and T's. Each element was assessed on their relevancy as a resource. Then all relations (positive/negative) between a strength/weakness and an opportunity/threat would have been indicated. But after trying it showed to be unorganized to cross-reference all elements for finding the placements of the ideas. Therefor the SWOT technique was a little bit adjusted.

All elements were shifted to the vertical axis instead of cross-referencing with each other and the Harris profile technique was included. This is a technique was used to evaluate ideas on a number of criteria, the elements.

4.3.1 Matrix

All SWOT categories were used as criteria in the Harris evaluation giving them points (-2, -1, 1 or 2). Seven categories were more related to the project then the others these were the green ones. The score for these categories were counted double. The sum of the points per search field was the total score of that field.

The outcome of the SWOT Harris Matrix is shown in figure 17.

Figure 17: SWOT – Harris Matrix

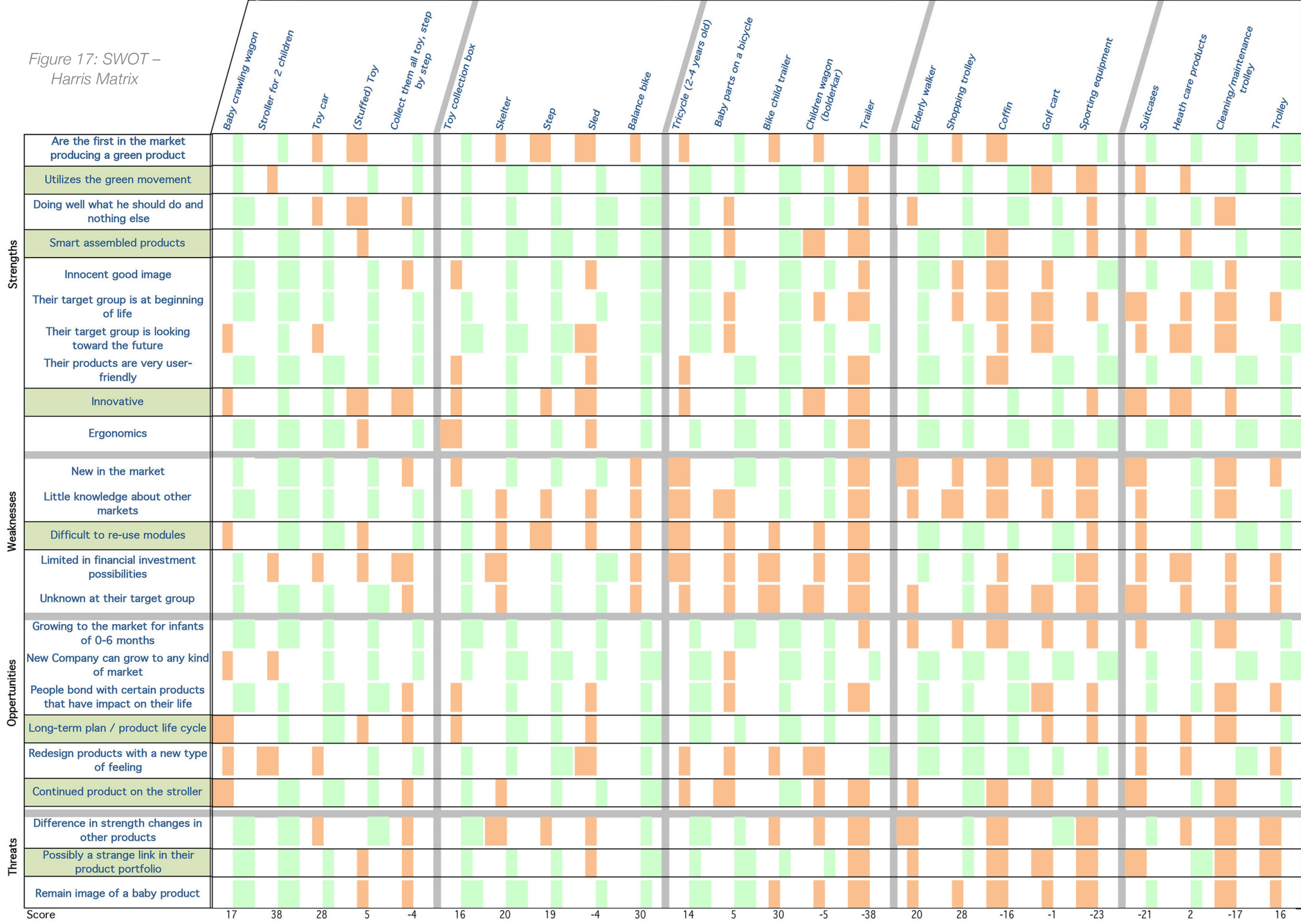




Figure 18: Product ranking

4.3.2 Results from the SWOT - Harris

After calculating the score the double stroller came out best with 38 points. Therefore it is advice for *Greentom* to develop this product. Yet for this project to show a feasible cycle the product needs to step away from a stroller and showing the first step in the cycle. The child trailer is the product with the second most points. In figure 18, 10 other products are shown with enough potential for future development. The first number in the circle means the rank of the product the second is its total score from the SWOT – Harris matrix.

Other categories that didn't make it:

- (Stuffed) Toy (5)
- Heath care products (2)
- Collect them all toy (-4)
- Children wagon (-5)
- Cleaning/maintenance trolley (-17)
- Trailer (-38)
- Baby parts on a bike (5)
- Golf cart (-1)
- Sled (-4)
- Coffin (-16)
- Sporting equipment (-23)

4.4. Evaluation, user study

Before selecting any of these possible products it's useful to look back at the design goal (paragraph 1.2):

I want to explore the possibilities, for *Greentom*, for new products, which are able to cycle in a re-usable system. I want to know if these products are feasible. What products offer the best opportunities and how to set up this service?

This stated that the product should be a follow up product on the stroller, to make it fit into the product cycle. This would exclude the tricycle and the baby crawling wagon, because these products would be used during the same time as the stroller. Later these products can be designed to be a new entrance point for the product cycle.

The best ideas were determined by qualitative interviews. Among five families (8 individuals), still in need of a stroller, the question which product would serve possible best as follow up product was asked (For a complete interview dialogue see appendix VII). Each participant got a three votes, their first choice was worth two points their second vote one point and third only half a point (For detail of all votes see appendix VIII).

The shopping trolley was preferred by most participants followed by the child trailer even though some believe they might wanted that product before you would be done with the stroller (this led to an insight that the service should be flexible, see chapter 6).

After that the balance bike was in favor. And some could see the elderly walker as possibility for their grandparents. Some participant preferred the step and an equal amount of votes went to the trolley. Nevertheless that trolley scored lower on the SWOT – Harris matrix and feasibility finds *Greentom* doubtful. Therefore only the step was selected to continue with.

Ranking:

1. Shopping trolley (8)
2. Child Trailer (6)
3. Balance bike (5)
4. Elderly walker (3)
5. Step (2,5)

This top 5 will be analyzed and checked for opportunities and problems in the next phase, which will lead to a possible redesign in the next phase. All involved parties will discuss those proposals.

Yet the ViP method and user study 3 showed insights for the service system as well. Those results are described in the next chapter.

4.5. Cycle system development

This service system is starting to take form. Some ground rules can be

“Personally I see the best possibilities in the shopping car or the child trailer, I believe they might be usefull at some moments”



Insight: The target group sees more value into the product when it is meant for them (and their child) instead of only for their child, like the toy car.

Figure 19: Product ranking

developed how this service will work and what the consumer will expect and desire from it.

4.5.1 Strategic service advice

Some insights were gained from the interviews what to expect from the service. As stated earlier *Greentom* needs to know their consumer and what product they could probably use best. Therefor they should always take the initiative to get in touch with their potential consumers.

Some participants stated the positive influence of the refund possibilities for the stroller when buying or upgrading the product is limited.

Another advice was to add a second hand system. This way *Greentom* can offer their consumers an option to return their product for a deposit. By doing so, *Greentom* needs to overhaul the product and if possible they can resell them for a discount as second hand.

The product cycle will probably work best if the used stroller can entirely be returned and the consumer gets back the same (fictionally) parts / materials into a new product. This gives *Greentom* the possibility to overhaul the products so they won't break down at some point or be incorrectly assembled. Plus if the cycle works there will be no need for re-assembling because the system could exchange with each other.

Warranty will be an issue at some point in this cycle. To make this idea work *Greentom* will probably need to be more generous in this service area, because the consumers need to be reassured that even their re-used product will last for at least a normal warranty period.

Insight: The Service should have a back-up plan. The promise of making perfect products sounds good but the possibility of a refund ensures people the service will always be of value to them. Else they will just sell it toward someone else.

Insight: The service gives little added value at the moment when the target group is looking for a stroller. The child is still a baby and while the parents look toward the future, the big picture is still blurred.

5. Product Selection

As a result of the previous sessions, five product opportunities came out best. They fitted the product portfolio and image of Greentom. They showed the best relation to the product cycle idea. And therefore this chapter continues by looking more into the opportunities how these products can be fitted into a cycle with the stroller.

5.1. Five products

As said this chapter shows whether the products will fit into the cycle. Before this can be decided all products must be analyzed. What are their most important requirements and their needed changes with the current stroller? Will there be problems and/or opportunities along the road with each product. And last but not least, comparable products (see appendix IX for visuals) will be described with a *Greentom* redesign impression.

5.1.1 Shopping trolley

The shopping trolley came out best in the SWOT/Harris matrix and was most selected by the participants to be a possible useful product in the near future.

Most important change of requirements

This shopping trolley needs to be capable of transporting about 50 liters of groceries and therefore able to carry 50 kg (see comparable products). Just like *Greentom* tested with the Upp, the trolley will be tested over a speed of 15 km/hour (on a bumpy road). Because of the increase in weight

Needed changes and remaining elements

Most of the needed parts can be re-used out of the stroller. Only the bottom part needs to be newly produced. Some parts of the stroller become unnecessary and a new fabric bag needs to be produced.

Problems and opportunities

The creation of a shopping trolley out of the stroller seems possible. Nevertheless the challenge will be to make cost efficient. The market price of a shopping trolley is lower than for strollers. When using elements from the Upp the trolley will probably become unnecessarily strong. Making the trolley foldable can create added value but the challenge remains to be able to produce it profitable.

In the markets 2-wheel trolley is well known yet also the 4-wheel version isn't uncommon. An opportunity for *Greentom* could be a version where extra wheels can be connected.

Comparable products

According to the website beslist.nl shopping trolley vary between

	Go Two trolley 99,-	Urbanista Dramaten New York 99,-
Dimensions:	103x48x36cm	100 x 32 x 32cm
Folded:	103x48x22cm	
Bag dimensions:	59 x 35 x 33 cm	
Adjustments:		Min height: 82 cm, Max height:100 cm
Weight:	3,2kg	3.2 kg
Content:	46 liter	55 liter

€9,49 and €249,94. Two popular but still basic models (2 wheels handle etc.) are the Urbanista dramanten New York and the Go Two trolley. Specifications:¹⁵



Figure 20: Redesign impression

¹⁵ <http://www.beslist.nl/products/r/boodschappenwagen/>

5.1.2 Bike child trailer

A bike child carrier is probable the most challenging product of the five. It is the largest product and has still some questions unanswered how the *Greentom* can build a carrier of their own.

Most important change of requirements

Most child trailers in the market are able to carry 2 children behind a bike. That means it's supposed to be able to carry 45 kg (2 children + luggage), maintaining a speed of 20 km/hour (on a bumpy road). Some versions are meant for 1 (bigger) child, these are able to carry 35 kg. Either way this is more than the Upp is designed for.¹⁶

Needed changes and remaining elements

The increase in need of capacity means the trailer is relative larger than the stroller. Therefore parts needed for the frame are bigger than the ones used in the stroller. The axis and wheels also need to be able to withstand the increase of weight.

Problems and opportunities

All trailers use air inflated rubber tires, but none under 500 dollars has any other kind of suspension implicated.²⁶ This gives an opportunity to see how suspension can be implicated, in the same way as the Upp uses PP. *Greentom* uses very limited amount of different materials. Nevertheless their only requirement is that they are recycled or used, which leaves room for alternatives.

Comparable products

Because there is a large range in products the average specification of the 10 best child trailers were taken as comparable specifications. The used child trailers are the: Dolphin xl, Burley d'lite, Chariot Cougar2, Chariot captain, Burley cub, Kidcar comfort, Weber Ritschie, Rody roller, Vanty and the Koolstop original (See appendix X for full data list).¹⁷

Specifications:

Average price	609 euro,
Unfold dimensions	83,9 x 93,3 x 96,3 cm (162 with rod) (WxHxL)
Mean folded dimensions	79,6 x 32,9 x 96,5 cm (WxHxL)
Inner dimensions,	64,4 x 65,4 x 58,5 cm (WxHxL)
Capacity:	Two children < four years
	Capable of transporting 45kg

The bike trailer market seems similar to each other but mostly differentiate in the front wheel option. With this wheel the trailer can be reformed toward a bigger stroller. The front wheel has three options:

- One or two front wheel
- Swivel or stationary wheel at front
- Front wheel attached to frame or arm

One swivel wheel attached to the frame is most common in the market. Research should show which version would fit best for a *GreenTom* version.



Figure 21: Redesign impression

¹⁶ <http://www.twowheelingtots.com/bike-trailer-comparisons/>

¹⁷ Bakker, K. 2003. "De grote kinderkarrentest". *De Vogelvrije Fietser*, mei, pp. 20-24

5.1.3 Balance bike

A balance bike is a logic choice as follow up product. When children are out of the stroller they are able to walk. The balance bike is meant as first step toward cycling and encourages the child's locomotion development.

Most important change of requirements

The product needs to be attractive for user, children with age 3 till 6. the aesthetic shouldn't be similar to the stroller. This would probably daunt the user away. Furthermore it is required to increase the capacity, because of the target group age and usage difference. Nonetheless with all needed changes this should be feasible.

Needed changes and remaining elements

The entire shape changed completely and is not comparable with the stroller. Only the wheels could possibly be re-used. Even the tires will probably be changed for inflatable once for different suspension. Leaving only the rims as re-usable parts.

Problems and opportunities

The material, PP (most common material in the stroller), is very bendable. This gives the stroller such a great suspension making springs unnecessary. Most balance bikes don't use any suspension at all. This gives an opportunity for improving the design and comfort. Even a balance bike that grows along with your child from a 3-wheel to 2-wheel bike is feasible for *Greentom*.

Comparable products

A lot of balance bikes are traditionally made from wood. Somewhat more appealing models are made from plastic. Most of those show a difference in boy and girl versions.

5.1.4 Elderly walker

The elderly walker might be the most obvious change in product

reusing most elements of the stroller.

Most important change of requirements

Instead of carrying children the walker now should be able to carry elderly. Most walkers come in two versions one able to hold 150 kg and one 125 kg. Even for the smallest version the specifications are way higher then for a stroller.

Needed changes and remaining elements

The elderly walker is able to re-use most parts from the stroller compared to the other five product categories. Almost the entire frame and even the fabric basket can be re-used in the walker. Only the top frame needs to be replaced by two (possible adjustable) handles. Calculations need to show how/if the axis and wheel need to be adjusted. The bumper needs to be replaced by a sitting part, which is shown in figure.



Figure 22: Redesign impression

Problems and opportunities

The company image could help make the walker cool and easier accepted by elderly. Making it maybe even acceptable for people on a younger age, when they already need it but don't want it.

Another opportunity is the market for children who need a walker; they would fit the company portfolio better. Nevertheless this market is very limited.

A problem could occur in the brakes; normal walkers have two types of brake options: a lock version (like the stroller has) and a friction brake. This requires some changes in the brake system.

Comparable products

In the market there is a wide range of available elderly walkers. The two best walkers, selected by Kassa¹⁸ are compared for finding the best usable measurements. Their mean specifications are described in the table below. It is clear that the stroller is a little different in dimension compared to the walker. For instance the stroller is only 55 cm width while the average of the Quatro and Topra Troja is 61 cm.¹⁹

Length user	Medium: 1,5 – 2m, Small: 1,35 – 1,7m
Max. User's weight	Medium: 150 Kg, Small: 125 kg
Height handlebars	Medium: 78 – 100 Small: 67 – 86 cm
Seat-height	Medium: 62 cm, Small: 54 cm
Weight	Medium: 7,4 Kg, Small: 7,1 Kg
Length	65 cm
Width	61 cm

5.1.5 Step

The step is a product used in many different age categories therefor the product needs to be designed strong enough so it won't break if some-one older than the target group stands on top of it.

¹⁸ kassa rollatortest, <http://kassa.vara.nl/tv/afspeelpagina/fragment/goedkoopste-rollator-wint-kassas-rollatortest/speel/1/>

¹⁹ <http://www.mediweb.nu/quatro-rollator/>, <http://www.mediweb.nu/topro-troja/>

Most important change of requirements

Different safety requirements should be implicated in this product. The step should be able to let a child play on it wildly. Therefor most steps are made from metal. A plastic step might be possible but should be strong enough in every situation.

Needed changes and remaining elements

Most components have to be remade since no elements can be found in the stroller. Probably only the wheels can be re-used from the stroller.

Problems and opportunities

This product has an opportunity to change the image of green product. Reason for this is because steps are being used among a wide range of consumers. Not only young children but teenagers as well play with it.

This range of consumers means lots of requirements as well. The components except from the wheels differ a lot from the stroller components so that none of them can be re-used. Therefor almost all parts must be newly made and these requirements can be met.



Comparable products

There is a wide range of steps to be found; yet the vision of *Greentom* should show a fresh new and yet simple product. The step made by Hilltoys has that kind of look (see appendix IX).

Figure 23:
Redesign
impression

5.2. Decision making session

Together with the coaches and *Greentom* it was concluded that the found ideas were well fit for future development. However no new luminous aspect could be found in that quest. Therefor it was decided

to step back once again in a brainstorm session, discovering an adjusted research question.

This brainstorm was done with five designers. In this session some of the earlier requirements were dropped. Goal of this session was “How to continue the project”. This would either result into a decision for a different product or confirm the previously found ideas. The session was very informative and contributed a lot to this project. Yet only the goal and results will be described in this chapter (Details about this session can be found in appendix XI).

5.2.1. Goal description

The goal was to realize a bigger picture, therefore some earlier set requirements in the goal definition had to be left out. *Greentom* agrees with this decision because the cycle will not be developed in the near future but over a longer amount of time. Allowing them to build the cycle eventually in accordance with their principles.

Creating a cycle with reusing elements is possible but only with a larger product portfolio. In the future this can probably be done when *Greentom* has multiple products, which can be combined.

Some of the basic rules that were left out were the re-using of the exact parts of the stroller into a new product. The main reason for this is that the product ideas had to be limited when only having one product in the product portfolio. A second rule that was dropped was *Greentom* being the only player; cooperation with other companies is possible. This could lead to a bigger step.

Greentom stated that they want to become a more product development community, for which people can gain royalties. In the future this might even be developed into an open source community. So the main goal of this session was to draw a line from now toward a *Greentom* cycle. In this goal the first step for the cycle is an important sub-goal.

5.2.2. Session conclusions

To allow *Greentom* to grow logically this session decided the development of the *Greentom* products should first continue in a base line. Starting with this base layer in their current field, transportation and nursing industry.

Eventually *Greentom* can grow toward these (linked) markets, but it will need to grow in layers. For example when *Greentom* would first develop a balance bike or step, they can grow toward toys or even sporting equipment (Details about this development line can be found in appendix XII).

As a second result the group decided that for product cycle with re-using component it was necessary to have a larger product portfolio. When a company only has one product their modules are limited and new modules will be needed for every other product; however when a company has multiple products they are able to switch elements. What is important in such a system is that when designing second or third products they should all maintain a standard dimension and connection. Make them eventually more capable of switching between modules.

Last decision was the project needed focus. Focus more into depth, with the product ideas. The ideas weren't wrong; even a smaller cycle could be found with each of the ideas. For instance the cycle could start from a tricycle and be adjusted toward a balance bike or a step. Or the bike trailer could start as small add-on on the bike and grow into the trailer later on. However, as stated before, there was no challenge in this innovation, so we looked further for other ideas.

5.2.3 Opinion of *Greentom*

In this decision the opinion of *Greentom* has to be implicated. With the new results of the session they agreed that a clear baseline should first be established before expending to further markets. Therefor starting in the transporting market seems best. Yet the thought of developing a similar bike trailer doesn't seem appealing enough.

“A child trailer is in fact a product to transport your children when riding the bike” *Greentom*

So their advice was to start in the market for transport children when riding the bike. They are confident that some kind of cycle can be found in this bike area.

5.3. Product direction

The direction this project will take is developing a way to transport children upon the bike. Even the option of developing their *Greentom* bike does not need to be excluded from the scope.

“Actually, you could now have in mind, a *Greentom* trailer that is very minimalist and simple to make.”

5.3.1 Idea generation

The product direction was still very broad. So before any sketches were made, some boundaries were set.

- The child should be transported by bike
- The product can either work in combination with a bike or be an entirely new bike
- The bike should be able to carry at least one child within age 0-8 years (8 is average when they start cycling on their own).
- The product should support the image of *Greentom*
- The product should be improve the current way of child transporting in some way, this can be:
 - Ergonomically, comfort
 - Capacity
 - Transportation effort
 - Image

Then the brainstorming began, while the first ones came easy the most came up by finding inspiration from the book *Designed for kids*²⁰ by using the essence of each idea and trying to relay it toward the child transportation on a bike.

Only the sketches that contributed to the process were photo scanned (They can be found in appendix XIII).

²⁰ Richardson P. 2008 “Designed for kids”, isbn 987-0-500-51413-9

5.3.2 Morphological chart

After a lot of sketching and brainstorming the best way to continue was categorizing the differences and ordering them into a morphological chart. Resulting into nine best solutions out of showing 1.152 possible combinations (6 Areas x 3 Type of products x (4+4 doubles) Specials x (4+4 doubles) Seating's).

Location of children on the bike

The location of the children on the bike is what influences the product ideas the most. For that reason it's on top of the chart. There are 6 feasible locations on the bike where to place seating for a child; the front, middle, and back of the bike, behind the bike and on either or both sides of the carrier.

Type of product

The type of product determines how the final designed product will be combined with a specific type of bike. Three categories were established; Add-on, Extra and Special.

The "Add-on" is a product type that will only work with a bike.

The "Extra" is a product type that can be integrated with the bike but can also work without.

The "Special" is a product type that requires a special bike.

The "Extra" and "Special" option could lead toward a collaboration with a bike company to for building a *Greentom* bike; *Greentom* states that they are open for this kind of cooperation.

Special

The special section has four optional features; Foldable, Integrated, Second purpose and/or Double capacity. These options clarify the specifications of the ideas.

Seating

The type of seating is determined by the position of the child. For children a couple of positions are common: laying, sitting and standing. A separate category was added for the possibility of cycling along.

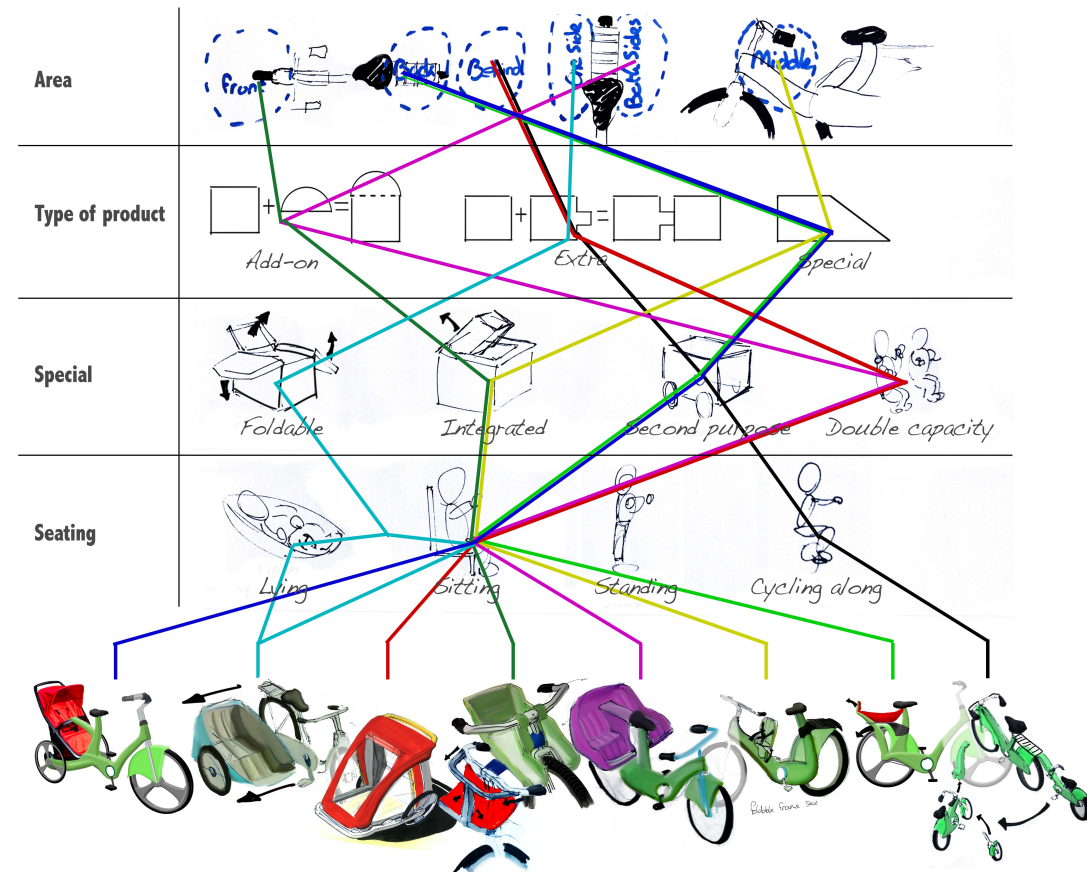
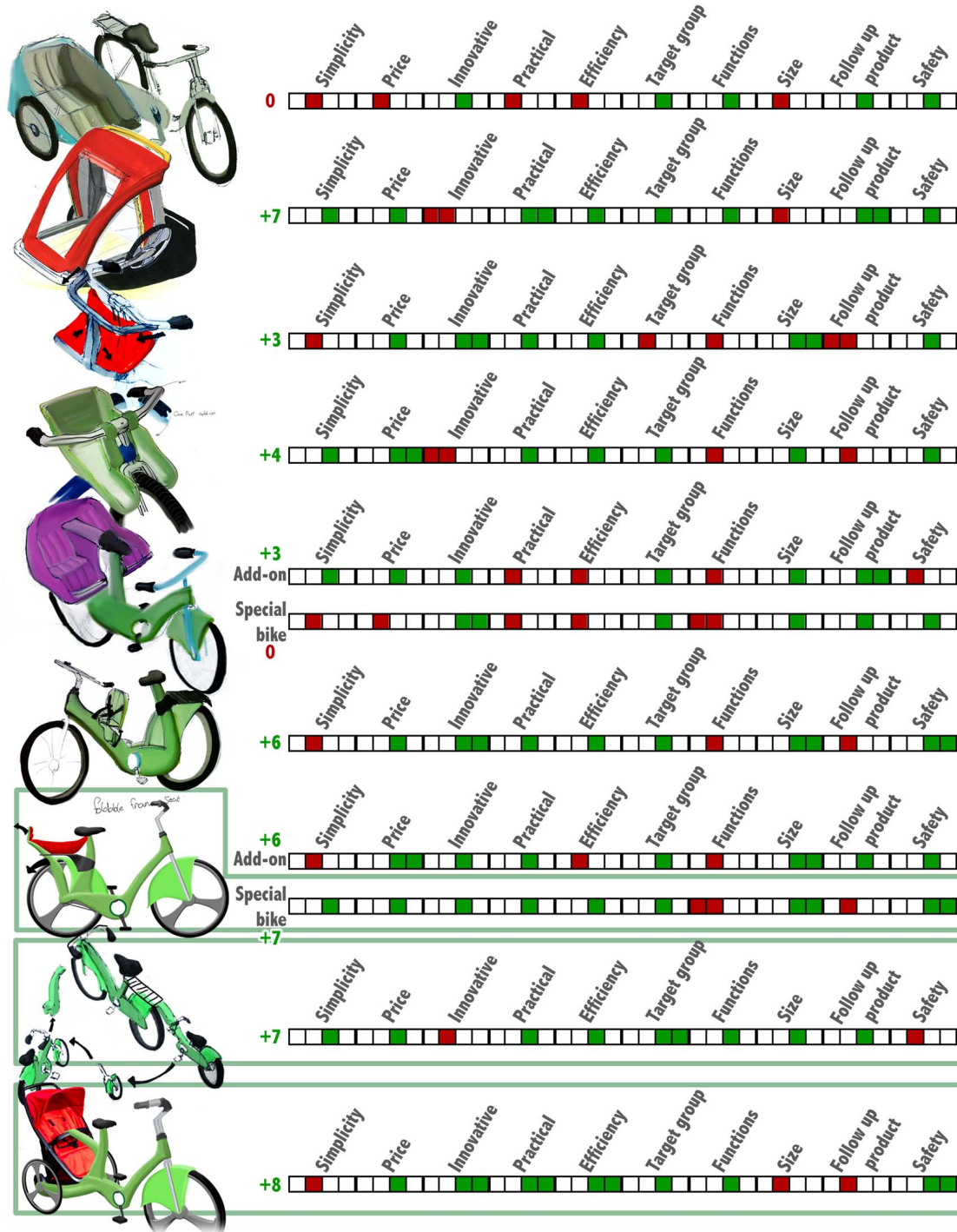


Figure 24: Morphological chart

Result

Nine possible solutions were the result of the Morphological chart, see figure 24. They originated starting from every type of area and seeking the best possible combination with the type of product, Special, and Seating.

Because the product ideas have many factors of assessment, it is best to evaluate these ideas in a Harris profile. Some important factors are for example the production price and simplicity of the product, but also its functionality and efficiency.



5.3.3 Harris profile

Together with *Greentom* the nine found options were evaluated upon ten factors. They determined the expected success factor of the ideas resulting from the morphological chart. The factors are chosen by *Greentom* and set by goal definition of this project; safety, simplicity, price, innovative, practical, efficiency, target group (fitting), size and follow up product.

Original there were nine combinations selected. Two of them could either be made into an add-on version or a special bike version. So in total the Harris profile contains 11 ideas submitted to 10-evaluation points.

The scores were determined in cooperation with *Greentom*; the result can be seen in figure 25.

Results

Four ideas stood out from the others gaining a score above six points. Three of these ideas (*Greentom* wanted to bring a new product to the market therefor the bike trailer didn't seem innovative enough) were created into concepts. Their new names are:

Fold-it-under, this product can unfold a child seat from underneath the seat and from its post.

The bike behind, this is an individual smaller bike that can be connected to a normal bike with a slight change.

The Upload bike, this is a bike able to carry the Upp unfolded.

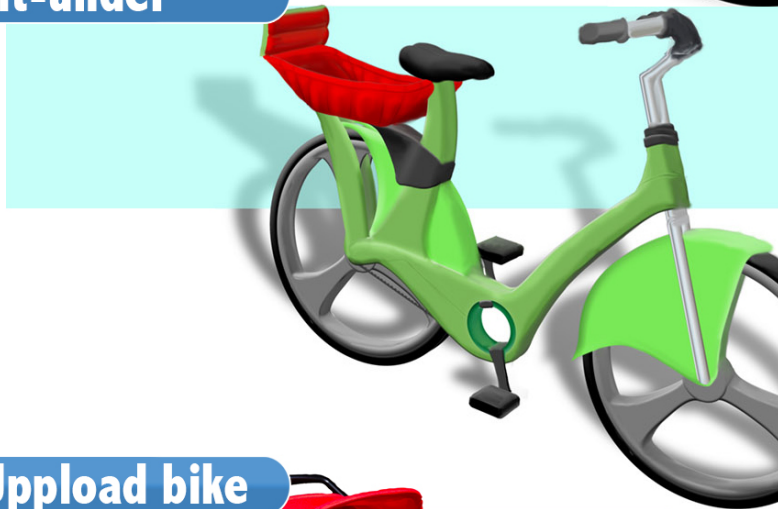
The third idea scored one point higher then the others yet this small difference doesn't make a conclusion yet for the best idea. In the next chapter they will be elaborated further and evaluated.

Figure 25: Harris profile

Bike behind



Fold-it-under



The Upload bike

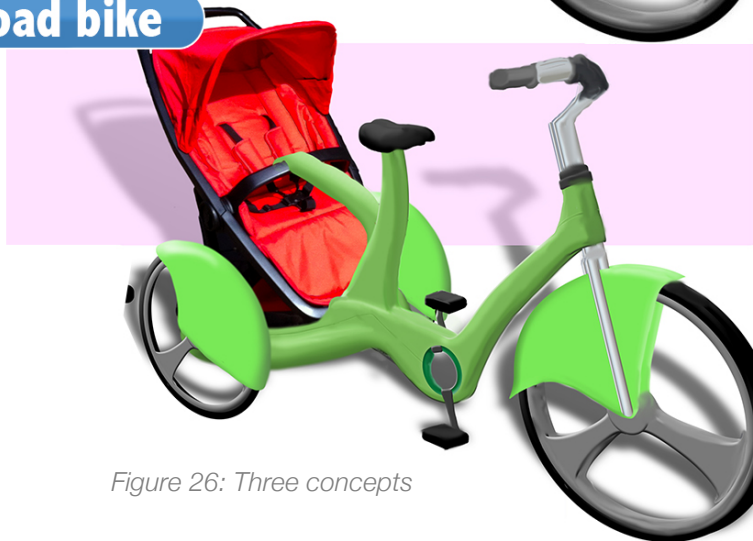


Figure 26: Three concepts

5.4. Three concepts

The Bike behind can fold the front wheel of the smaller bike into its frame and can be connected with a swift turn of the luggage carrier on the larger bike. This concept can be used for children who are already able to cycle (4-5 years old²¹). Yet they are either still learning or not yet able to travel for longer distances on the bike. If the child or parent wants to, they can connect the bike and cycle along. Similar product exists in the market yet the simple connection and the deformable child bike is new.

Fold-it-under is a mothers bike which looks like a normal bike when not being used for children. The child seat unfolds from the seating and post. This will ensure that the seat stays clean and dry. When folding it back the seat will span itself elastically back underneath the seating. By replacing the fabric the seating can be used for older children and grow along with the child.

This product will probably work best with a special made *Greentom* bike. By only producing it as an add-on it will most likely be visible and in contrast with the rest of the bike.

The Upload bike is meant for transporting the Upp with child unfolded from A to B by bike. This concept is unique and combines the two markets of the stroller and the bike world. The Upp doesn't have to be adjusted and a cycle would be possible when the child grows out of the stroller into a bucket, making it a cargo bike.

A more detailed concept description can be found in appendix XIV. There are two groups of interest now, which should be consulted for determining which concept is best. Those are the consumers and *Greentom* themselves.

²¹ <http://peuterkleuter.jongegezinnen.nl/Ontwikkeling/Kleuter/Fietsen-zonder-zijwieltjes.htm>

5.4.1 Greentom's opinion

To determine which concept should be worked out further, *Greentom's* opinion was consulted. They were most fond of the Upload bike, yet believed that there were other possibilities for uploading their stroller on a bike.

There main reason for this concept it should be most fitting for *Greentom* and they believe there is no such thing yet in the market.

5.4.2 Questionnaire

With an online questionnaire a panel of eleven parents within the target group of *Greentom* determined the public opinion (See appendix XV for the full questionnaire and its results). The concepts were evaluated upon: Innovative, Safe, Comfortable, Possible to use with multiple children, Likely to be used without children and General impression.

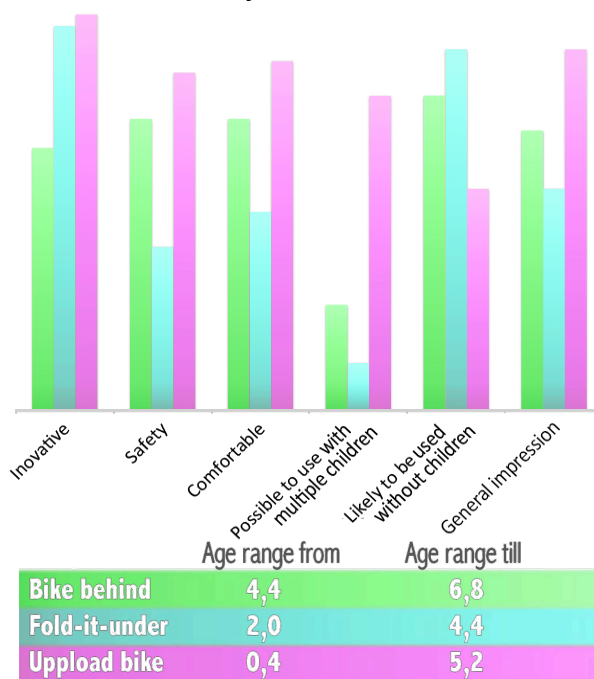


Figure 27: Questionnaire results

These factors were chosen because *Greentom* wants to create the most innovative product, which of course should still be safe and comfortable. Furthermore it should not be a product that would look like an extra product instead of the consumers' normal bike. Therefore it is important that the consumer believes it can be used with more than one child and without any children.

Overall the general impression of the product

gave an important insight which product is preferred by the public, first the Upload bike second the Bike Behind and thirdly the Fold-it-under. In almost every factor the Upload bike won, except the factor "likely to be used without children". Which can be explained by some comments that the product idea is great but it looked like a bike for disabled people, especially when being used without the stroller. This can be a result of the handicapped image of the three-wheel bike in the Netherlands. Therefore a user test should be done to find out which position the stroller is most preferred onto a bike.

The panel was also required to choose a range of age they would use the product for. This would show if there are options of creating a cycle. The outcome from this age range shows that there is a small gap between the end of the stroller use (3 years) and the bike behind. Beside of that the bike behind and the fold-it-under will only be used for a short moment in life. The Upload bike logically overlaps with the stroller age, but exceeds it as well. This means consumers would be interested in using the bike longer than the stroller in some sort of cycle system.

5.4.3 Conclusion

The concept choice is determined on the opinion of *Greentom* and the panel, see figure 27. The last influence on the decision originates from the problem definition, which states to create a product cycle. This will probably only succeed with the Upload bike.

Therefore it is clear that the concept for transporting the stroller unfolded by a bike is the best. In this current version however some adjustments have to be made to make it really successful. The upgrade of this concept should cope with the comments given by *Greentom* and the panel. Therefore a second step should be made to determine which position would be optimal.

5.5. Positioning

The most important factor, for the exposure of the bike, is the positioning of the stroller onto the bike. There are 6 possible combinations to be made:

- The wheels 2 or 3 cargo bike version
- Position of the stroller (front or backside)
- Looking direction of the child (forward or backwards)

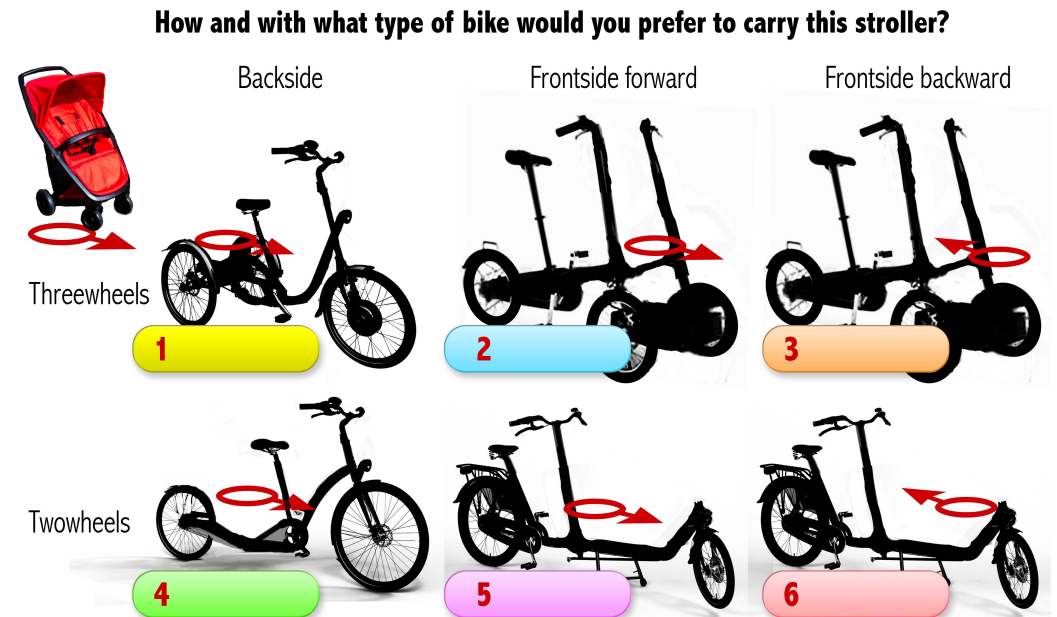
For making this decision the opinion of the consumer and some bike repairmen were included.

5.5.1 User test position preference

With a simple question sheet a quantities research was done among 20 parents with children in the park (most of them were using a stroller or came by bike). It was interesting to see that a large part of the public opinion went out to behind the bike (option 1 and 4) if they imagined a way of transporting the stroller without pictures. But when showing them the possibilities visually most of them changed to option 5 and 6, see figure 28.

Some of them explained they changed opinion. Initially behind felt safer. But when they saw the picture the idea of being able to see the child made them feel more comfortable. With visual option it was easier to include the social reasons. Plus the safety aspect was judged better than before.

Other people wanted a combination of 5 and 6, making it possible to change the direction of the stroller if they wanted to (The entire user test can be found in appendix XVI)



Note there may be assumed that the stroller fits and is safe approved.

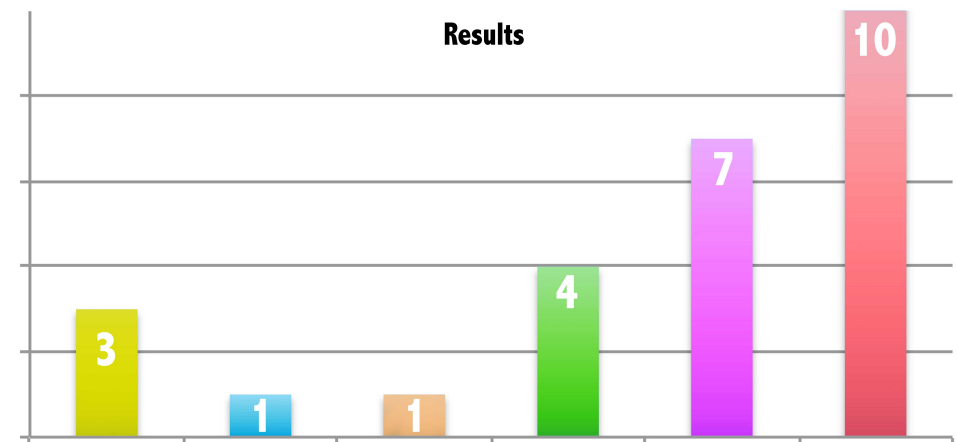


Figure 28: Votes

5.5.2 Bike repairmen opinion

For the opinion of the bike repairmen a qualitative research was required. Therefor two interviews were done in different shops. The main question was where and how they would place the stroller and which type of bike they would use:

“When children are being placed backward they will always be tempted to turn around seeing what mommy sees and what new things are coming in sight. You don’t want them to be moving all the time.”

“Research shown that most parents would like the stroller uploaded on a two-wheel cargo bike, mounted in the frontal position. Would you agree that is the best option?”

“The choice of a two wheel bike mounted at the front is logical for the Netherlands. But when looking toward other Europe countries three wheelers are more common and in Asia even the two wheel behind version three wheeler.”

5.5.3 Concluding, pro’s and cons

The public opinion with visual information is considered most important, because the pictures give a better image of the emotion it will provoke, which was the goal of this research. The research was limited to the Netherlands and therefor the outcome is only relevant here. *Greentom* will start launch this product in the Netherlands and later on develop toward other countries. Extra research will be required then to see which product will bring the most success there.

Some parents wanted to be able to choose both forward and backward seating in front of a two-wheeler bike. Nevertheless the interview with the bike repairmen showed that sitting backward might make it more dangerous because children will be tempted to move recklessly when trying to look forward.

Therefor this project is chosen to continue with the two-wheel bike mounted forward at the front. In a follow-up study the option of backward riding with the stroller should be tested, to show how steady

the stroller would remain. Another study could be started before introducing this concept in other countries.

5.6. Unique selling points

Greentom wants to distinguish themselves in the market from other stroller companies. This product can help them achieve that goal by making it possibility to transport the stroller unfolded by bike, quick, efficient and simple. This is the important unique selling point for this product. These USP makes the product not only differentiating in the stroller market, but cargo bikes as well. Yet there are more reasons why the consumer should be interested.

Transporting the stroller; Quick, Efficient and simple

Transporting the stroller with the least effort

Consumers experience a lot of effort in transporting the stroller by bike. Some products exist for transporting the stroller folded up; nevertheless no product is able transport it unfolded. Bringing the stroller on the bike will become extreme simple and makes it therefor the main unique selling point.

Exchangeable bike front ends

By making the front end of the bike exchangeable the Upload bike can start with a smaller version. The Fietsfabriek for example creates two types of cargo bikes, a smaller and larger version. The frame of a cargo bike uploaded with the *Greentom* stroller is also smaller then the standard cargo bike. This allows the consumer to start with a more simplistic cargo bike version and later grow into the larger model. This system will from now on be referred to as a modular system. Consumers from the earlier user test stated that the idea of driving such a large bike is difficult withholds them from buying such a bike.

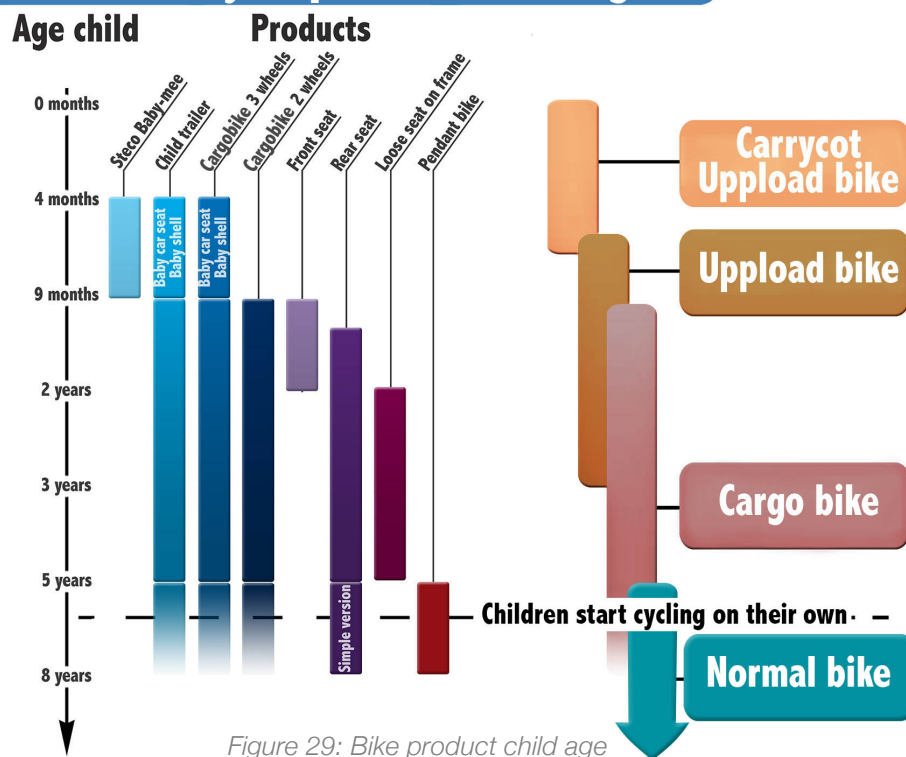
Bike seat development

The distinction between the products used to transport children, is the children age usability. Most parents start with a front seat followed by a rear seat or seat on the frame. After that the children either drive on their own or the parents buy a pendant bike or child trailer.

Cargo bike owners are able transporting their children from birth until the children begin to find it dull to ride along (usually around the age of 6-7 years). Yet parents are still required to buy extra car seat kits for the baby (Maxi Cosi) and a bike seat for their toddler to place them in the bucket.²²

With this product intermediate products won't be necessary anymore. By just using the perfect seating in the stroller as seating on the bike no more extras are required. Both the *Greentom* carrycot as well as the stroller can be loaded on the bike. And when the child is too big for the stroller it can be exchanged for remuneration into a bucket to make a complete cargo bike. After 7 years, the cargo bike can even be converted to a normal bike due to modular system, see figure 29. This plan makes it more durable than all the other products that parents are buying now.

Bicycle products child age



Proud feeling of the parents

Especially in the early stages of parenthood parents feel a huge sense of pride of their child. Uploading the stroller at the front of the cargo bike can display this proud image, as a throne for the child.

Materials will always be recycled

By creating such a modular system parts will always return to *Greentom* and can be re-used in for example a second hand cycle, or can either be recycled. The new parts can be made from these recycled materials.

²² <http://www.hollandse-bakfietsen.nl/bakfiets-overzicht-kinderleeftijd-en-oplossingen/>

6. New approach

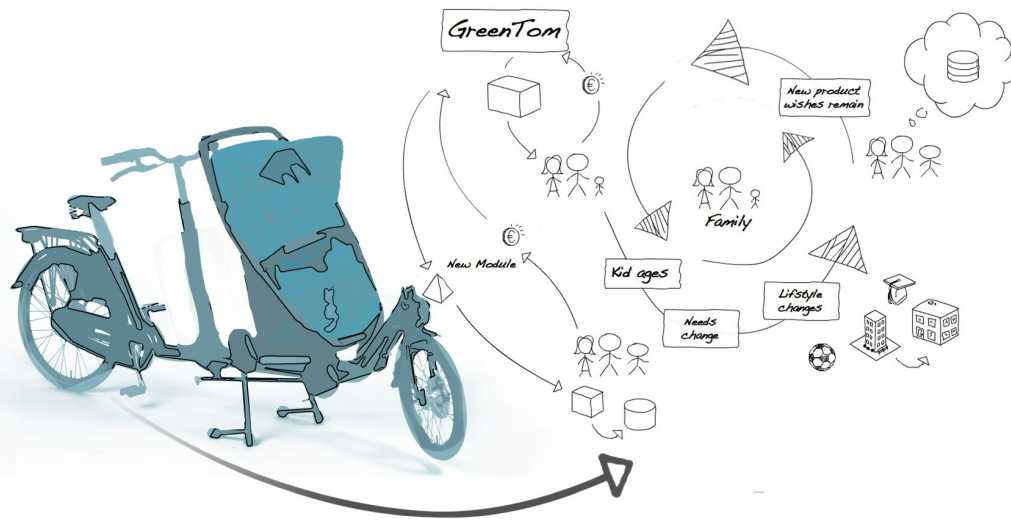


Figure 30: Upp cycling the bike cycle

The project started with the search for a product cycle with the consumer and company in the center. Even the option of re-using elements was analyzed. It seemed impossible to choose a challenging but small product portfolio. Some products were found but required intensive changes to the product requirements. Therefore the project made a slight turn with the Upload bike. Opening new doors to a different kind of cycle. This chapter will show what is behind these doors.

6.1. New product cycle

In the Netherlands almost everybody rides a bike. Yet for new parent cycling with their child is a whole new dimension. Besides facing the new dangers, parents want to know how to transport their child best. As stated in chapter 5.6, parents need to use many different products over time.

This new cycle is developed upon the growth of the child. By uploading the stroller equipped with the Carrycot (being developed by Greentom) a child can be transported from birth till he is 3 years old. After that Greentom will provide their consumers with the opportunity to grow into another model bike combination. Eventually the cargo bike can even grow into a normal bike.

By returning of the no longer used parts, the consumer receives a discount on the follow-up product. This allows Greentom to set up a second life cycle with the used product. Making the plan even greener and above all, the second life cycle will even be more profitable than the first (see chapter 9).

6.1.1 Challenge points

The challenges in this plan are the bike and the connection between the stroller and the bike. The bike should be built with a modular system. This means that the front of the bike is made exchangeable and can be separated from the back module.

The connection between the bike and stroller requires an add-on. This add-on will allow the stroller to be safely mounted and locked.

For coping the first challenge Greentom needs to collaborate with a cargo bike company. The bike company “De Fietsfabriek” is very interested in this plan because it allows them to address their target group in an earlier stage and thereby extending their product life. The second challenge (add-on) can be solved by Greentom.

6.1.2 Bike modular system (BMS)

The life cycle of the BMS starts with a basic bike, delivered by *de Fietsfabriek*. This bike is equipped with an extension-option for the front wheel. This basic bike can be changed into the smaller version of the cargo bike and later on to the larger version. At the end of the cycle the bike can be brought back to the basic version with a normal front wheel. Besides these standard options consumers have the option of switching toward different types of cargo bikes. This can be of interest if they feel they made a wrong choice or just want to try something else.

The development of the bike can be seen in figure 31 on the following page, showing all in's and out's during the cycle. This development was also seen in the product development line earlier used (see chapter 5.2.2).

The safety and usability of this bike should not be influenced by the exchangeable option. The bike repairmen stated that making a bike exchangeable wouldn't create problems in those aspects. The company *Workcycles* is already building in modules. However, *Workcycles'* goal is not to make them exchangeable but to make the assembling process faster and easier. The secret of making it exchangeable is in the headset.²³ For more information see appendix XVII.

Exchanging the modules is not a job for the consumer. Bike repairmen should be instructed for this job, thereby foreseeing in a guarantee-clause. They should be a reseller of *de Fietsfabriek's* products. When the consumer goes to such a reseller they are offered a variety of possibilities. The parts that are left with the reseller determine the discount for the consumer and are being returned at the next delivery of *de Fietsfabriek*.

De Fietsfabriek should develop this challenge further, because this side of the market has little in common with *Greentom*. Therefor this project will focus more upon the add-on.

6.1.3 The add-on

The add-on makes the connection between the stroller and the frame of the cargo bike. By bringing these products together a new market is created and is therefor the first step into the cycle.

Without this add-on it will be impossible to create a cycle for the product. Therefor this project will focus into this first step of the bike cycle.

The goal of the add-on is to connect the Upp to the cargo bike. Yet the lower tube of the cargo bike (see appendix XVIII) is at 34cm high. Therefor a second function could be added to help the stroller lift and connect to the frame. This is needed when the children grow older and heavier.

The consumer will probably start with a simple add-on on the smaller cargo version, from now on referred to as Basic-version. Later they will grow into a lifting and larger version.

Some less strong parents might choose at start for the easier lifting version. This version shall become the first focus point of the project, because the cycle will only work if everybody (P5 – P95) is able to upload the stroller (chapter 7.1 shows this version is necessary). Therefor the Basic-version will be designed after a successful proof of concept of the easy lifting model.

²³ <http://www.workcycles.nl/>

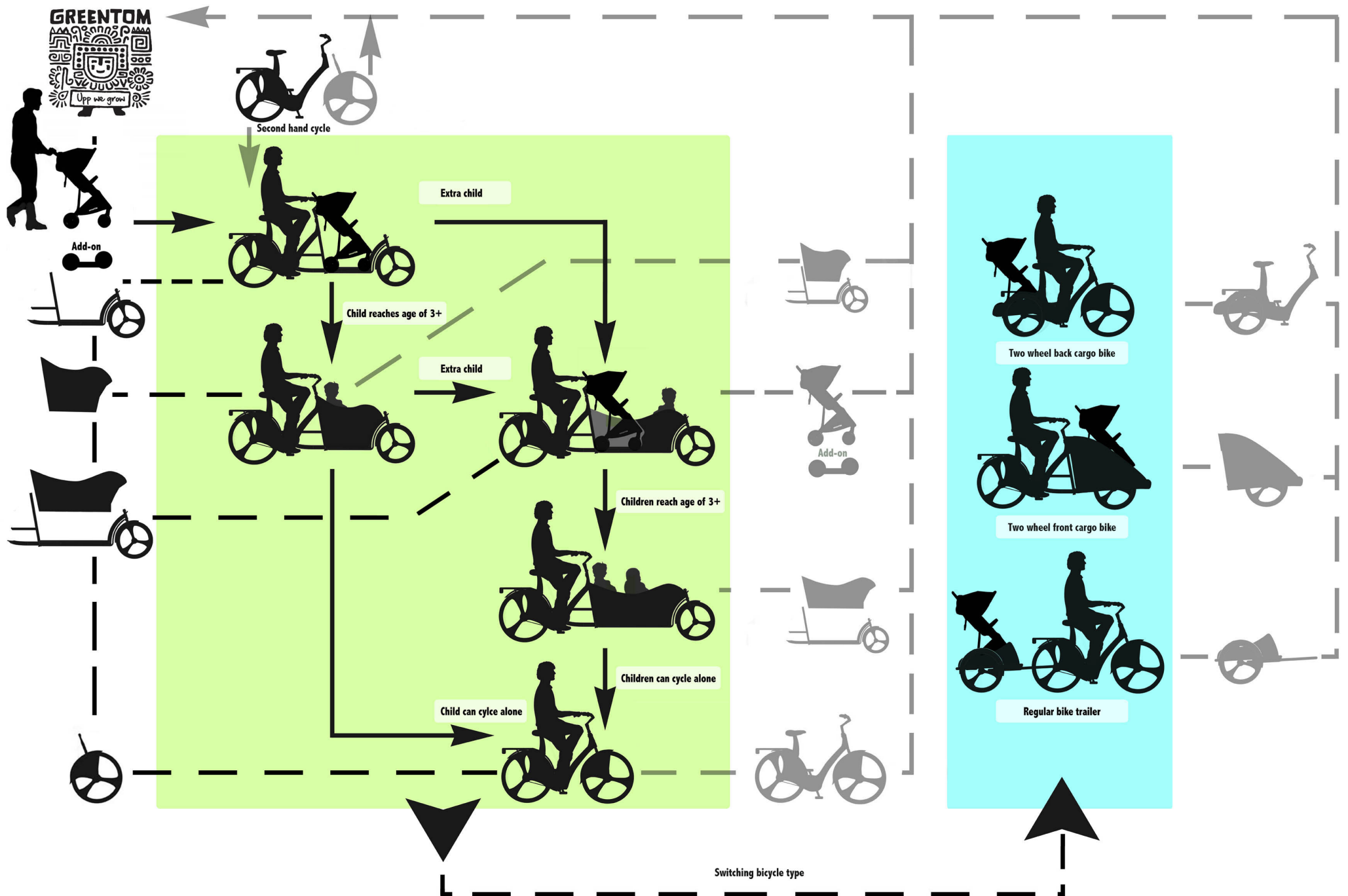


Figure 31: The new product cycle

6.2. New problem definition

For this project the new goal definition is zooming more into the first step of the cycle, the connection between the Upp of Greentom and a cargo bike. Without proving the feasibility of this step, the entire idea of connecting both products will not get further than a concept.

Since the product direction is now more concrete, a new product definition can be stated. Based on the interviews done before, a clear consumer opinion showed what problem this design could solve. The product cycle itself solves another problem on a longer-term base.

6.2.1 Short-term problem

Investigating the short-term problem focuses on the advantages of the stroller cargo bike combination.

What is the problem?

People are obliged to use an unsustainable transport because there is no good solution to take transport a child over a distance of 2-10 kilometers, without needing to carry him at arrival. For example when bringing the older child to school, the mother needs to carry her other child at the schoolyard.

Who has the problem?

The problem is common among young parents (couples) who raise a child, age till 3 years old. They use seats on the bike for their child and own a stroller. But it is not comfortable to bring both child and stroller on the bike. The parents who would like to use the bike for transportation live in big cities. The cargo bike is designed for parents who usually cycle alone with children and luggage.

What are the goals?

The goal is to design a product making it as easy as possible to transport the stroller and child while cycling. This also means easy loading and unloading. Furthermore the bike should still be good steerable and not require more effort than the normal cargo bike.

Next the product needs to make a safe connection between the stroller and the bike. This connection should be simple but infallible to attach and lock. It should be impossible to forget this lock by accident.

What are the avoidable side effects?

The product should not become a luxurious extra. It should give an alternative for when only the car on a relative short (cycle) distance. The product should support the consumer with uploading and make a safe connection between the bike and stroller. These requirements should not intervene with each other. This could irritate the consumer.

Which ways of action are available in the beginning?

There are many possible ways the product could support the stroller while uploading. Brainstorming and categorizing the solutions in a morphological chart should explore these.

6.2.2 Long-term problem

Investigating the long-term problem shows the possibilities of the product cycle. When users enter the market with the stroller and finally end with a normal bike.

What is the problem?

Some durable products have longer life duration than its average period. This results in an unused product that has still value that can be re-used. Besides the second hand market there are little profitable options to return the product into a new cycle.

In the bike market for children support these products can be compared with different seating's. For example the front seat can only be used when children are older than 9 months and younger than 2 years. After that the children are switched to a rear seat, some parents choose other alternatives like a child trailer.

Who has the problem?

People, who strive for an upmost product use and a green living, prefer a system on which they can depend their product wishes will always be sustainably offered.

What are the goals?

The main goal is to bind the consumer over a longer term with *Greentom*, in a positive way. The offer *Greentom* has, should be fitting the wish of the consumer. It should always address the consumer on the right moment. Only this way *Greentom* takes care that there products/materials are always being used effectively.

What are the avoidable side effects?

The products will only be used temporarily. Thus the products are not yet at the end of their usage after the user is finished with it. A second cycle should make this system even more beneficial and sustainable. Nevertheless it will only succeed as long as the consumers' treat the products as their. So requirements will set for returning the product in reward for a second product.

Which ways of action are available in the beginning?

The bike loop should be fitted in the big circle of *Greentom*. Therefor the earlier found opportunities for *Greentom* should make a link in the lifecycle. A business plan for the bike loop should be written how the bike and stroller will return to the companies and how new parts/products are being delivered and installed. In the future this should also be done for the large lifecycle.

6.3. List of requirements:

The design will focus on combining both the cargo bike to the stroller. The connection in between is leading in this step and therefor the element that will be designed.

Certain aspects were considered for the list of requirements: Safety, uploading, unloading and the required maneuvers of the cargo bike.

The context mapping session later in this project (chapter 7.2) also contributed to the list.

Requirements:

Safety

- In case of an emergency break the stroller should stay stable.
- The locking mechanism should be infallible.
- The stroller should be stable when cycling uphill or downhill, max 15%
- The stroller should remain stable in a corner, altering the bike max 30 degrees.
- The stroller should not interfere with the steering space of the bike.
- The child and stroller should not alter the balance more then the in a normal cargo bike.
- The sight of the driver should be comparable to the cargo bike version see chapter 6.3.2.

Uploading/unloading

- The user should be able to upload the stroller from both sides of the bike.
- All maneuvers should be made within the allowed ergonomically positions and forces, see chapter 7.2.1
- The stroller should be able to be lifted by a p10 women (strength) and p95 men (length).
- The stroller should be able to be uploaded in one move when approaching the bike.
- The stroller should have a quick release to lift the (empty) stroller out of the locking.
- The stroller should have a quick insert for placing the stroller into the locking without using the upload system.

Cargo bike

- All functions of the bike should still be able to be used as a normal cargo bike yet without the functions of the bucket.
- The upload system should be able to be replaced by the bucket.

Wishes:

Greentom

- The product should be designed as simple as possible. Minimalism is preferred
- Extra functions should be easily integrated or left out.
- The design should allow the product to be assembled as fast as possible.

Consumers

- If possible the child should be able to be seen by the driver.
- The stroller should be transportable with extra luggage, a bag of groceries for example.
- The connection should simple and give a safe feeling for the user

6.3.1 Ergonomics

The product should be usable by almost every parent even grandparents. Nevertheless the product only focuses on people who are able of riding a bike. Therefor human measurements were used from Dined using the p5 and p95 of male and female between 20 and 60 years old.

Small or large measurements were used, depending on this situation what end is determining. For example, when tilting the stroller the P95 is of great importance because people will have to be able to lower the handle far enough down which will take more effort for P95 compared to P5. An overview of the used data is given in figure 32 All standing measurements are needed for loading the stroller, the sitting ones for riding the bike.

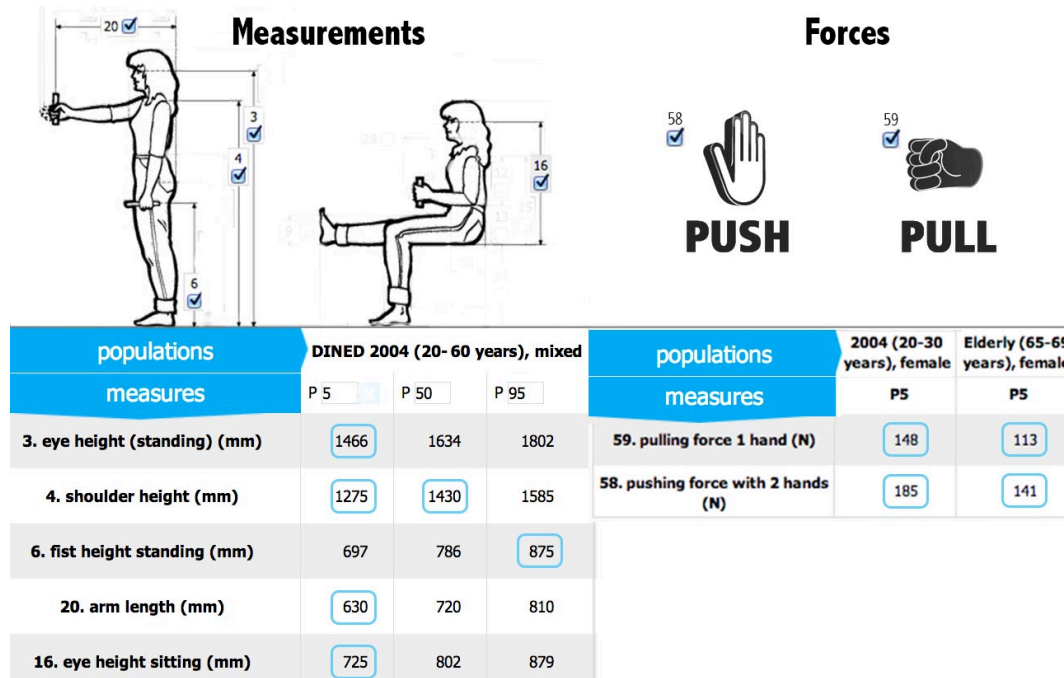


Figure 32: Ergonomic measurements

6.3.2 View

Especially in traffic, it is important that the parent maintains vision on the dangers and maneuverability of the bike and road. Vision on the child wasn't required but a wish of the parents. To ensure the child is safe his feet and hands should be visible when they are protruding, creating dangerous situations.

As requirement when looking straight forward, the stroller or bike should not block the vertical field of view. Required limit: normal sight field, meaning 15 degrees downward. Wished limit: field of color discrimination, meaning 30 degrees downward (See appendix XIX).

6.4. Priority list decision-making

During the following phase some decisions will be made, how the design will work and how it will look. These decisions will be made based on certain weighed qualities. Besides that the idea should be feasible (a must) the qualities had their own order of importance: Safety, Simplicity in use (forces), Simplicity in use (maneuvers), Simplicity in use (intuition), Simplicity of the product, Overall appearance, Aesthetics (fitting with the Upp), Aesthetics (fitting with the bike) and Green Production. They are based on the problem definition and the values of *Greentom*

This order is not always the same for every situation, during several actions the order importance changes. Figure 33 shows the importance of each quality for these situations.

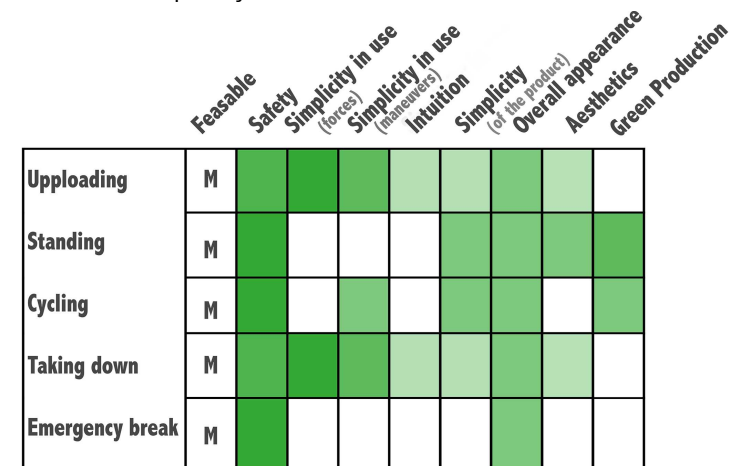


Figure 33: Priority diagram

7. Product development

At this stage the product direction is clear. This chapter is going to elaborate the design further. There are certain challenges that need to be overcome to prove the design will work and will be feasible. Because of this the project doesn't aim on creating a complete finished design. There will always remain some open matters in the end. This paragraph describes which goals will be met and the ones left open.

7.1. Challenges

The challenge of a Design for Interaction project always focus on the interaction of the user and tries to optimize this in every perspective. Therefor the interaction with the user will be the leading input for showing that it is possible to start a life cycle with this product.

The stroller should be loadable by a P5 woman, including pregnant women. A P5 woman with age of 20-30 year has pulling force of 148N with one hand, considering that sometimes even grandparents would like to take their grandchildren on the bike this number drops to 113N (see chapter 6.4.1). The total weight of a fully loaded stroller is 27,3kg (7,3Kg stroller + 15Kg 3 year old P95 child + 5Kg luggage). So it is impossible to lift a fully loaded stroller for the grandparent and the P5 women (20-30 year).

That is why the main goal of this project will be developing an effective ergonomic lifting mechanism.

Besides the importance of ergonomic lifting the stroller, the safety aspect for the child should be well designed. Therefor the locking mechanism should hold the stroller even in a scenario of an emergency break. That is why the product should be able to absorb forces from any direction. Eventually the end user must have a safe feeling about the connection. Beside safe it must be simple to lock, whereby the locking mechanism must be infallible.

Besides a safe and simple locking mechanism, the scenario of a (strong) parent wanting to lift the stroller quickly from the bike should be considered. This means the design should intergrade a quick snap connection. Even visa versa should be possible, allowing a parent to upload the stroller by lifting without using the lifting mechanism.

The product development will focus on:

- User interaction maneuvers
- User force calculations
- Uploading mechanism
- Locking mechanism
- Quick snap option

The product development will give a global overview on:

- Absorbing forces
- Production
- Price calculation, business plan

The product development will not elaborate:

- Strength calculations
- Spring calculations
- Friction

7.2. Context mapping

The goal of the context mapping session was to find the best combination of personas, environment and scenario for every product. The context mapping also contributed to the list of requirements.

Personas

The personas were created based on the life analysis to some average families and some variations on that. The families got a second card as well; this card showed them three years later. The effect of the second card was most of the time that they needed a different product.

Environment

There were three type of environments available, one family living in the big city Amsterdam, one in an average city Delft and one in a village.

Scenario

The scenarios were normal day jobs, like going to the groceries or visiting friends for dinner. They included location (mapped) and time.

Conclusions, product use

The final resulting card is the product type; this showed exactly for what situation which product would serve best.

An example can be found in figure 34. Combinations are almost endless but all cards can be found in appendix XX.



Figure 34: Context mapping

7.3 Upload mechanism

The add-on of the easy lifting model should contain an upload mechanism. This mechanism helps the user lift and connect the stroller with the bike, in a simple movement.

While the Basic-version will surely lift the stroller from the side, since there is only one way to lift a fully loaded stroller, see figure 35. This will be done with one hand on the bumper bar and the other balancing the stroller at the handle bar. The easy lifting model could be lifted with different approaches depending on the to be designed mechanism. Therefor the approach of the stroller should be considered pertaining to the bike.



Figure 35: Uploading the Basic version

7.3.1 Combining, morphological chart

After the approach the stroller will be placed on the bike via the following steps: lift, position, connect/hold and lock the stroller. In a brainstorm with de Fietsfabriek, which included the Triz matrix technique²⁴, all-possible mechanisms of each step were placed in a morphological chart, see picture 36 (sketches can be found in appendix XXI). After this the best combination was selected.

²⁴ <http://www.triz40.com/>



Product approach



Upload system



Positioning



Holding



Locking system

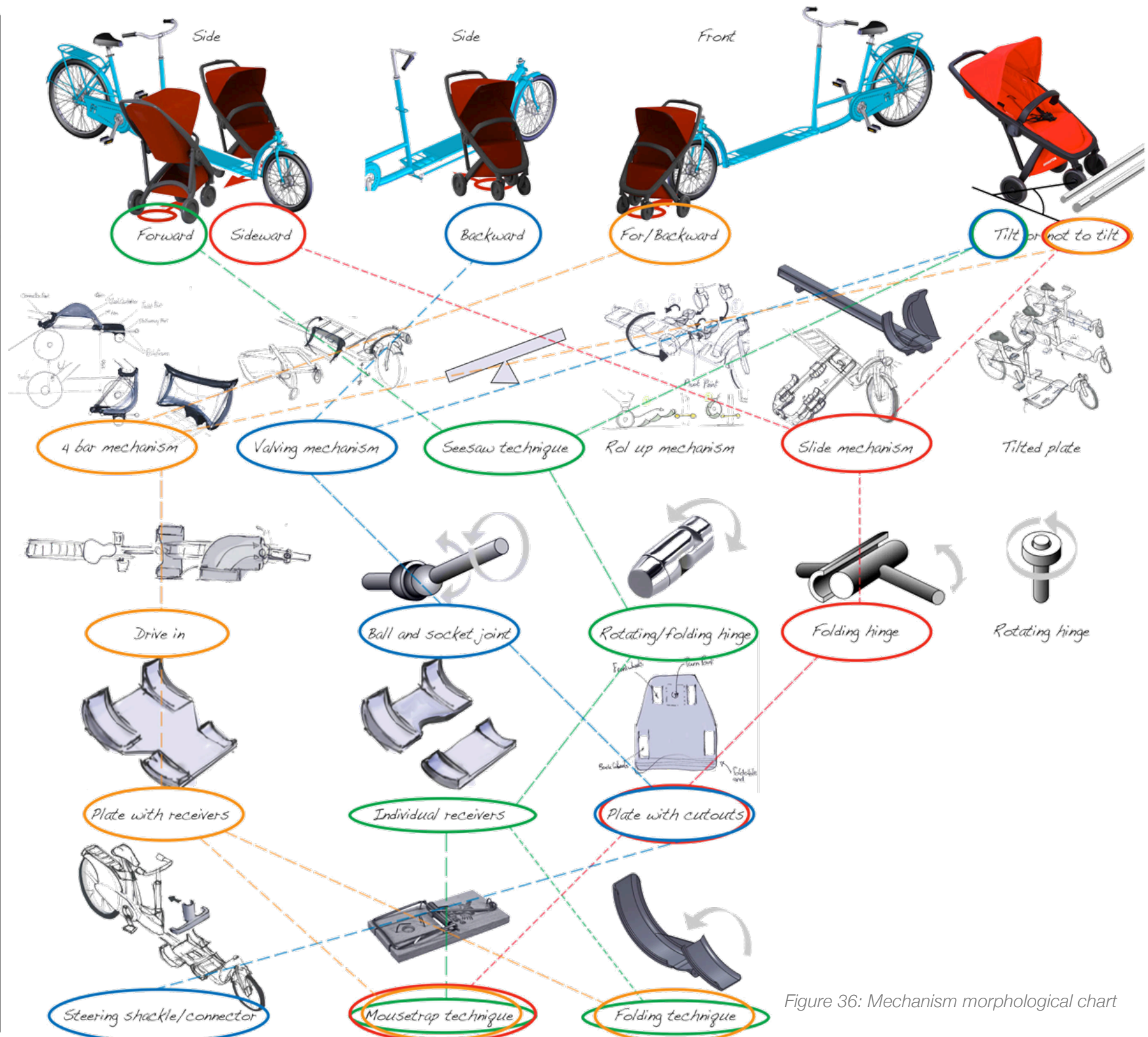


Figure 36: Mechanism morphological chart

7.3.2 Chosen combination

All lines were developed starting from with a different approach and followed the most logic path for that option.

Even though all possible approaches were considered the most obvious version came out best. The stroller approaches the bike from the side in a forward position and ends sideways frontwards on the bike (see figure 37). This approach is most logic since considering the length of the bike.



Figure 37: Uploading easy lifting model

The lines that were considered not sufficient enough:

- Side – Sideward (red line), would add to much friction trying to roll the stroller sideward.
- Side – Backwards (blue line), would require the user to bent over the bike into an uncomfortable position.
- Front – Backwards or frontwards (yellow line), would require to lift the stroller up higher then necessarily.

Further more tilting the stroller is an easy and common maneuver stroller user. Even larger (P95) parents can tilt the front of the stroller almost 20cm ergonomically.

A seesaw lifting system would be the best assisting version; since such a design allows the user to simple roll the stroller upward

and after passing the tipping point the mechanism will almost lift the stroller by itself.

After lifting the stroller needs to be positioned and turned. Therefor a rotating/folding hinge (folding for the seesaw effect) seems best. A ball and socket joint would have the same effect. But by separating these two movements, the stroller will probably become more stable and the user will be more assisted in the placement of the stroller. This assumption will be tested with a prototype in chapter 7.4.

When the stroller is in place it needs to be connected and supported by the frame. Since the turning part is also part of the connection to the stroller, it was chosen to use individual receivers. This option allows the front part to be connected and still be able to turn.

The front wheels will roll up a plate and flip after the tipping point. At first the back wheels were considered to be the only option for support the rear of the stroller. Yet the plate is able to connect to the inner side of the frame.

The locking of the stroller should preferably work automatically. There were several options considered, as can be seen in chapter 7.3.5.

7.3.3 Lifting mechanism

The initial idea of the lifting mechanism consists of three main parts (see figure 38). The Flip board functions as the seesaw of the system for lifting and tilting the stroller. Then there is a turn/twist part, which acts as the name tells it. Finally the connector part makes the connection to the bike.

With this mechanism the user is able to lift and position the stroller in one flow of 5 simple steps (see figure 39). For every step a calculation was done to see what force is required from the user. For these calculations a full stroller was considered using a 3-year-old child (P90 15kg), luggage (5kg, *Greentom's* value) and the stroller (7,3kg). The most intensive step is rolling the stroller upward the flip board. The resulting force necessarily was 151N. In comparison a P51 female is able push 218N with two hands.

This shows that this system is usable for the target group of *Greentom's* stroller. All calculations can be found in appendix XXII.

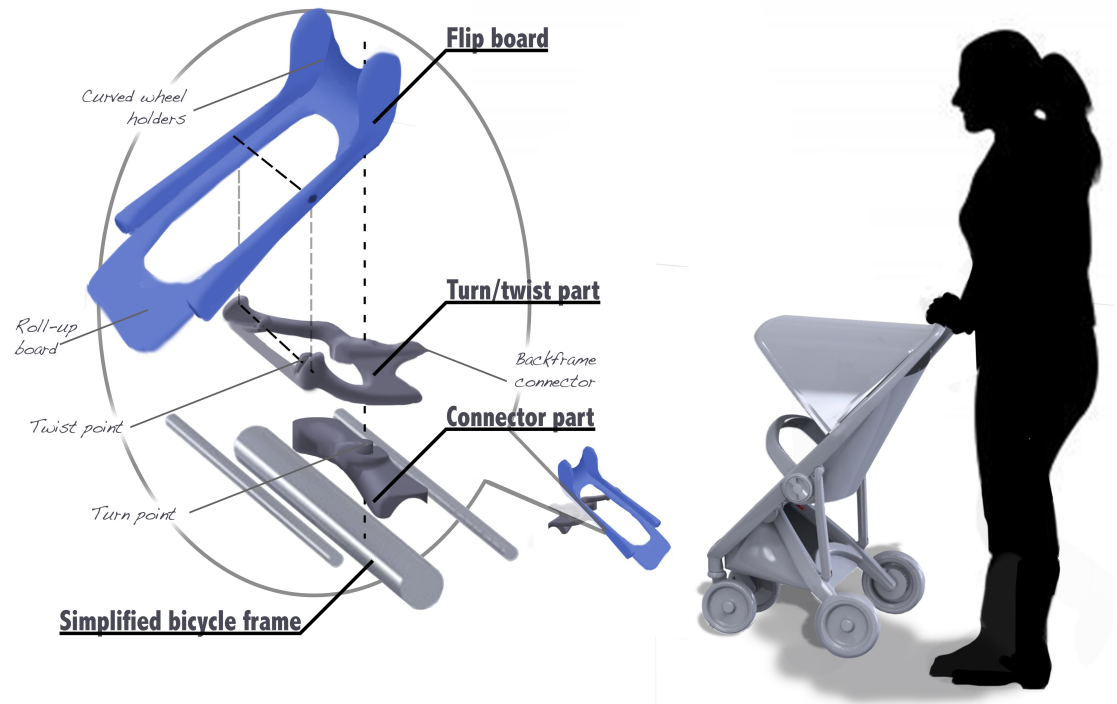


Figure 38: Lifting mechanism

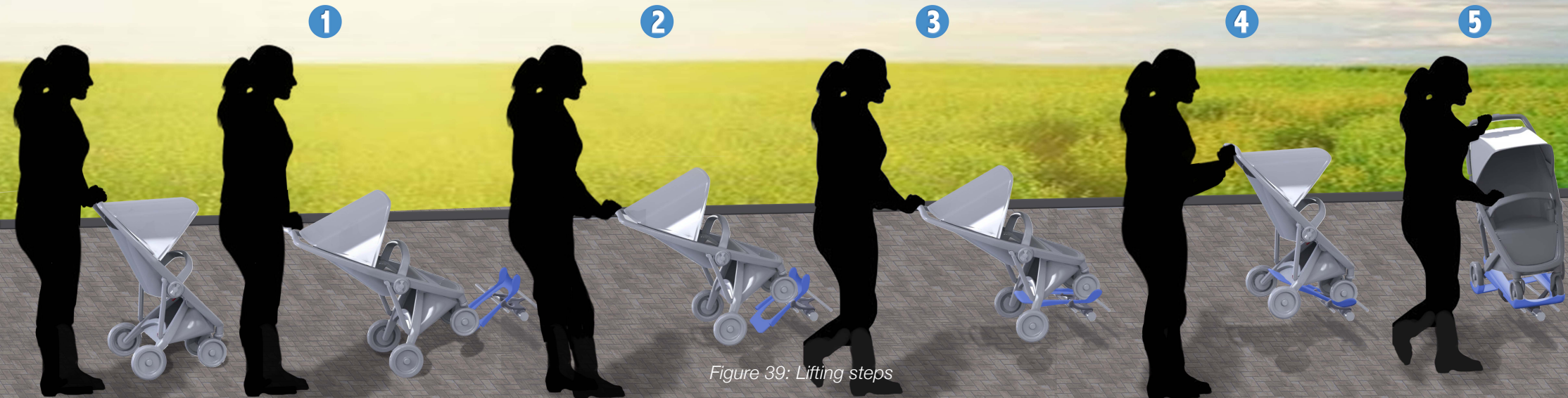


Figure 39: Lifting steps

Turning

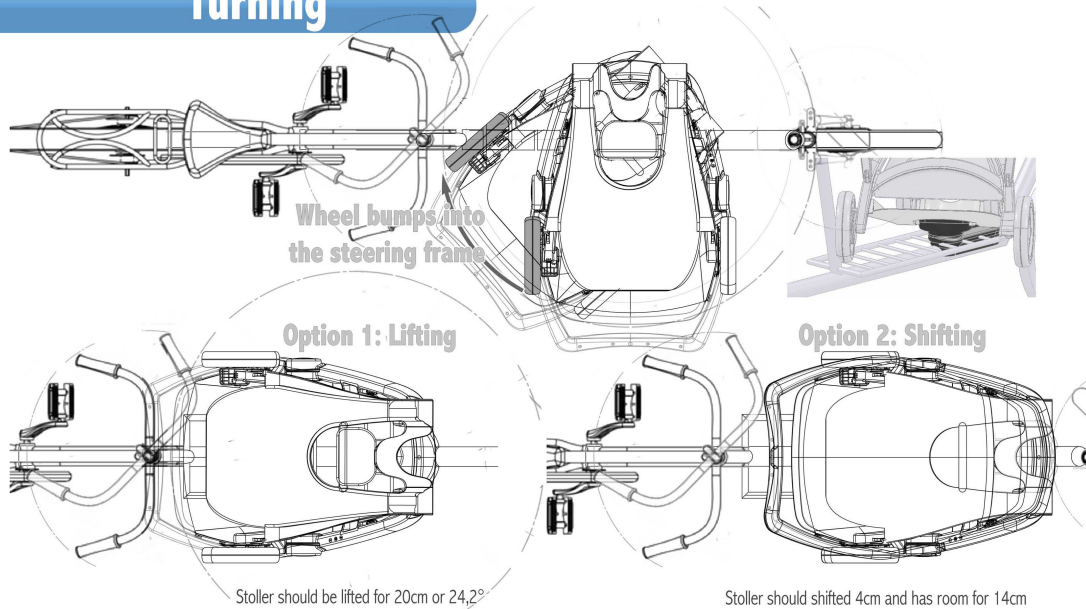


Figure 40: Turning

Turning and shifting

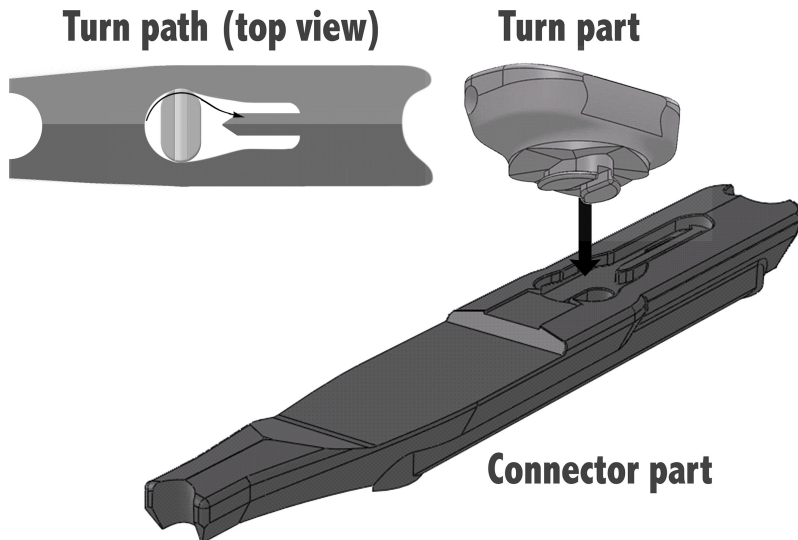


Figure 41: Turning and shifting

7.3.4 Turn and sliding mechanism

Turning of the stroller proved to be not as easy assumed. At a certain point the stroller interferes with the steering tube (see appendix XVIII for the cargo bike details). Therefore the stroller either needed to be lifted or shifted.

Both solutions could help the wheel just get passed the axis. Only the lifting option had to be lifted for 20cm or 24,2°, see figure 40. Therefore shifting 4cm seemed a better option. To make most use of the backside the stroller is now shifted 14cm. This way the front of the stroller overhangs the frontal tube of the bike. This even gives an opportunity to make a connection between the front tube and the flip board. This will immensely improve the balance of the stroller because the connection is not in the same bottom surface but gives a higher connection.

The connector part should therefore allow the turn/twist part to shift. The connector part was designed, inspired by a keyhole idea, using a smaller slide ending in a round turn point for the turn part. The bother of the turn point got a rounded rectangle to follow this path. The turn path can be seen in figure 41.

The connector part was created with a slope on both topsides. The turn part contains the same slope but negative in four corners. This helps the user position the stroller. In fact, the two parts can now be placed in four positions relative to each other.

Finally the turn part has two round wings at the bottom. This prevents the turn part from falling out of the connector part and balances the turn part during the lifting of the stroller.

Appendix XXIII shows how this part was developed step by step for further information.

7.3.5 Locking system

With the Stroller's front wheels placed on the flip board, the stroller can be prevented from slipping forward by using a curved edge. Therefore only a lock has to be made on the back of the stroller preventing the stroller from tilting forward in an emergency break for example.

In the morphological chart, chapter 7.3.1, there was shown the locking system would be based on a mousetrap and a folding technique. The principles of the locking system were developed in co-operation with Greentom.

Three possible locking mechanisms, see figure 42, were able to lock the stroller at the back. First the Rear wheel lock; this version needs the back wheel support and locks the stroller by overlapping the back wheels. This could lock automatically by creating an edge, which is being pushed down when the wheel pops in. Releasing the stroller could be done with a kick against the top.

Secondly the Inner wheel lock, which locks the stroller by hooking into the inside of the wheel. This could also be done automatically with a cornered edge, which tips and locks when the wheel pops in. This version would also require a back wheel support.

At last the Loop lock; the user is able to push a loop over the backside of the frame. This version could be done without back wheel support.

Figure 42: Possible locking systems



Chosen version

The loop lock seemed the most stable connection since it could create a triangle in the three connection points (front wheels, back wheels, and back frame). However at first it didn't seem possible to be mechanized. But when making the loop part of the flip board it can be locked using a Four-bar linkage. This linkage locks the stroller when it is being tipped over at the turn point of the flip board.

While the other systems could fail and accidentally unleash the stroller the loop lock with four-bar linkage is only able to be unlocked by first turning the stroller, or pulling back the lock when wanting a quick release.

By removing the back wheel support the bike becomes smaller when not being used by a stroller. Nevertheless the stroller needs to be stable and not able to fall backward. So a U-bar should be added beneath the flipboard, which hooks into the connector part. In case of an emergency break the U-bar prevents the flipboard from tilting forward, see figure 43.

The stability of this design should be tested with a prototype.

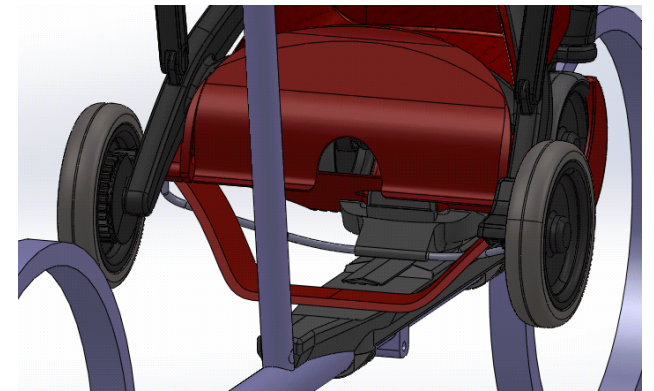


Figure 43: Rear view of the locked stroller

7.4 Prototyping

After many brainstorm changes and predictions, the prototyping phase started. Because the interaction with the user is leading in this, the goal of the prototype was testing if the required maneuvers were feasible. The prototype gave a good impression how the real model is going to work. Yet the difficulty of the model required making some simplifications.



Figure 44: Prototype

7.4.1 Simplifications

The main difference between the design and the model is found in the strength of the model. Even while testing the bottom of the (3d printed) turn part broke off. The repaired model could only be tested with an empty stroller.

The addition of the connection to the front tube of the bike would have been too time-consuming to build. Therefore an improvised round wooden block replaced this part. This part had no influence on the goal of testing the needed maneuvers.

Some bike parts, like the bike stand, were improvised since de Fietsfabriek only provided a bike frame. Luckily the bike was just stable enough for testing. Yet it was impossible to ride the bike, however stepping wasn't excluded.

Furthermore in the model the stroller is a little bit tilted backwards. Therefore the steering space was a little bit smaller.

In appearance the add-on prototype doesn't look similar to the design. This is not a problem because the prototype was meant to test the maneuverability of the stroller. See figure 44 and appendix XXIV for more pictures of the model.

Because of these simplifications some features of the product won't be resembled in the real version as wanted. These features were evaluated with the set expectations, see figure 45.

Resemblance	Veracious		Quality	
Uploading	5		2	
Turning	3		1	
Shifting	1		1	
Unloading	3		1	
Quick - uploading	5		2	
Quick - unloading	5		4	
Safety	3		3	
Stability	3		1	
Stability after change	3		3	
Four bar mechanism	4		5	
Steering space	2		2	
Appearance	3		4	

Figure 45: Resemblance

7.4.2 Adjustments

Before testing it was clear that a back wheel support was needed to keep the stroller balanced when turning around a corner. While the stroller felt well connected in length direction, it lacked in balance toward the sides. By adding support to the back wheel this balance was found. This support only thwarts with the stroller when it's being uploaded (solvable by turning the stroller a bit further). Therefore in the test a helping hand will be used sometimes because of these limitations.

7.5 User test

The original plan for the user test had to be adjusted because the product needed assessment during the test. One of the participants earlier used during the ViP test was interested in helping for this test.

7.5.1 Research goal

The main research goal was to find out if the easy lifting version allows the user easily to mount the stroller without any help. Other goals were to test if the maneuvers were logical and feasible. Therefore the participant was only told that he had to place the stroller on the bike. The add-on was placed in its locked position.

The participant tested four other tasks:

- Offloading the stroller by using the add-on
- Quick release (offloading, by the basic method)
- Quick upload (uploading, by the basic method)
- "Riding" the bike with stroller (driving was impossible so only the vision and balance was tested in a static version)

7.5.2 Participant

As explained above a participant from the ViP test was asked to help out with the test. He (32, father of two children 1 and 3 years old) was able to lift a fully loaded stroller but for the test an empty stroller was used (for preventing damage to the model).

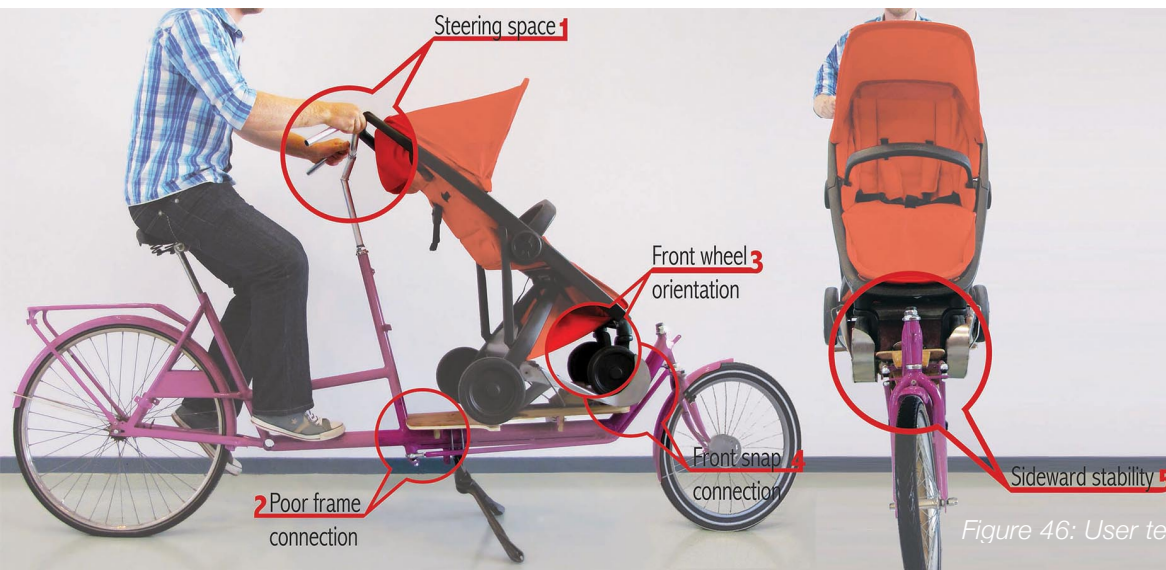


Figure 46: User testing / problems

7.5.3 Results

During the test the participant was unable to upload the stroller without any help. Some of the problems were foreseen as result of the simplifications, other problems were new. In total ten problems (numbered in figure 46) were found. Some were easily solved and were only a problem in the model; others gave great feedback to the design. The most important result was: the mechanism, design for assisting by separating the two hinges, only limits the users maneuverability. The ball-and-socket joint combination as stated in chapter 7.3.1 will allow the user more freedom. For that same reason the turn part should also be separated from the slide system. These and the other problems are displayed in table of figure 47.

Model		Real	
Problem	Cause	Problem	Solution
1 Steering Space	Tilted stroller	no	
2 Bad Frame connection	Poor looking	no	
3 Front wheel orientation	For wheel spin	yes	Connection not at wheel but at front frame
4 Front snap connection	No snap	no	
5 Sideward balance	No support	yes	Placing backwheel support halfway the end of the wheel
6 Side supports thwarts	When uploading the stroller	yes	Placing backwheel support halfway the end of the wheel
7 Upload stability	Loose turn part	yes	Separate turn system and slide separate system
8 Upload slope	Too oblique	yes	Increase slope (also closes off the luggage hatch + safer)
9 Pivot point	Guiding the turn part leads to limitation	yes	Separate turn system and slide separate system
10 Shift friction	Metal U-bar instead makes to much friction over the wood	yes	Other slide or turn system and plastic flipboard with plastic U-bar should require less force (in the model it was solved with grease).

Figure 47: Results



Figure 48: User testing

8. Second product development

The first design and the prototype gave great insight and showed what points should be improved. This chapter shows the development towards the final design. Between the first and final design there were 2 more designs made, each with their flaws but also the good qualities and usable for different scenario's

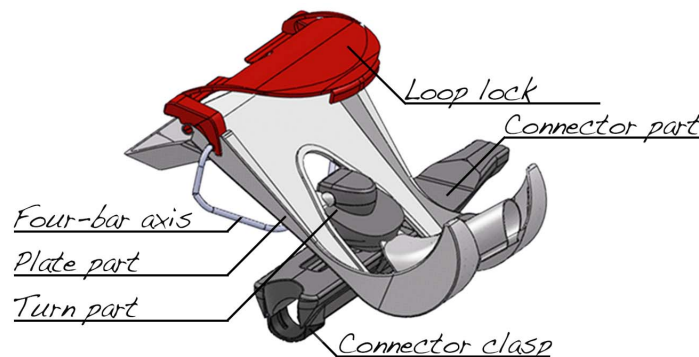


Figure 49: First design

8.1. Deluxe-version

The prototype showed problems with the front wheel and positioning when shifting forward. The Deluxe-version is the improved design, which solves these problems.

The main difference lies in the rotation system. In the model showed separating the turn and lift movement with two hinges would limit the movement instead of guiding the stroller.

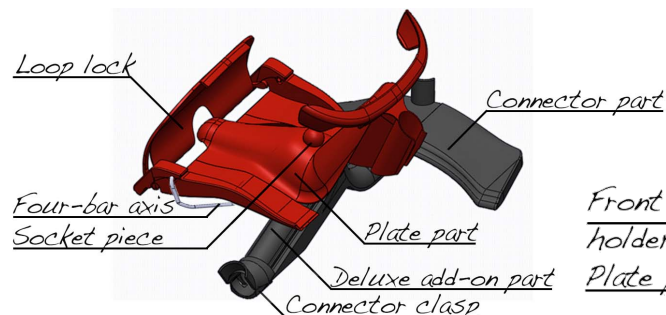


Figure 50: Deluxe-version

Therefore the Deluxe-version has only one ball joint connection for more freedom of movement.

Furthermore this version lowers the stroller while shifting forward. The plate part, which holds the stroller, shifts as a socket over the connector part at the bike frame. This can be done creating a top point on the connector part (5cm higher) and diagonally shifting the plate part. Besides from the easy guiding the function of lowering the stroller is a much more stronger connection to the bike frame. Plus the view of the parent is improved.

Last the Deluxe-version got a rear wheel support from the connector part, the prototype showed this was necessary.

The Deluxe-version only fits the larger version of the cargo bike from de Fietsfabriek

Locking

The Deluxe-version works like the first design with a seesaw lifting technique. Therefore the loop lock with four-bar-linkage will still work perfectly.

8.2. Basic-version

As stated earlier in chapter 6.1.3 the first design was meant for parents unable to lift the stroller. However, some parents will only be irritated with such assistance. These are the parents strong enough to lift their child and stroller together or the child steps in after the stroller is placed. Therefore a Basic-version was made. This version doesn't support the lifting of the stroller and receives the stroller in a vertical movement. This version is able to fit into the shorter and longer version of the cargo bike from de Fietsfabriek.

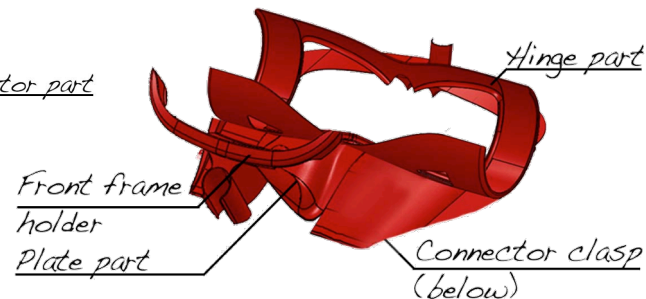


Figure 51: Basic-version

Locking

Because the stroller comes in from above the locking mechanism can be made simpler with a wheel lock.

8.3. One-way-turn-version

The final design is a new and simplified approach. By changing the turn point of the plate from the middle toward the front (next to the front tube of the bike) the stroller can be mounted in one simple turn. The disadvantage of this turn point is that it must choose a side and therefor can only turn one way.

Nevertheless the point can be made on both sides and by switching turn parts the user is able to choose the preferred side. The model itself has two turn parts assembled, whereof always one must be placed upward into a clamp (see detailed pictures in appendix XXV). This version combines the best techniques developed from the earlier models, see figure 53 The Deluxe-version only fit the larger version of the cargo bike from *de Fietsfabriek*

Locking

Because the plate can now reach the ground it is simpler to use a roll up technique. This is similar to the locking of the Basic-version, but will flip while rolling up instead of moving down. Since the front wheels are more on the inside of the stroller they drive over the flat piece of the hinge part (see detailed pictures in appendix XXV).

Second when the stroller has been loaded and the parent want to ride away the last thing they do is the refolding of the bike stand, automatically done when cycling away. The extended end of the bike stand ensures that the hinge part is secured.

Because of the closure engages on the top half of the wheel, it cannot

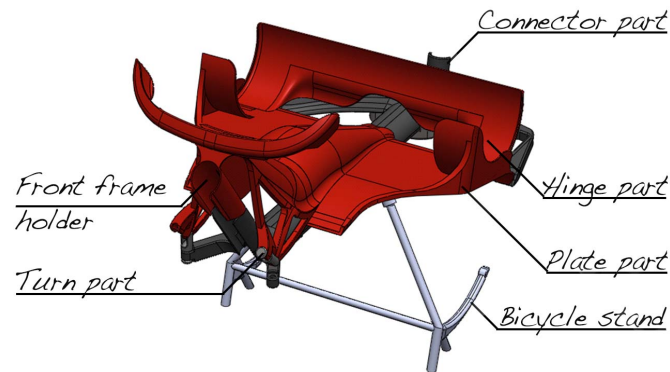


Figure 52: One-way-turn-version

come loose when, for example the baby carriage starts tilting. In this way there is no vertical force upon the stand. This is needed to unlock it and can simply be done with placing the foot on the rear section of of to bike stand (see detailed pictures in appendix XXV).

This locking type also allows parents to upload the stroller via the basic maneuvers, the quick snap release or upload method. All they need to do is to put down the bike stand (if not done yet) and pull back the hinge part.

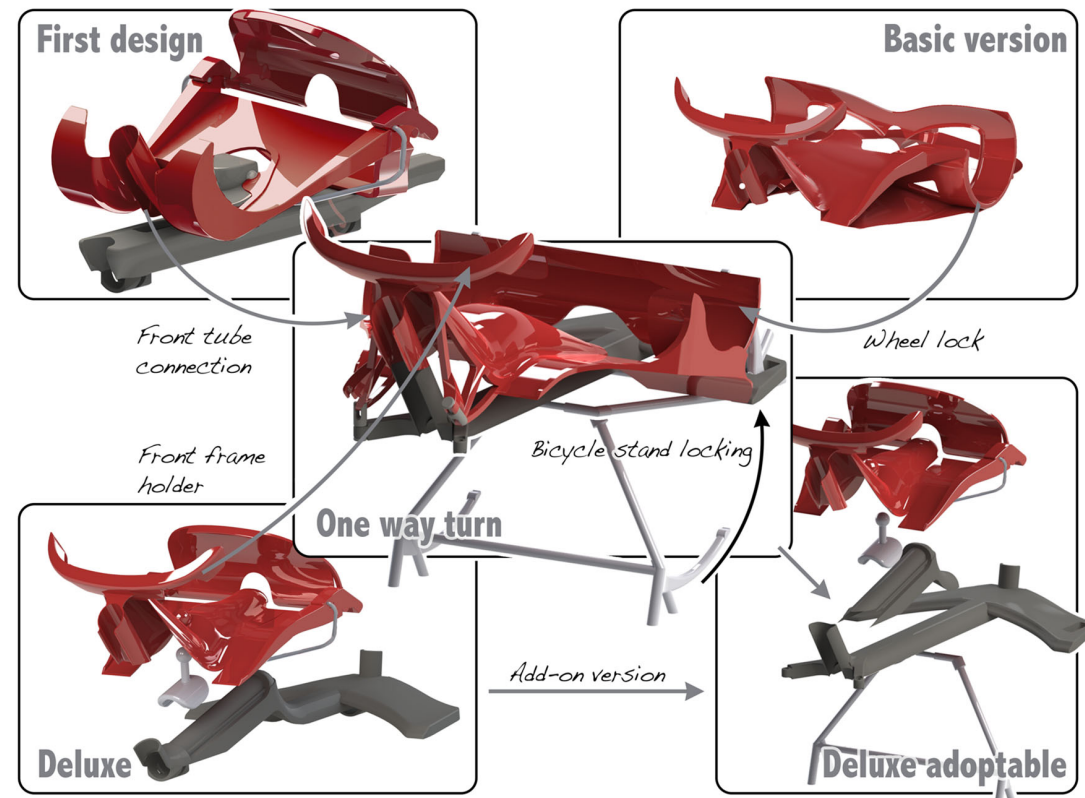


Figure 53: One-way-turn-version development

8.4. Deluxe-adaptable-version

With a slight adjustment on the connector part the One-way-turn-version can be turned into the Deluxe-version. This is useful for example when the child gets too heavy to lift and the parents still want to use the lifting function.

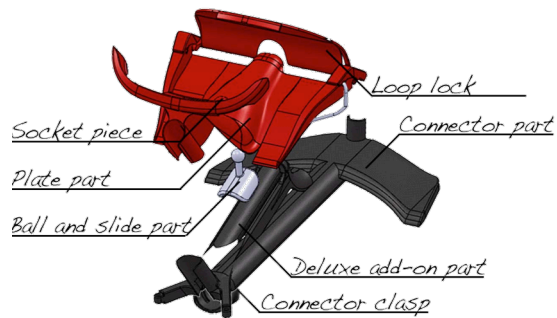


Figure 54: Deluxe-version add-on

8.5. Evaluation

All five designs will still have their pros and cons as seen in figure 55. Unfortunately they cannot be tested as a prototype and should be evaluated on the expectations of the design. This is done in collaboration with the coaches of this project. As result the total score of the four latest designs did not differ that much from each other. Yet a large difference can be found within the evaluated factors, based on chapter 6.4. Only the appearance factor was left out because the products don't differ enough in appearance.

The most simplistic product is the Basic-version and scores best on intuition as well. Yet as stated earlier this product will not be able to be used by everybody. P22,1 females (between 20-30 years) or below aren't strong enough. All other versions can be lifted by at least a P5 female (between 20-30 years). Calculations of the force limits can be found in appendix XXVI.

The Deluxe-version should be tested with a model to determine how helpful it will be. It is expected this version guides the consumer the best with uploading and locking. Further more this version seems the safest version but this should be tested as well.

The One-way-turn-version is a lot simpler than the Deluxe-version while still helping the consumer with lifting the stroller in comparison with the Basic-version. This One-way-turn-version exceeds the others in maneuvers, because it can be mounted in one simple turning movement.

In consultation with Greentom it was decided that the One-way-turn-version is the best version for the general target group. The Basic-version can be used to fit the smaller cargo bike and eventually grow into the One-way-turn-version. If needed an add-on can be developed to be placed on the One-way-turn-version for upgrading it into a Deluxe-version. Yet the added value of this version should first be tested with a model.

Summary	Number of parts	Maneuvers		Forces		Locking	
		Uploading type	Second movement	Maximum	During the turn	Mechanism	Front holder
First-design	9	Seesaw	Slide forward	151 N	120 N	Four-bar-system	Wheel
Deluxe-version	9	Seesaw	Slide downward	151 N	120 N	Four-bar-system	Front frame
Basic-version	4	Human lifting	-	273 N	-	Wheel lock	Front frame
One-way-turn	8	Turning	-	140 N	140 N	Wheel lock with bicycle stand lock	Front frame
Deluxe-adaptable	10	Seesaw	Slide downward	151 N	120 N	Four-bar-system	Front frame

Evaluation	Safety		Forces		Maneuvers		Intuition		Product simplicity		Total score
First-design	2		3		1		2		1		9
Deluxe-version	5		5		3		3		3		19
Basic-version	3		1		4		5		5		18
One-way-turn	3		4		5		4		4		20
Deluxe-adaptable	4		5		3		3		2		17

Figure 55: Summary and evaluation

8.6. Ergonomics

With the One-way-turn as final design, the position of the Upp on the bike has been made clear. All ergonomics while cycling can now be determined. These results can be seen in figure 56.

As driver two models were inserted: the P5 and P50 20-60 year mixed. The P50 is shown for the vision of an average person and the P5 to show the bottom limit.

As requirement was set at least the visual limit. With an unfolded hood the P5 can only see 14° downward. However it can be assumed that the smallest persons would do everything to optimize their vision and therefor always fold the hood, giving them a 20° vision. The average person has no problem with this requirement and almost has an unblocked view of the entire color discrimination field (27° of the 30° visible, stated as wish in chapter 6.3.2).

For the child a model of a P95 boy was used to see how far he could reach and if this would create a dangerous situation. Assumed is that he is shifted forward in the stroller because of loose straps. As can be seen it's impossible for the child to reach the front wheel neither with hand nor feet. Furthermore when the child would stick out his arm the driver (P5) is able to see it. Even when the hood is folded up the driver (P5) is able to see the child when he is (dangerously) hanging forward. When the child is sitting backward he is difficult to be seen because of the handlebar and the fabric (this was a wish (improvement) of the consumer).

It was also stated that the stroller could interfere with the steering space. The driver is able to make a turn of 75° what can be seen as uncommon maneuver.

Last there it was preferred to be able to bring extra luggage. In this version the parent has beside the cargo of the Upp the option to store a standard groceries bag behind the stroller.

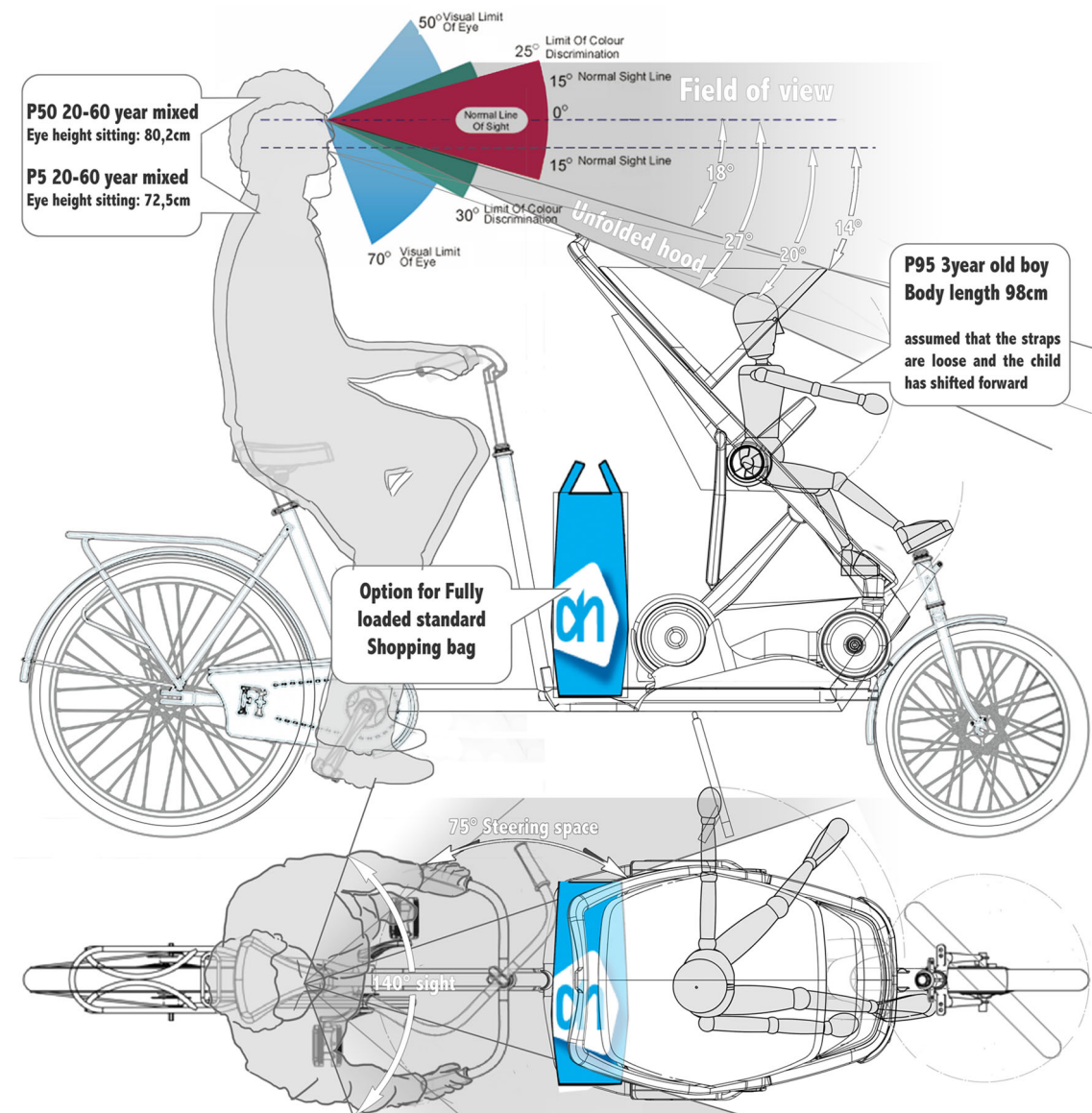


Figure 56: Bike mounted with Upp and users

8.7. Production

The plate part has a complicated form. Injection molding would be a logic choice for such a part because of the high amount of details. Yet the releasing of the mold might be difficult. To simplify this form inserts could be used during the injection. Because of intense forces upon the turn part connection this would be necessary anyway. That way the inserts can be made from steel preventing it from breaking. If one insert would contain both sides of the turn part connection, the plate also increases in its stability (preventing the plate part from bending when being loaded). The front tube connection and frame connection could even be produced separately and be attached to the insert afterward. This would simplify the mold as well.

The turn part might look simple; yet it either should be made from two elements or contain a less stronger snap connection. This makes it attachable to the connector part. This part needs to withstand great forces, therefore a steel material probably will be required. Yet the back wheels of the stroller are mounted on a plastic (PP) axis with a diameter of 20mm. Since the stroller should be able to ride on its back wheels alone, a bit larger axis would be strong enough since the load is no different. This should be calculated in a further stage.

The hinge part will just like the plate part be injection molded. It can easily be attached with snap connections to the plate part (no axis needed). The snap connection can simple be included in the mold of the hinge part.

The connector part could be made by extruding a base profile and connecting an injection molded front and injection molded back to it. The front part should contain the two connection points for the turn parts. It probably needs to be made stronger than visualized. This should be calculated in a further stage. Just like the stability of the wings at the rear part. The connector part can simple be injection modeled with ribs on the inside.

The connector clasps are the simplest parts. They can be attached by using snapping parts. The purpose of these parts is simple keeping the connector part in place. The rear connector clasp could be made slightly larger for giving support to the wings of the connector part.

The bike stand should be connected to the frame of the bike and be made from the same steel as the frame. While Greentom can make all the other parts it is best that this part would be made by de Fietsfabriek since

they are best capable of creating their stand. The extended end of the bike stand could also be made as clickable add-on. When it would break of it can easily be replaced by a new part.



Figure 57: Parts and production

9. Business plan

9.1. The customer

The main consumers of *Greentom* are environmentally conscious young parents. Their first contact with *Greentom* might be in the store or online. At those points they should be informed about the possibilities of transporting the stroller by bike. Because they probably are more environmentally aware they will probably prefer using the bike to the car. Therefore the product will be more appealing to them compared to other companies' strollers.

Because this product is new in the market, it will start out as a small niche market; but when successfully it will grow into a mass market eventually.

9.2. Problem

The pricing model of the stroller bike combination is relative high to enter the market. So the target group will be relative small. With only small production numbers this project will hardly get profitable. In that case there will be no future for this combination.

9.3. Solution

To enlarge the target group a lease construction could be introduced when the customer is looking for a stroller. A lease construction offers the customer one or more product(s) or service(s) on a monthly or annual based subscription. This service consists, besides extra warranty, basic maintenance and safety checks, in the upgrades in products and even changes in product types. This makes the lease construction fit for the cycle as described in chapter 6.1. All key partners (bike repairman, stroller shop and bike shop) can include this construction in their product assortment.

9.4. Key partners

For this project to succeed it would be unwise for *Greentom* to start producing cargo bikes. A key partner like *De Fietsfabriek* has the capacity to do this; they see the value of the product and are willing to work with *Greentom*.

Greentom's products are sold via Babypark so there is no need for opening special lease shops.

Local bike repairmen will complete the service. These repairmen can foresee in all the necessary parts for upgrading the product. The returned parts can be sent back either to *Greentom* or *de Fietsfabriek*. In return the consumer receives a discount on the chosen follow up product. This bike repairman is also the partner to deliver the regular maintenance.

9.5. Product Life cycle

For recycling the product *Greentom* can choose from several options by remanufacturing or refurbishing (done by a Third party). *Greentom* wants to keep the cycle in their own hands. Therefore they will choose for remanufacturing. They always offer the new consumer a warranty. There are three options to do so. The cheapest one is with a simple check and a couple of replacements. The second one is offering as good as new product features, meaning checking everything and replace most elements that are of influence on the product features. The third one is offering complete new product features. The consumer is assured that everything with the slightest scratch on it has been replaced and the product is truly new.

Obviously these three options will have different economic results.

Second life cycle

		System	Remanufacturing (initial manufacturer)																
		Offer	New warrenty					As good as new product features					Complete new product features						
			Process		Price			Process		Price			Process		Price				
Product/part	New price		Replacement	edit time	hourly	costs	Replacement	edit time	hourly	costs	Replacement	edit time	hourly	costs					
Wheels	2	Clean	1%	0,02	2	23,5	0,8333	Clean	1%	0,02	2	23,5	0,8333	Clean/replace	50%	1	2	23,5	0,8333
Bearings	0,5	Check/replace	50%	0,25	2	23,5	0,8333	Replace	50%	0,25	2	23,5	0,8333	Replace	100%	0,5	4	23,5	1,6667
Tires	2	Check/replace	33%	0,66	4	23,5	1,6667	Replace	33%	0,66	4	23,5	1,6667	Replace	100%	2	8	23,5	3,3333
Frame	18	Check/replace	10%	1,8	5	23,5	2,0833	Check/replace	10%	1,8	5	23,5	2,0833	Clean/replace	50%	9	6	23,5	2,5
Belts	3	Check/replace	10%	0,3	3	23,5	1,25	Check/replace	10%	0,3	3	23,5	1,25	Clean/replace	50%	1,5	3	23,5	1,25
Plastic shackle	2	Check/replace	50%	1	4	23,5	1,6667	Check/replace	50%	1	4	23,5	1,6667	Replace	100%	2	4	23,5	1,6667
Fabric seating	20	Clean	5%	1	1	23,5	0,4167	Clean/replace	20%	4	1	23,5	0,4167	Clean/replace	50%	10	1	23,5	0,4167
Seating board	1	Replace	100%	1	1	23,5	0,4167	Replace	100%	1	1	23,5	0,4167	Replace	100%	1	1	23,5	0,4167
Fabric basket	2,5	Clean	5%	0,125	2	23,5	0,8333	Clean/replace	20%	0,5	2	23,5	0,8333	Clean/replace	50%	1,25	1	23,5	0,4167
Fabric hood	5	Clean	5%	0,25	3	23,5	1,25	Clean/replace	20%	1	3	23,5	1,25	Clean/replace	50%	2,5	2	23,5	0,8333
Spring mechagnism	2	Check/replace	33%	0,66	4	23,5	1,6667	Check/replace	33%	0,66	4	23,5	1,6667	Replace	100%	2	6	23,5	2,5
Brake system	4	Check/replace	33%	1,32	3	23,5	1,25	Check/replace	33%	1,32	3	23,5	1,25	Replace	100%	4	5	23,5	2,0833
Sub total			8,385		14,167			12,51		14,167			36,75		17,917				
Total			62		22,55166667			26,67666667		54,66666667									

Figure 58: Second life cycle table

The send back ratio of the third option will probably be equal to the send back ratio of a new product. The send back ratio of the first option will be lower than for new products. This is because most returns are made in the first year due to manufacturing faults. Therefor these returns are already filtered out.²⁵

By looking at the costs of these options for recycling the Upp (see figure 58), the best option for *Greentom* would be either offering a new warranty or making the product features as good as new again. The costs for this are low enough for making a larger profit on the second cycle. This will create a second or third cycle even more profitable. See chapter 10.6 End of life, for more information about these cycles.

9.6. Aftersales

The aftersales should be flexible, informative and provoke interactivity. Because the consumer has several options in this product, the sale should be flexible in products but not in number of changes. If the consumer would like to swap after a year, month or even a week or so this should be possible. However, the total number of changes must be limited to prevent abuse of the system. For the consumer this product will be a great investment only worth when using it for a longer period therefor the product delivery and service should be optimal. The consumer and salesmen should always be aware of the product opportunities they can follow in the cycle. In the after sales the reseller should be informed about these options and *Greentom* will keep contact directly with the customer and reseller. This way the customer is always aware of the most valuable options. Indirectly a customer is able to contact resellers who will redirect them toward *Greentom* if necessary.

²⁵ Den Hollander, M. Promovendus on 'Products that last'

A third goal in aftersales is an open community. *Greentom* is willing to grow and able to expand to other markets. Therefor an open source platform can be created for the development of new products.

9.7. Pricing

The consumer will only be interested in this kind of system if *Greentom* and *de Fietsfabriek* are able to show the consumer that their children can grow up in these closed cycles. This system is able to provide a bike for the first 7 years of a child (or 2) and able to grow into a normal bike (with +2 year warranty). Therefor the lease contract should cover a total of 9 years. The total costs in this period are depicted in figure 59 (2850 euro). The annual subscription costs would then be about 320 euro (2850/9). Using recycled parts would give a 25% discount (about 700 euro's). For example the consumer gains a two-wheel cargo bike and a stroller for this price in the first year.

9.8. Future vision

Greentom and *de Fietsfabriek* should start of with the two-wheel cargo bike version mostly focused on the Netherlands. This allows the customers to follow a basic system; they can grow from the stroller version toward a standard cargo bike.

A large follow up step for *Greentom* might be a universal regular bike trailer. This version can be hooked up behind a regular bike. For this version the help of *de Fietsfabriek* might not be necessary since this design will focus on a general bike.

After that *Greentom* and *de Fietsfabriek* can expend to foreign markets. In other European countries a three-wheel version is preferred (double wheels in front). For Asia a bike three-wheel version with double wheels in the back is more commonly used.

							Consumer				Company		
Cycle step	Product	Supplier	Selling points	SendBack	Reposit point	Refund	Max Return price		Warrenty Price	Production	Profit	Net Profit	
First hand cycle:													
Stroller	Upp	GreenTom	Babypark	-	-	Offers discount on the bucket bike			2 year 250,00	62,00	188,00	94,00	
first model bakfiets	bakfiets	De fietsfabriek	Bicycle reseller	-	-				5 year 1.500,00	800,00	700,00	350,00	
Second child wihtin 3 years	Longer module and bucket	De fietsfabriek	Bicycle repair Shop	Shorter front module, bucket	Bicycle repair Shop	Discounted on the longer module	20% 40,00	2 Year 250,00		200,00	10,00	5,00	
Second child after 3-7 years	Longer module, bucket and Upp	De FF and GT	Bicycle repair Shop	Shorter front module, bucket	Bicycle repair Shop	Discounted on the longer module	20% 40,00	2 Year 500,00		262,00	198,00	99,00	
Only child grows older 3+	Bucket	De fietsfabriek	Order online or BRS	Upp	Babypark	Discounted on the short bucket	20% 50,00	2 Year 75,00		20,00	5,00	2,50	
Both children 3-7 years	Other bucket	De fietsfabriek	Order online or BRS	Upp	Babypark	Discounted on the longer bucket	20% 50,00	2 Year 75,00		20,00	5,00	2,50	
All children 7+	Normal bike model	De fietsfabriek	Bicycle repair Shop	longer or shorter front module,	Bicycle repair Shop	Discounted on the bike module	20% 40,00	2 Year 200,00		100,00	60,00	30,00	
sum							220,00	2.850,00		1.464,00	1.166,00	583,00	
Second hand cycle:									25% discount				
Stroller	Upp	Firs user	RecycleTom Shop	-		Offers discount on the bucket bike			2 year 187,5	50	137,5	€ 91,67	
first model bakfiets	bakfiets	De FF and FU	RecycleTom Shop	-					2 Year 1125	540	585	€ 390,00	
Second child wihtin 3 years	Longer module and bucket	Firs user	RecycleTom Shop	Shorter front module	RecycleTom Shop	Discounted on the longer module	10% 20,00	2 Year 187,5		40	127,5	€ 85,00	
Second child after 3-7 years	Longer module, bucket and Upp	Firs user	RecycleTom Shop	Shorter front module	RecycleTom Shop	Discounted on the longer module	10% 20,00	2 Year 375		40	315	€ 210,00	
Only child grows older 3+	Bucket	Firs user	RecycleTom Shop	Upp	RecycleTom Shop	Discounted on the short bucket	10% 25,00	2 Year 56,25		10	21,25	€ 14,17	
Both children 3-7 years	Other bucket	Firs user	RecycleTom Shop	Upp	RecycleTom Shop	Discounted on the longer bucket	10% 25,00	2 Year 56,25		10	21,25	€ 14,17	
All children 7+	Normal bike model	De fietsfabriek	Bicycle repair Shop	longer or shorter front module	RecycleTom Shop	Discounted on the bike module	10% 20,00	2 Year 150		100	30	€ 20,00	
sum							110,00	2.137,50		790,00	1.237,50	825,00	

Figure 59: Financial table

10. Evaluation and conclusions

While the other project would end with a prototype this project went on beyond. A provisional design was prototyped and not only evaluated but redesigned into two new versions as well. After that even a fourth design was made capturing all elements that were good from the pre-designs. Of course a design is never finished and can always be improved therefor the product and project will be evaluated here. And ending with a self-evaluation.

10.1. Product

Expectations

The One-way-turn is a product that can be developed in the future, using green materials end positioned in a green lifecycle. The lease concept makes it possible to position the products for a large targetgroup. The cooperation with several key partners makes it possible to get the utmost benefit of the market approach.

The interaction of the user with the product will be fully intuitively. The last design provides a simple movement so everybody should be able to handle the products.

The user enthusiasm could provide in an open source platform for new product ideas and developments.

The cooperation between *Greentom* and *de Fietsfabriek* could benefit for both of them.

Potential improvements

Some opportunities are left un-explored. For instance when positioning the stroller, by using the lifting mechanism of the One-way-turn-version, a pin hole connection could be made between the plate and

connector part. This would help the stroller find its position and is able to absorb sideways forces.

The product portfolio must be broadened. This project worked with the original Upp of *Greentom*. This will lead to a future where the consumer has more choice in exchanging products.

What remains undone

Because interaction is the focus for a Dfl project, not all parts were elaborated into detail.

While suggestions were made how to produce the add-on there is still a lot of fieldwork to cover in this area. Just like a lot of calculations about strength and stiffness of the materials.

More tests should be done with a new model based on the final design. The first step should be done testing a front tube connection, because it is unclear how this part will connect, release and holds its grip in between. This should determine the safety of the new used techniques (locking mechanism and product balance) and the usability of the turning mechanism.

10.2. Project

Expectations

The initial project goals were not easy to reach for. The brought up ideas were not that challenging. Nevertheless the project started and had to be adjusted half way for a more realistic goal.

The communication with all stakeholders was hard to arrange. It took a lot of time to get the right players around the table, when needed.

Process

Many design techniques have been used. Only a few of them contributed to the end results.

10.3. Self-evaluation

There is a golden moment to start writing the report. This moment is hard to be found. I spent my last hours in writing before the deadline was there. However, I started writing at the very beginning of the project, for not being to late. There must be a best way in between. I don't know yet where it is, but I will keep on looking for it and will definitely find that moment.

One method to help me in this is making a lot of short notes and arrange the content in a mind map.

A positive thing I experienced was you couldn't start soon enough with prototyping. Especially bad ones deliver the most insight.

Nevertheless a user test might be difficult with a simplified model.

Performing test yourself will never give enough insights, always refer back to your target group.

While sometimes the inspiration is hard to be found it is always there at the end of the project. At those moments a step back might seem as a negative thing; yet these are the steps forward.

Sources

Countless Internet sites, books, graduation reports, folders, magazines and professionals have been consulted during this project. The main sources that could help other people that are interested in the subject or want to know more about something can be found here, categorized by theme. All the websites have been last visited at October 5. 2013.

Stroller companies

Greentom	http://www.greentom.com
4moms	http://www.4moms.com
Bugaboo	http://www.bugaboo.com/overview ,
Easywalker	http://www.easywalker.nl/
Maclaren	http://www.maclarenbaby.com
Mutsy	http://www.mutsy.nl
Orbit baby	http://www.orbitbaby.com/
phil&teds	http://www.philandteds.com
Quinny	http://www.quinny.nl
UPPAbaby	http://www.uppababy.com

Trend watching

Can a playground be Too safe	Tierney, J. 2011, "Can a playground be Too safe?" The New York Times. http://www.nytimes.com/2011/07/19/science/19tierney.html?_r=0
Centraal Bureau voor de Statistiek	http://www.cbs.nl/nl-NL/menu/themas/arbeid-sociale-zekerheid/publicaties/artikelen/archief/2003/2003-1198-wm.htm
Kamerbrief Groene Groei	Kamp, H.G.J. 2013, Kamerbrief Groene Groei: voor een sterke, duurzame economie http://www.rijksoverheid.nl/onderwerpen/duurzame-economie/groene-groei
Phone bloks	Hakkens, D. 2013 http://www.phonebloks.com/
Population and Household Economic Trend Report	"Population and Household Economic Topics". http://www.census.gov/population/www/www.Trendwatching.com

Life development

Centraal Bureau voor de Statistiek	http://www.cbs.nl/nl-NL/menu/themas/bevolking/faq/specifiek/faq-hoeveel-kinderen.htm
Centraal Bureau voor de Statistiek	Demografie van gezinnen, Maarten Alders, 2004
Development Through life	Newman, B.M. and Newman, P.R. 2006. Development Through life: A psychosocial approach 11 th ISBN: 978-1111344665
Parental guide	http://www.parentalguide.org/babystroller.html
Peuter kleuter	http://peuterkleuter.jongegezinnen.nl/Ontwikkeling/Kleuter/Fietsen-zonder-zijwieltjes.htm

Product reviews

De grote kinderkarrentest
Hollandse bakfietsen
Inhabitots
Kassa rollatorrest
Two wheeling tots

Bakker, K. 2003. "De grote kinderkarrentest". *De Vogelvrije Fietser, mei*, pp. 20-24
<http://www.hollandse-bakfietsen.nl/bakfiets-overzicht-kinderleeftijd-en-oplossingen/>
http://www.inhabitots.com/top-strollers-for-green-%20babies/vibe_2_toddlers/?extend=1
<http://kassa.vara.nl/tv/afspeelpagina/fragment/goedkoopste-rollator-wint-kassas-rollatorrest/speel/1/>
<http://www.twowheelingtots.com/bike-trailer-comparisons/>

Design Techniques

Creative Facilitation

Delft Design Guide

General Morphological Analysis
Mindtools
Triz Matrix
ViP Vision in Design

Tassoul, M. 2009 "Creative Facilitation", 3th edition 2009,
ISBN 978-90-6562-200-6
Boeijen, A., Daalhuizen, J. & van der Hoog, W. *Delft Design Guide*. 2010
ISBN: 978-90-5155-066-5
Ritchey, T. (1998). *General Morphological Analysis: A general method for non-quantified modeling*
http://www.mindtools.com/pages/article/newTMC_08.htm
<http://www.triz40.com/>
van Dijk, M. Hekkert, P. 2011. "ViP Vision in Design",
ISBN: 978-90-6369-205-6

Miscellaneous

Cradle to Cradle

Designed for kids
De Fietsfabriek

Dined
Experimental eco-design

How Great leaders inspire action
Mediweb
Mediweb
m-gineering balhoofd
Products that last
Visual impact

Workcycles

Braungart, M., Mxdonough, W. *Cradle to Cradle*. 4th ed. 2004, Amersfoort, Wilco
ISBN 987-90-5594577-1
Richardson P. 2008 "Designed for kids",
www.defietsfabriek.nl
ISBN 987-0-500-51413-9
www.dined.io.tudelft.nl
Brower, C. Mallory, R. Ohlman Z. 2009. *Experimental eco-design* Kerkdriel, librero
ISBN: 978-90-5764-439-9
http://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action.html
<http://www.mediweb.nu/quatro-rollator/>,
<http://www.mediweb.nu/topro-troja/>
<http://www.m-gineering.nl/balhoofd.htm>
Den Hollander, M. Promovendus on 'Products that last'
[http://www.epd.gov.hk/eia/register/report/eiareport/eia_1402007/](http://www.epd.gov.hk/eia/register/report/eiareport/eia_1402007/For%20HTML%20version/Section10.htm)
<http://www.workcycles.nl/>

Definitions

Bio-based

Products that are commercial or industrial products (other than food or feed) that are composed in whole or in significant part of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials.²⁶

Clustering

Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar (in some sense or another) to each other than to those in other groups (clusters).²⁷

Cradle to cradle

Holistic economic, industrial and social framework that seeks to create systems that are not only efficient but also essentially waste free.²⁸

Green products

Products that have less impact on the environment or less detrimental to human health than traditional equivalents. Green products might, be (part-) formed from recycled components, be manufactured in a more energy- conservative way or be supplied to the market with less packaging (or all three).²⁹

Harris profile

Graphic representation of the strengths and weaknesses of design concepts.³⁰

Headset

Set of components on a bicycle that provides a rotatable interface between the bicycle fork and the head tube of the bicycle frame itself.³¹

Innovation

Change (ref. Buijs, 1986) of which the consequences are not readily foreseeable. A change having a more profound effect on a system than a change involving “more of the same”. In other words changes at the level of norms, values, beliefs, behavior and self image of those involved. The consequences that are least predictable are those of a social nature, the interactions between people and the relations of humans with their products.³²

Module/Part/Product

A part is a single piece of a product assembly; a module is an assembly of a few parts. All modules together make a complete product.

Morphological chart

Morphological Analysis or General Morphological Analysis is a method developed by Fritz Zwicky (1967, 1969) for exploring all the possible solutions to a multi-dimensional, non-quantified complex problem.³³

Persona

In marketing and user-centered design, personas are fictional characters created to represent the different user types within a targeted demographic, attitude and/or behavior set that might use a site, brand or product in a similar way.³⁴

²⁶ Braungart, M., Mxdonough, W. *Cradle to Cradle*. 4th ed. 2004, Amersfoort, Wilco ISBN 987-90-5594577-1

²⁷ http://en.wikipedia.org/w/index.php?title=Cluster_analysis

²⁸ http://www.biopreferred.gov/Biobased_Products.aspx

²⁹ <http://www.enviro-news.com/glossary/letter/r>

³⁰ Boeijen, A., Daalhuizen, J. & van der Hoog, W. *Delft Design Guide*. 2010 Chapter 2.3 ISBN: 978-90-5155-066-5

³¹ [http://en.wikipedia.org/wiki/Headset_\(bicycle_part\)](http://en.wikipedia.org/wiki/Headset_(bicycle_part))

³² Tassoul, M. 2009 “Creative Facilitation”, 3th edition 2009, p. 194 ISBN 978-90-6562-200-6

³³ Ritchey, T. (1998). *General Morphological Analysis: A general method for non-quantified modeling*

³⁴ [http://en.wikipedia.org/wiki/Persona_\(user_experience\)](http://en.wikipedia.org/wiki/Persona_(user_experience))

Recyclable

Materials those can be used for the procedure of drawing on used materials, or components of used materials, to create something new. The benefits of this depend on its further use.¹

Recycled

Products that are making of used materials. The benefits of this include waste mitigation/ abolishment, a reduced use of raw materials and less in the way of air pollution (which incineration of the used materials would create), so contributing less to the greenhouse effect.¹

Refurbishing

Refurbish means to "clean up again," refurbish means "to provide with new furnishings," redecorate means "to add new decoration(s)," and renovate means "renew or restore to as-new condition."³⁵

Remanufacturing

Remanufacturing is the process of disassembly and recovery at the module level and, eventually, at the component level. It requires the repair or replacement of worn out or obsolete components and modules. Parts subject to degradation affecting the performance or the expected life of the whole are replaced. See an example of a professional automotive electronics remanufacturing flow. Remanufacturing is a form of a product recovery process which differs from other recovery processes in its completeness: a remanufactured machine should match the same customer expectation as new machines.³⁶

Reposit center

A reposit center is a place where things are returned and possible even being re-offered for sale.

Return ratio

Defines the amount of products that have been returned of malfunction, given as an percentage of the total amount of sold products.

Reusable

To be able to use again, especially after salvaging or special treatment or processing.³⁷

Search fields

Search field is a strategic idea of future activities of a company, which is based on knowledge of external opportunities and awareness of internal capabilities (strengths).

SWOT

Strengths: characteristics of the business or project that give it an advantage over others.

Weaknesses: are characteristics that place the team at a disadvantage relative to others

Opportunities: elements that the project could exploit to its advantage

Threats: elements in the environment that could cause trouble for the business or project

Up-cycling

Up cycling is the use of waste materials to provide new useful products. Ideally, it is a reinvestment in the environment and embodiment of the notion that while using resources one is also contributing to them and their value. This is anti-thesis of the consumed and waste concept in society.³⁸

³⁵ <http://www.thefreedictionary.com/refurbishing>

³⁶ <http://encyclopedia.thefreedictionary.com/Remanufacturing>

³⁷ <http://www.thefreedictionary.com/reusable>

³⁸ <http://encyclopedia.thefreedictionary.com/Upcycle>

APPENDIX I. User study - Appearance

Participants (16) were asked a short question without providing them with too much information. They were shown an image of the stroller produced by Greentom and their logo. This was done to catch their first impression, an impression uninfluenced by the vision and strategy of Greentom. After their first reaction more information was given to them and all 16 participants felt generally good about the company. The first impression/reactions gave some interesting results; the second part was too general.

Question form:

Keywords I think of when looking at this new brand and their product:



Product

Brand

The participants were also asked to mark the words resembling to Greentom's logo. This shows the first impression a consumer would get of the brand itself. As final question they had to answer if they knew any other stroller company names.

The results are presented in the following table. The numbers before each answer corresponds to the number the participants who gave this answer.

Results:

Product related			Brand related		Stroller company	
	Baby thing			Clear	8	Bugaboo
	Beautiful			Colored	5	Maxi-cosi
2	Bulky			Foldable	3	Mutsy
	Cheap			Fresh/New	3	Quinny
	Cheaper bugaboo			Funny		
	Clear			Good for the world		
2	Colored		2	Happy		
	Dull			Indian style		
	Dustbin wheel			Innocent		
3	Easy to use	3		Innovating		
	Foldable	3		Modern		
	Frame cheap			Protection		
	Fresh		2	Reliable		
	Functional			Soft		
	Funny			South American		
	Green	3	2	Strong		
	Heavy	2	3	Traditional		

APPENDIX II. User test - Usability

Two married couples and one pregnant couple were asked for trying out Greentom's stroller (Upp) and answering a couple of questions. All parents had experience in using a stroller and had (already) bought one. Goal of this research; understood what consumers feel and think about the product and what they find important. The studies were done individually and qualitative at their home. Besides a couple of standard questions it was more interesting to hear their life stories about what they did with the stroller. For example one couple talked about how they went to the beach last week and how great it was that the large wheel of their stroller didn't always get stuck in the sand.

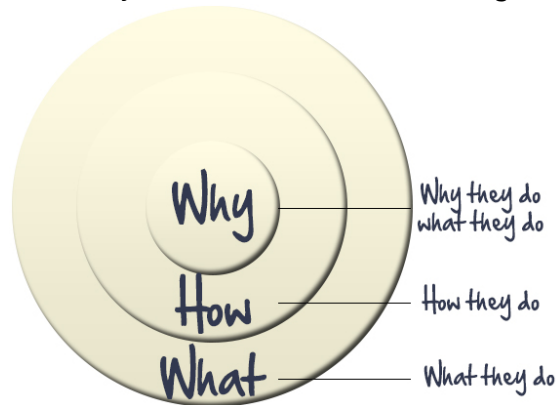
All couples agreed the stroller looked comfortable and was incredibly easy to control. After trying out the stroller I told them about the production and vision of Greentom. All parents thought the green production method of Greentom offers added value for the consumer.

After some questions and stories I got a lot of feedback over what the stroller was missing or what was good about it. Below this feedback was sorted

<i>Positive</i>	<i>Improvements</i>
Extremely light weight stroller	Needs a carrycot
Very compact and even smaller when folded up	Larger storage capacity for luggage
Very maneuverable, even possible with one hand	A place to hang shopping bags, or the baby bag
Nice color and aesthetics	The hood shows a folding line, could be better with a second rib
Great brakes, other strollers always seem to slip when they are put on the break	The strap closure in the seating is made from plastic which will probable break once in its lifetime
The fabric is easily removable which is great for cleaning	For taller people an extendable handle
Great folding button. Simple and easy to unlock with one hand	Wheels are really small and are probably to get stuck in the sand on the beach
Simple but effective hood	The wheel tire material doesn't seem durable
	Stroller has a basic look

APPENDIX III.

Simon Sinek explains in a TED talk “How great leaders inspire action”³⁹ by using the golden circle; why, how and what, based on cognitive science. This explains why Greentom will be able to grow toward other branches.



The normal way companies communicate is “outside in”. They know what products they sell and how to tell the consumer what makes them the best. Some even know why they do it (profit is a result not the why). We communicate normally from the clearest thing to the fussiest thing.

Inspiration by great leader

But inspired companies work “inside out”, like Greentom they believe they can prove green products can be great. Making their products more efficient with great designs, environmental/user friendly, comfortable and for a reasonable price. They just happen to make strollers, and soon other products

This explains why Greentom will be able to create products within other branches and why a consumer will feel comfortable buying them from Greentom.

“The goal is not to do business with everyone who needs what you have; the goal is to do business with people who believe what you believe.” (S. Sinek) That’s why the service Greentom wants to offer to the consumer will be very important; they want to keep track of their consumer and get to know them. When their requirements change Greentom has a product ready for them. This service will grow into a network of consumers who believe in what Greentom offers.

³⁹ http://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action.html

APPENDIX IV. Strategy wheel

The following table shows the score from each factor, of all strollers being used in the strategy wheel.

		Price	Size	End of life system	Weight	Green materials	Options	Oldfashion/ Innovative	Usability	Source
Bugaboo	donkey	1199	1	1	15	1	5	4	3	http://shop.bugaboo.com/INTERSHOP/web/WFS/Bugaboo-Bugaboo_US-Site/en_US/-/USD/ViewProduct-Start?SKU=Bugaboo_Donkey_Mono
Orbit baby	Stroller travel system G2	940	2	1	11,5	3	4	4	3	http://shop.orbitbaby.com/product/stroller-travel-system-g2/
4moms	origami	849,99	2	1	13,1	1	4	5	5	http://www.4moms.com/origami
Bugaboo	cameleon	750	3	1	9,6	2	2	4	2	http://www.bugaboo.com/product?id=1820&id2=1821
Uppa	Vista	729,99	4	2	11,6	3	3	3	3	http://www.uppababy.com/products/product.php?id=236
phil&teds	Vibe 2	699	2	1	12,4	1	3	3	4	http://shop.philandteds.com/push/vibe-2-stroller-buggy-phil-and-teds
Bugaboo	bee	649	4	1	8,5	2	4	4	3	http://www.bugaboo.com/learn/bugaboo-bee?Locale=en_US
GreenTom	Upp	250	4	4	7,3	5	2	3	3	
Uppa	G-luxe	189,99	5	2	5	2	1	2	2	http://www.uppababy.com/products/product.php?id=171
Maclaren	Triumph	180	4	2	5,2	2	1	1	2	http://www.shopmaclarenbaby.com/Triumph/MV000032,default,pd.html?dwvar_MV000032_color=Medieval-Blue#start=1

APPENDIX V. Trends and developments

Trends

Green Products

People starting to realize a consuming economy isn't going to last forever. This results into a change of behavior. Waste is being separated, products are being re-used and green energy is more in favor. Therefore green products are also seen as better products.⁴⁰

Locally produced products

Cheap labor was the answer for sharper pricing products. Due to concerns about the environment and the CO2 footprint consumers are turning back to locally produced materials and products. There is also a trend to more artisan producers, who are able to produce unique items. The same can be said for industrial produced products. They are being perceived as better quality and depending on the type of product; healthier and unique. For instance Dutch design is growing extremely fast.

Product should be safe

Nothing is being produced anymore without legislations. Recently the safety rules of playgrounds have been adjusted again. Nevertheless "There is no clear evidence that playground safety measures have lowered the average risk on playgrounds," said David Ball, a professor

of risk management at Middlesex University in London. Still companies have to oblige these rules. Else they can be sued if anything happen.⁴¹

Health life

There is a general trend among consumers to buy healthier products, resulting in a shift into multiple industries. For example bakeries put less salt in their products (Louws, 2011). Consumers want to know what truly healthy is and expect food companies to be responsible for their health and well being (Alicia Stetzer, 2008). Other products like home weight losing equipment follow this trend. Over longer time this can especially be found in the home shopping business.

User centered brands and products

Consumers want brands and products that are honest and have empathy, understand the needs and demands of users and are capable of fulfilling these needs without hidden costs and being open about your flaws with a human touch. (Trend Report 2012)

Customized products

Consumer's no longer just want a product with one function they want it to be adaptable to their situation. Made for them and adjusted to their wishes. For example the enormous growth in the smart phone industry can be explained by all apps available everyone can decide now what their phone should do. An idea of making the phone literal customizable even made the news lately, called Phonebloks.⁴²

⁴⁰ Kamp, H.G.J. 2013, Kamerbrief Groene Groei: voor een sterke, duurzame economie
<http://www.rijksoverheid.nl/onderwerpen/duurzame-economie/groene-groei>

⁴¹ Tierney, J. 2011, "Can a playground be Too safe?" The New York Times.
http://www.nytimes.com/2011/07/19/science/19tierney.html?_r=0

⁴² Hakkens, D. 2013 <http://www.phonebloks.com/>

Social media

With Facebook entering the stock market (18 may 2012 for 38 USD) and rising this month for the first time above 50 USD, there is no denying this trend is important.⁴³

The trend of Social media has made an enormous change for consumers, but companies see the value of it as well. Thus making social media an excellent way to communicate with and to (potential) customers.

The decision for buying products or services is very much depending on the opinion of friends. This is caused by the scale, speed and impact of social media, 85% of the world population is covered with commercial wireless networks. Consumers will discover products through their social network, will write reviews, rate products and will shop together (digitally). (Trend Report 2012).

Developments

Baby boomers

In the years 1946/1947 the war was ended which resulted into a large birth wave. This has consequences for nowadays. People born that year are now 66/67 years old and retired. This means the population in Europe is aging. Resulting in enormous consequences (besides the political ones) in the market. These elderly people are creating a huge new market with different needs.⁴⁴

Need for time efficiency

A development that already started decennia ago is that the western culture has a need to use its time efficiently. In this (well-developed) culture people have the need and money for undertaking a lot of (social) activities, besides a fulltime job. Retailers anticipate on this need by making ready-made dishes that are easy to prepare, for instance by using the microwave. This development is also described by Eisma Business media (2009) as 'easy everything'. Consumers want products on the go, and products, which ease life.

Premium products

Premium products are becoming more popular. This is caused by the segmentation strategy, companies want to stand out and so does the consumer with their product. Innovative packaging is especially important with premium products. An example can be found with the Origami stroller by 4moms.

BRIC

There is no economic growth of importance in the western world (North and South Europe, Japan and USA). The global economy is rebalancing. BRIC (Brazil, Russia, India and China) but also Mexico and other Asian countries are becoming economic powers where consumer markets are expanding and where new production processes are created. Consumers from BRIC countries demand other products than products produced for the European or USA market. (Trend Report 2012).

⁴³<http://www.iex.nl/Aandeel-Koers/350002220/Facebook.aspx>, last visit on 30-09-13

⁴⁴ "Population and Household Economic Topics". Census.gov. Retrieved August 21, 2010.

The sessions followed a three-step module of which the first step started with a guided fantasy. The goal of this guided fantasy was to get all the participants into the same mindset and explain the problem (definition) to them. After this their first ideas and feelings were drawn on paper to eject the first common sense ideas.

The first results came through creating a vision how Greentom will need to settle its company in the future market. This started with a brainstorm generating context factors divided in: developments, trends, states and principles, all related to the stroller-world and the possibility the new service of Greentom is going to provide. These statements were clustered in seven different overlapping context factors with a corresponding title and then 4 were clustered again into two bigger categories, as you can see in figure 16.

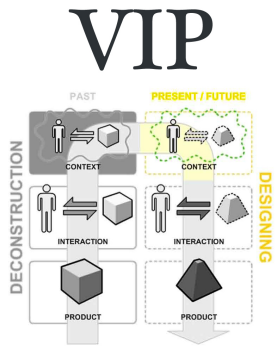
These seven context factors combined show that in the current situation people are in a quandary between the need for more durable

APPENDIX VI. ViP Session

products and wanting to make the best of a bargain. This leads to the opportunity for economy in a sustainable way. Other important factors were that people always want to be accepted and feel satisfied. That is why they follow wishes trends and fashion. Beside that factor another important one came from the combination of weather and influences and all-in-one products: people want their product to be adaptable to the conditions they are in and to personalize the product.

As final step of the first part the result of these context factors a statement was created what is the first part of the vision:

Greentom should always be able to offer their proud customer options for new added value.



Customizable products to conditions

Weather and influences

- P** Seasons change
- D** Climate change may affect requirements of the product or the consumer.
- P** Difference in terrain requires different product requirements.
- S** Weather conditions determine where a product should be prepared for.

All-in-one products

- T** Smart products grow in their use and potential
- T** Chips in products can make a lot possible such as track and trace
- T** More and more people have a smart phone and the apps possibilities keep growing.
- D** Single products are getting more functions.
- D** People have more money left for luxury products

Social

- T** Social media is growing and becoming more important.
- T** Online dating and meeting friends is getting normally.
- D** People have more free time.
- P** Children love to play.
- T** New products such Greenwheels are successful by having multiple users.
- T** Resale and hiring is increasingly made use of.

Convenience for efficiency

- D** People buy more and more online.
- T** People want to be self-sufficient.
- S** People prefer to do the work themselves to manage their own account.
- P** Development of 3D printers makes home production possible.
- S** Time must be spent as efficiently as possible.
- P** People tend to be lazy.
- P** Automation has made mass production possible.
- S** People find foldable products convenient to clean and transport

Economy in a sustainable way

Durable

- D** Renewable energy is growing.
- D** Recycling is becoming more and more is better being separated.
- T** Origins of materials are better investigated (fair trade).
- S** Sustainability such as consumption of less energy, is in doubt with the desire of mobility and usability.

Economy

- S** Enough money means growth, contraction means crisis.
- P** We live now in the rich continent.
- D** BRIC, Global economy is rebalancing, Brazil, Russia, India and China increase in power.
- D** People put their money onto the bank.
- P** Large companies decide for us what is on the market to stand.
- S** People want to make the best of a bargain.

Wishes, Trends and Fashion

- P** People love to pamper themselves.
- T** Home decor is also fashionable.
- S** Fashion means belonging, socially bound.
- S** People want to find satisfaction but are thereby unsatisfied.
- P** People want to be proud.
- S** People want choice.
- S** Materialism makes happy.
- P** People want to be successful.

Development
Trend
State
Pinciple

VIP statement: Greentom should always be able to offer their proud customer options for new added value.

Figure 16: ViP brainstorm part 1

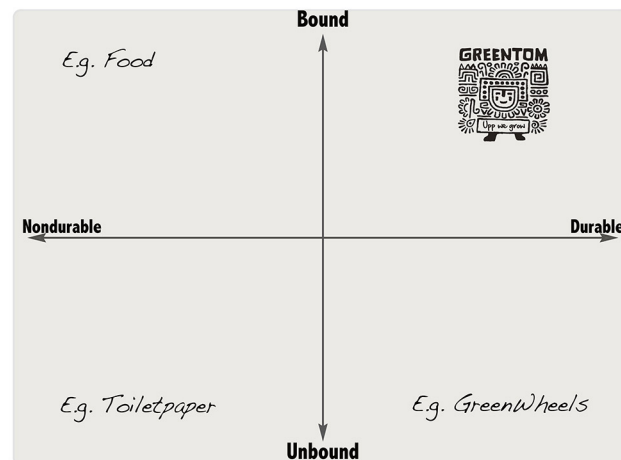
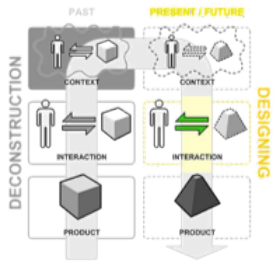


Figure 17: ViP brainstorm part 2

The second part of the vision is combining the two most important factors where Greentom needs to differentiate itself from its competitors, in order to make the idea of the project a success. First of all the durability level of the company is extremely important (still competing in a reasonable price market). Second the factor of how much a customer bounds itself to the company/product. Figure 17 shows the location where this project will locate itself to be able to segregate from other companies (with some other examples the other extremes of the diagram are explained).

Thirdly with the context factors, the quadrant and the ViP statement we developed relationships; human-product interactions (figure 18). A metaphor with a guide dog is used to describe what the interaction with Greentom should be like.

VIP



VIP statement: GreenTom should always be able to offer their proud customer options for new added value.



This is Sammy, he is a well trained guide dog who is able to help his boss Josh. Sammy was just a pup when he got to know baby Josh. They played together and helped each other on the way. Now they have grown older together and there is a special bond between them.

Sammy will never leave his side and whenever Josh needs him he is there for him.



Over the years they got to know each other like no-one else does. Therefore Sammy knows what Josh likes and dislikes.

Josh trusts that Sammy will always be there for him, and will always be helping him. All his life Sammy has fulfilled many tasks and now he always looks forward, so Josh won't hit his head or anything.

Through life Sammy learned everything and developed new tricks to overcome every kind of obstacle. This makes Sammy very adaptable to every situation.

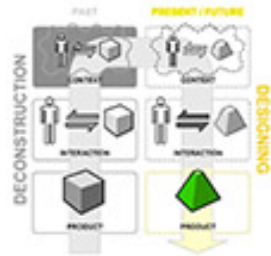
Sammy represents what the product of GreenTom Should be: Able to adapt, growing a special connection with the owner and fulfill different functions through life.

GreenTom should always be available for their customers and reach out to them. This will create a bond of trust and therefore the product will be used all their life.

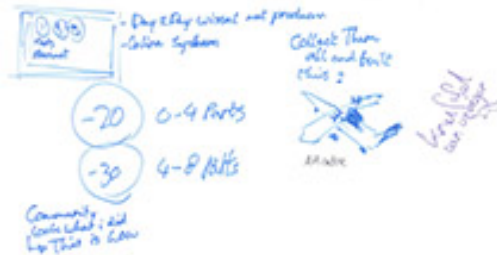
Figure 18: ViP brainstorm part 3

VIP

VIP statement: GreenTom should always be able to offer their proud customer options for new added value.



Brainstorm



Hoe 2 gebondenheid bij GreenTom implementeren

Vertrouwenheid:
gebruik groen ham in later ontwerp

Linas in
Nieuwsbrief
Clubhouse
GT onlezen

OPEN DAGEN

STAPPEL WAART

"GOLDEN ROBBITS"
(GATIS BEGRIPENIS VRIJDE
ALS JE LIFE TIME CUSTOMER
BENT)

- PRODUCT VERBODING ISD KLEUR
- RECONSTRUCIE IN STROEF
- RECONSTRUCIE IN STROEF

- ben overtuigd dat als product goed is, gebondenheid vanzelf ontstaat → mond op mond reclame is altijd het beste !!!
- mensen laten uitproberen → testen openbaar maken
- gebruik v. GreenTom leidt tot nostalgie als het een goed product is (je wilt de tijd vasthouden) dus gebondenheid (of verbondenheid)
- nostalgie = belangrijk item
- GT - netwerk

Hoe 2 implementeren het sociale gezicht bij GreenTom

VBN-ers in zielige landen laten zien dat mensen eraan werken
it vooral in pr laten zien hoe het geproduceerd wordt door de mensen met een beperking
programma's zoals: de wereld draait door contacten
: heuringsdienst u waarde
: etc.
: KENNISREKEN (sociale)

Selling/Distributie punten (DSN's)
AFLEVEREN

mensen met beperking

SPONSORING VAN:
- SOCIALE ACTIVITEITEN
- PERSON GEbruiksvoorwerpen
- voor sociale groepen

Medewerkers GT stimuleren

on "SOCIALE NEUW ACTIVITEITEN
TE ONTPLOOITEN"

Producten ontwerpen voor hulp

Zielehuis voor
Schiedamsche wagen

koopwagen
proberen in TV serie's product
te laten zien

Hoe 2 Nieuwe bijeenkomst waarde bij GreenTom implementeren

PERSONEEL	MATERIAL	LOCATIE	DISTRIBUTIE
- GEMISSEN - OPLEIDING - FLEXIBILITEIT	- AFVAL - VERBODEN (materiaal) - VERBODEN (materiaal) - VERBODEN (materiaal) - VERBODEN (materiaal)	- TUNIS - NL ALS MANDAGH - STORE - 3D-PRINTEN	- INTERVIEW - 3D-PRINTEN - ONDERZOEKEN

Hoe 2 Levenswijze bij GreenTom implementeren

Productie weestrijp/Isobank voor medewerkers: "WIT KOSTER EN DEN IJST"

Instructies voor medewerkers/kleuten
voor duurzaam gebruik

Levenswijze met
TU-DELT → STAGES

Verwisselbare
Wiel en stijlende
onderdelen



- punt voor reclame: dat het een duurzaamproduct is: geschiedenis van een product laten zien: moet een stijlgevoel worden (way of life)
→ "in wil erbij horen" zoals ook bankfiets: iedereen wil zo'n ding

Figure 20: ViP brainstorm part 5

How 2 bind the consumer to GreenTom

~~STATISTICA~~

Vertrouwdheid:

gebruik green tom in kinderboisje

[AANBRENGBONUS
NIEUWS KLANT

LIDMAATS IN
NIEUWSBRIEF

CLUBWAARD

GT ONCEEREN

TOM JONES
TOMMIE (THE WHO)

OPEN DAGEN

STEDER WAAR

"GOLDEN ROUTE"

(GRATIS BEGRAFENIS WILDT) IS
ALS JE LIFE TIME CUSTOMER
BENT)

- PRODUCT VERWIJZING ISD. KANT
- RECON LEISINGEN IN 30000
L. BIJ AANSCAF → WAARDEN

- ben overtuigd dat als product goed is, gebondenheid vanzelf
ontstaat → mond op mond reclame is altijd het beste !!!
 - mensen laten uitproberen → testen openbaar maken
 - Introduceren Als de ^{nieuwe} Markter
Go All the way + reclame voor maken
 - gebruik v. greentom leidt tot nostalgie als het
een goed product is (je wilt de tijd vasthouden)
dus gebondenheid (of verbondenheid)
 - nostalgie = belangrijk item
 - GT - museum

Amusief
van vroeger

IDD. 75
→ generatie is
ermeer vertrouwd
en weet de ket op
waarde te
schatten

How 2 create a socail face for GreenTom

- * BN-ers in zielige landen laten zien dat mensen eraan werken
- * vooral in pr laten zien hoe het geproduceerd wordt door bv mensen met een beperking
- * programma's zoals: de wereld draait door contactuuren
 - : huuringsdienst v. waarde
 - : etc.
 - : KEURMERK (SOCIAAL)

↳ kosten minimum loon

↳ Sticker de verkoop in
geveerd landen opzetten
daar is meer vraag naar
"dit product is"
...
fundering

Selling/Distributie punten { ISW's
AFLEVEREN

mensen met beperking

Medewerkers GT stimuleren

om "SOCIALE NEVEN ACTIVITEITEN
TE ONTPLOOIE"EN

Producten ontwerpen voor hulp

Realistisch?



Ziekenhuis kar



Schoonmaakt wagen

loop wagen
voor baby's / beperkten

Gratis modellen aanbieden
op goede beurzen als prijs

proberen in TV serie's product
te laten zien

How 2 Create sustainability for GreenTom

Productie wedstrijd / Ideebus voor medewerkers: "Wie heeft er een idee?"

→ Voorlichting
Instructies voor gebruikers / klanten
voor duurzaam gebruik

Stategieel systeem



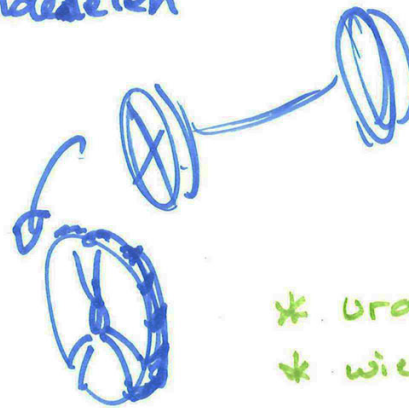
Verwisselbare
Wielen en stijfende
onderdelen

terugsturen
of service at home
at store

Hand geschreven not
TU-Delft →
STAGES



blaadjes
uit product
Groeiën



Groter
voor ander
terrein



splitsing
vervang



beoordeling
of roll.



speelgoed

* vraag prijs van maken:
* wie heeft er nog meer ideeën voor
een groenere betere wereld zodat
de ijsberen niet hoeven te verdrinken

- punt voor reclame: dat het een duurzaam product is: geschiedenis van
een product laten zien: moet een stylecoon worden (way of life)
→ "ik wil erbij horen" zoals ook bahfiets: iedereen wil zo'n ding

APPENDIX VII. Interview target group

Kim (30, zwanger van eerste kind) en Jasper (31) onderzoek 3 februari 2013

Kinderwagen uittesten

Dit is de kinderwagen van Greentom. De eerste vragen die ik jullie wil stellen wil ik nog niet teveel informatie bij geven. Dit omdat ze specifiek zullen gaan over het product zelf.

Hoe vinden jullie het gebruik van de kinderwagen aanvoelen?

Mooie kleur zwart rood, lekker wendbaar voelt erg stevig aan en toch ook licht. Hij stuur echt makkelijk zelfs met 1 vinger wendbaar.

Kan de rugleuning ook nog naar een andere stand, naar een lig-stand?

Hij heeft een mogelijkheid om gedeeltelijk nog naar achter te leunen door de klip aan de achterkant te schuiven.

Maar het idee van het ontwerp van de kinderwagen is om alle onnodige extra toepassingen zoals mogelijkheid tot instellen van de vering van de wielen weg te laten zodat er een kinderwagen overblijft die goed is waarvoor hij bedoeld is namelijk een kind vervoeren. Want uit onderzoek blijkt dat veel ouders al die extra mogelijkheden nooit gebruiken.

Maar ik vroeg me af of het ook voor een baby bruikbaar is.

Greentom is bezig met de ontwikkeling van een reiswieg daarvoor, momenteel hebben ze alleen nog adapters om een reiswieg van bijv. Maxi-Cosi erin te zetten.

Heb je nog enige aanbevelingen voor de kinderwagen wat jullie er anders aan zouden willen zien?

Vrij weinig bergruimte, want je hebt veel mee te zeulen als je een kind heb. Ik zou bijna zeggen dat je dat misschien als accessoire eraan kan hangen.

En de sluiting van de riem gaat denk ik kapot omdat het plastic snel verouderd.

Bedenk nu dat jullie kind ongeveer 3 jaar oud is, hij/zij kan dus lopen, en je gebruikt de kinderwagen steeds minder. Op een gegeven moment heb je er hem zelfs niet meer nodig. Wat zou je er op dat moment mee doen of willen doen?

Naja kijk misschien komt er ooit nog een tweede, maar als je dat stadium voorbij bent... boodschappen wagentje... Nou ik zou eerder zeggen verkopen via marktplaat. Ga geen kinderwagen bewaren toch. Nee inderdaad

Denk je dat je gehecht kan raken aan zo'n product en het misschien moeilijk kan zijn om de kinderwagen weg te doen?

Ik ben niet zo'n nostalgisch mens dat ik een kinderwagen wil bewaren. Maar je heb dan ook nog een wieg en dan kan je ook nog de luiers gaan bewaren...

De kinderwagen is gemaakt van gerecyclede materialen en de bedoeling is dat je dat er niet aan kan afzien.

Dat is waar. Wil er wel bij aanmerken dat het er ook niet uit ziet als de Ferrari onder de kinderwagens, ik zou er ook niet de top prijs voor willen betalen.

Enig idee wat een kinderwagen kost?

Een echte goede kinderwagen rond de 1000 euro. Ik vind hem wel strak hoor trouwens.

Prijs is hiervan 250 euro, zodat ze concurrerend zijn met de goedkopere niet groene kinderwagens. Dit is mogelijk omdat het slim is ontworpen door onnodige onderdelen samen te voegen of weg te laten.

Het idee is om het mogelijk te maken dit product een tweede leven te geven zodra je hem niet meer nodig heb, wanneer je kind(eren) eruit zijn gegroeid. Dus over drie jaar tenzij je nog een extra kind krijgt dan waarschijnlijk over ongeveer 5 jaar.

En dan is het uitgangspunt dat hij na vijf jaar nog in tact is.

Ja, maar de onderdelen kunnen natuurlijk vervangen worden.

Wat voor vervolg producten kan je bedenken zodra je de kinderwagen niet meer nodig zou hebben?

Wij hebben nog geen rollator nodig over vijf jaar, en ik ben ook geen golfer dus ook geen golfkar. Dat zou je er volgens mij wel prima van kunnen maken.

Ik associeer een boodschappenkarretje, maar ja dat is dan ook wel weer erg groot.

Maar zou jij daar dan boodschappen mee willen doen?

Ja dat weet ik ook niet veel oude mensjes. Naja, kijk als je gaat lopen, je hoeft niet te sjouwen dus dat zou ook wel iets zijn wat praktisch is.

Even nog nadenken... nou een kruiwagen ja dat zou nog wel kunnen gebruiken. Dus als ik hem niet zou kunnen verkopen...

Als jullie zouden nadenken over een kinderwagen te kopen en het product cycle idee is mogelijk, zou dat dan een toegevoegde waarde voor jullie kunnen betekenen?

Nee voor mij niet zozeer. Naja de prijs kwaliteit verhouding dat is denk ik wel waar we naar zullen kijken bij de aanschaf. Bugaboo dat is dan een dure. Ik hoor dan van jou dat het bedoeld is als groen product en dat vind ik ook hartstikke goed natuurlijk.

Het idee is dan om meerdere onderdelen her te gebruiken en die op een andere manier samen te stellen met een aantal nieuwe onderdelen om zo een nieuw product te krijgen.

Denken jullie dat dit idee haalbaar is, en heb je daar vertrouwen in?

Ik heb wel vraagtekens bij de wielen hoelang die met slijtage mee zullen gaan.

Uiteraard zal het schuim slijten, hoewel het al heel snel zichtbaar vies wordt is het materiaal ontworpen om langdurig mee te kunnen gaan. Waar zouden jullie eventueel problemen zien in dit verhaal?

Wielen zijn overigens niet lelijk, ik vind het er wel bij horen.

Verder heb ik wel me twijfels of het na twee kinderen nog wel in goede staat is. Die wielen zijn na vijf jaar denk ik niet mee bruikbaar.

De wielen zullen inderdaad na zo'n tijd wel vervangen worden maar ook omdat de nieuwe functie waarschijnlijk andere wielen vereist.

Waar ik me dan vooral zorgen om zou maken zouden die scharnier punten zijn. Heb natuurlijk ook een hoop plastic producten, bijvoorbeeld zo'n reiskoffer en daar zit zo'n druk knopje en dat blijft op een gegeven moment klemmen. Alle bewegende scharnieren van plastic zijn volgens mij niet zo'n geweldige combinatie.

Ik verwacht dus dat in de draaiknop problemen komen. Juist omdat mensen er steeds sneller en handiger in worden, zodat je een keer teveel kracht gebruikt.

Welke onderdelen zie je als goed zouden blijven om mee te nemen in een vervolg product?

Het frame denk ik. Ja het frame.

Wat verder ook zou kunnen om de producten te reviseren en weer tweedehands te verkopen via de fabriek, maar dat je hem dan bijvoorbeeld kan kopen voor 125 euro.

Hergebruik van deze materialen is natuurlijk dubbel zo goed voor het milieu, maar biedt dit volgens jullie voldoende motivatie om mee te doen met zo'n product cyclus?

Wat voor andere motivatie zou je kunnen bedenken wat zou kunnen helpen?

Het zou voor mij interessant zijn als ik toch de garantie krijg maar dan met een korting krijg op een tweedehands product.

Of een statiegeld systeem dat je weer geld terug krijgt bij het inleveren.

Maar het inwisselen van onderdelen voor een nieuw product met de garantie vind ik wel positief.

Stel je voor dat je nog een tweede kind zou willen, zou je dan een tweede buggy kopen of heb je liever de mogelijkheid om je buggy te veranderen in een 2 persoonskinderwagen.

Product ideeën showen:

Ow zo'n fiets karretje, die is wel erg uitdagend, maar is het idee dat je dan echt de materialen hergebruikt of alleen het frame?

Allebei gedeeltelijk. Alles wat sowieso niet kan worden hergebruikt moet worden gemaakt en dat zou dan fictief met de materialen die je inlevert kunnen worden gedaan.

Met dat fietskarretje is natuurlijk wel de vraag van hoe lang kunnen ze daar in blijven zitten. Want het uitgangspunt is wel dat wij het naar het derde jaar met hetzelfde kind weer gaan gebruiken.

Ja, uiteraard ik denk niet dat je je kind gaat inwisselen...

Haha nee inderdaad maar ik wilde even weten welk tweede leven, of dat het echt voor ons?

Ja precies dat is de bedoeling.

Maar in de kinderwagen blijven ze vaak nog totdat ze 2 of 3 zijn, of langer als je een lange tocht moet maken gebruik je hem nog even. Ligt er aan welke dan maar dan wordt het voor 2-3 jaar omgebouwd. Ja dan vind ik de kindertrailer erg leuk en het boodschappen wagentje ook wel.

Niet iedereen vindt zo'n boodschappen wagen natuurlijk leuk. Maar je zou met dit herontwerp er een nieuw image aan kunnen geven.

Ja precies dat het een flitsend model wordt. Dat het niet helemaal meer een oude mensen ding is heeft. Want ze zijn erg handig.

Ik vind de trolley ook nog wel handig af en toe. Ja ik heb het meeste met de boodschappen wagen. En de driewieler is ook nog wel handig. Ja ik weet niet hoelang ze daar in kunnen, omdat ze dan nog in de kinderwagen zitten

Eigenlijk valt die gewoon af omdat hij overlapt met de kinderwagen.

Ja die balance bike is ook erg leuk omdat ze dan leren hun evenwicht te bewaren. Misschien nog handiger dan een fietskar.

En je kan er een bierkratje van maken...

Of een fietszitje, die sluit echt aan of gaan daar ook al baby's in, toch wel.

Je kan er ook nog een design kinderstoel van maken, want dan kan je echt het frame hergebruiken.

Op een gegeven moment draagt een kind dit product door heel zijn leven mee met allerlei verschillende functies. Denken jullie dat hij/zij dan echt een band met het product zou kunnen krijgen

Als de onderdelen dan nog herkenbaar zouden zijn. Dan wordt het toch op een gegeven moment een bierkrat. Haha Als het een jongen is wel als het een meisje is dan... als het een meisje is dan wordt het een make-up doos.

Product impressie showen

Owja dan komt dat rood natuurlijk terug, en dan wordt het uiteindelijk een rollator.

Ja dat is natuurlijk een van de meest logische dingen die je eruit zou kunnen halen natuurlijk. Zodra je het bovenstuk eruit zou halen.

Ja dat is dan natuurlijk redelijk eenvoudig. Maar je heb dan natuurlijk niet vaak een rollator nodig. Maar dan kan je er niet echt even op leunen.

Ja nou als je dit bovenstuk vervangt voor iets naar voren en hier een zitje van maakt heb je al redelijk snel een rollator idee.

Maar goed de boodschappen kar ziet er ook leuk uit. En makkelijk te maken, eenvoudiger zelfs. Die ballance bike is ook leuk.

Je kan er ook nog een stoel van maken als je dit eruit haalt en hier een zitvlak plaats, niet eens een rolstoel. Maar volgens mij is hij dan wel stabiel. Dan heb je gewoon een bureau stoel.

Wat het lastige gaat worden is dat een vervolg product ook een op zichzelf staand product moet zijn en dat het niet meer de impressie geeft van een baby wagen.

Maar goed die fiets is natuurlijk ook voor oudere en jongere kinderen dus dan kan het nog wel dat gevoel hebben.

Ik ben verder zelf niet zo nostalgisch ingesteld dat hetzelfde stukje plastic weer terug komt maar als het een tweede leven krijgt vind ik dat al mooi.

Ja als je het aan iemand verkoopt die het dan gebruikt

Ja of heel vaak worden die dingen ook door de familie heen gegeven. Zo zou de rollator misschien op dat moment nog net geschikt zijn voor de opa of oma.

APPENDIX VIII. User study - Product selection

Participant	child traler	balance bike	toy car	shopping trolley	skelter	elderly walker	step	baby crawling wagon	toy collector	trolley	tricycle
1		1		2			0,5				
2	2						1			0,5	
3	1			2	0,5						
4	2			0,5			1				
5	0,5			1		2					
6		2		0,5		1					
7	0,5			1						2	
8		2		1							0,5
	6	5	0	8	0,5	3	2,5	0	0	2,5	0,5

- 1 shopping trolley 8
- 2 child traler 6
- 3 balance bike 5
- 4 elderly walker 3
- 5 step 2,5
- 6 trolley 2,5
- 7 tricycle 0,5
- 8 skelter 0,5



The diagram above shows, the results from the user study. All participants received a first second and third choice, respectively attributing two, one and half a point.

The sheet the participant received can be seen in the picture on the left.

The picture on the right is an example of one of the responses the participants gave.

APPENDIX IX. Comparable products

Urbanista Dramaten New York – 99,-

- Dimensions: 100 x 32 x 32m
- Max height: 100 cm Min height: 82 cm
- Bag dimensions: 59 x 35 x 33 cm
- Weight: 3.2 kg
- Contains: 55 liter



Go Two trolley 99,-

- Dimensions: 103x48x36cm
- Folded: 103x48x22cm
- Weight: 3,2kg
- Contains: 46 liter



Average price 609 euro,

Unfold dimensions 83,9 x 93,3 x 96,3 cm (162 with rod)

Mean folded dimensions 79,6 x 32,9 x 96,5 cm.

Inner dimensions, 64,4 x 65,4 x 58,5 cm.

(WxHxL)

They trailer is able for transport of two children < four years.

All trailers specify they are capable of transporting 45kg.



Hiltoys step

Length user

Medium: 1,5 – 2m,

Small: 1,35 – 1,7m

Max. User's weight

Medium: 150 kg,

Small: 125 kg

Height handlebars

Medium: 78 – 100

Small: 67 – 86 cm

Seat-height

Medium: 62 cm,

Small: 54 cm

Weight

Medium: 7,4 kg,

Small: 7,1 kg

Length

65 cm

Width

61 cm



Quatro



Topra Troja



APPENDIX X. Bike trailers

According to the Dutch organization “Fietzersbond”; Dolphin xl, Burley d'lite, Chariot Cougar2, Chariot captain, Burley cub, Kidcar comfort, Weber ritschie, Roady roller, Vanty and the koolstop original, are the top 10 bike trailers available.⁴⁵ Their specifications has let to what the perfect average of an bike trailer should be, see table below.⁴⁶

	Price	innersize			maximum age of		zonder stang		met stang	Folded size			Capacity
		width	hight	legspace	two children	width	hight	Length	Length	width	hight	Length	
dolphin xl	789	65	76	58	4,4	79	103		162	79	39	101	45
burley d'lite	599	63	65	58	4,2	82	97			80	31	93	45
chariot cougar2	614	56	64	55	2,5	83	97			80	27	105	45
chariot captain	614	68	61	52	2,9	82	93	102		82	37	100	45
burley cub	559	62	70	62	6	80	97	95		77	37	103	45
kidcar comfort	549	76	70	56	5	93				93	35	95	
weber ritschie	799	63	61	60	2,9	81	88	80		72	41	80	50
roady roller	749	73	72	74	6	80	78	108		80	43	110	
vanty	275	60	58	50	2,2	88				76	17	88	
koolstop original	545	58	58	60	2,2	91				77	22	90	
Avarage	609,2	64,4	65,5	58,5	3,83	83,9	93,286	96,25	162	79,6	32,9	96,5	45,83333

⁴⁵ Bakker, K. 2003. “De grote kinderkarrentest”. *De Vogelvrije Fietser, mei*, pp. 20 – 24

⁴⁶ <http://www.twowheelingtots.com/bike-trailer-comparisons/>

APPENDIX XI. Decision making session



Time line DMS

For the decision-making session some techniques were combined originating from the book Creative facilitation.⁴⁷

The first part of the session was to get the 5 designers into the same mindset. This started of with a small briefing about the problem definition and a “Guided fantasy” to get into the same mindset.

After the warming up was done and the real insights and conclusions were made, a session of “Brainwritting” to force out the first ideas that come to mind was started.

After that the goal changed of breaking some ground rules because this was what probably let to more obvious ideas. This was done by “Attribute listing” the ground rules and breaking them with “Provocative questioning”.

Eventually we ended with a discussion how the “Future perfect” would look for Greentom.

Because only after the warming up results were made, the technique’s Brainwritting, Attribute listing, Provocative questioning and Future perfect, will be described. But first the goal description of the session.

Goal description

The goal was to realize a bigger picture, therefore some earlier set requirements in the goal definition had to be left out. Greentom agrees with this decision because the cycle will not be developed in the near future but over a longer period of time. Allowing them to build the cycle eventually according to their principles.

Some of the basic rules that were left out were the re-using of the exact parts of the stroller into a new product. The main reason for this is that the product ideas were to meager when only having one product in the product portfolio. A second rule that was dropped was Greentom being the only player. Cooperation with other companies is possible.

Creating a cycle with reusing elements is possible but only with a larger product portfolio. In the future this can probably be done when Greentom has multiple combinable products.

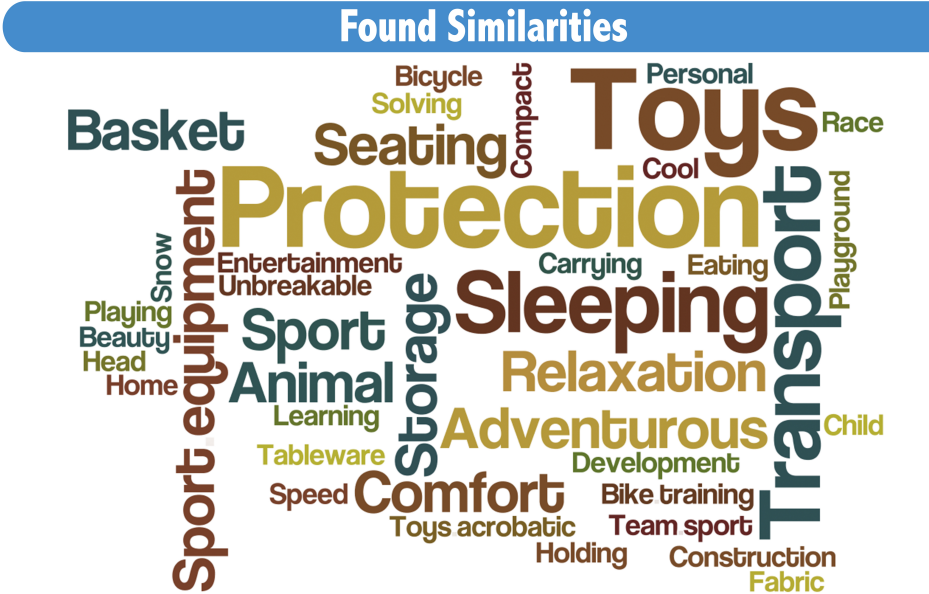
Greentom stated that they want to become a more product development community, for which people can gain royalties. In the future this might even be developed into an open source community.

So the main goal of this session was to project a line how to get from the actual status quo toward a Greentom cycle. In this goal the first step for the cycle is an important sub-goal.

⁴⁷Tassoul, M. 2009 “Creative Facilitation”, 3th edition 2009, p. 54, 56, 59, 71, 75 ISBN-13 978-90-6562-200-6

Brainwriting

The Brainwriting session was used to get the participants going and to force out the best ideas. Yet after analyzing something interesting came up. The ideas were developed continuing on the previewed idea. Between these ideas similarities were created, showing interesting categories. These show initial field ideas where Greentom grow toward, see figure below. The total brainwriting scheme can be found on the next page.



Attribute listing

This phase of the session had to and could be shortened, because of time savings. Therefor after explaining the goal of this part a set of attributes was given:

What is Greentom?

- Sustainable and environmentally friendly use of resources
- Makes their product without unnecessary applications
- Clever way of assembling
- Consumer market
- Manufacturer of children's products (strollers)
- In the health care business

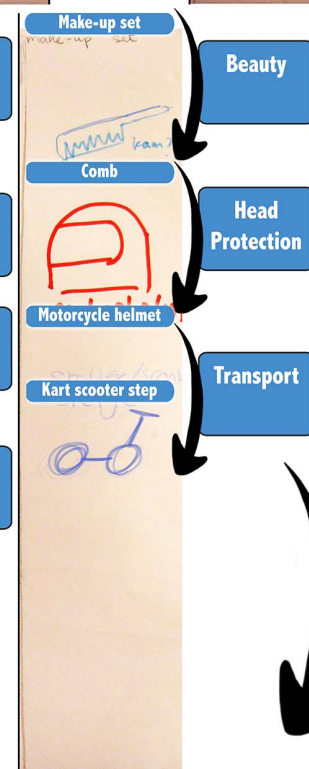
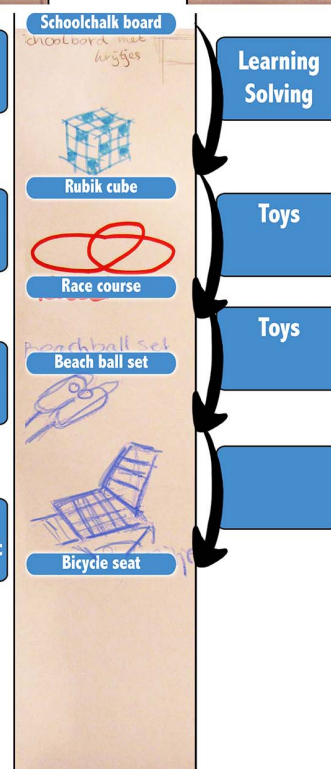
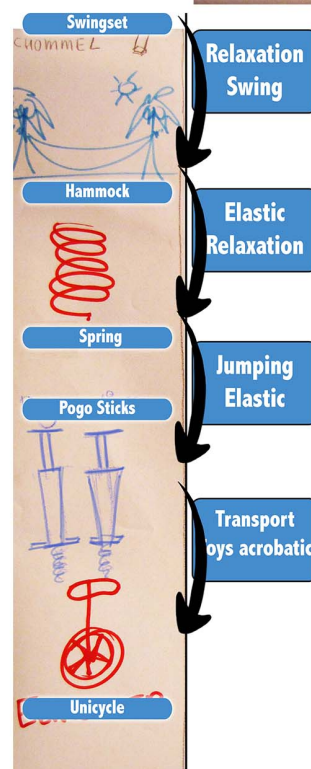
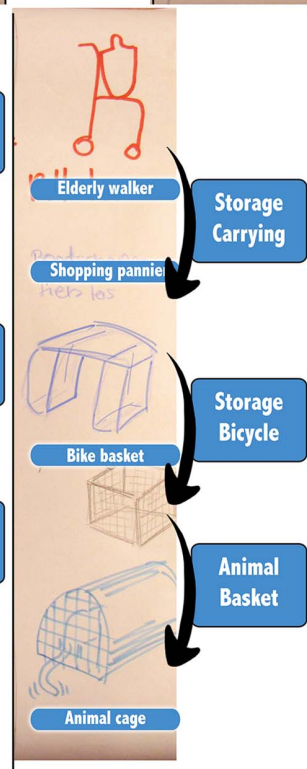
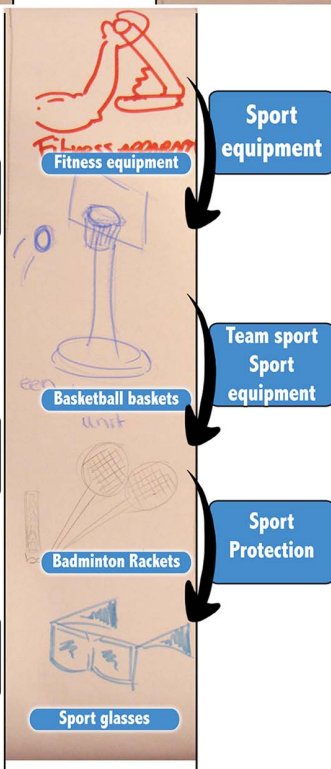
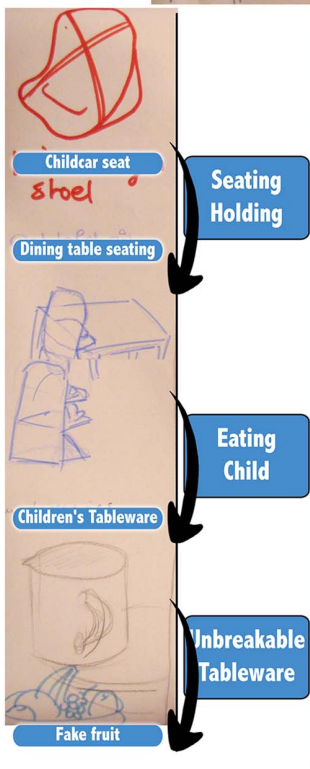
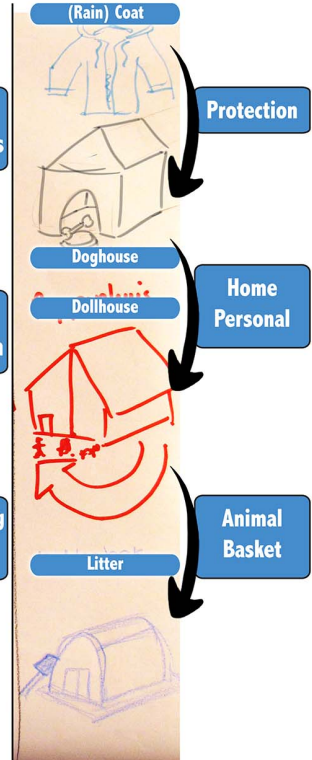
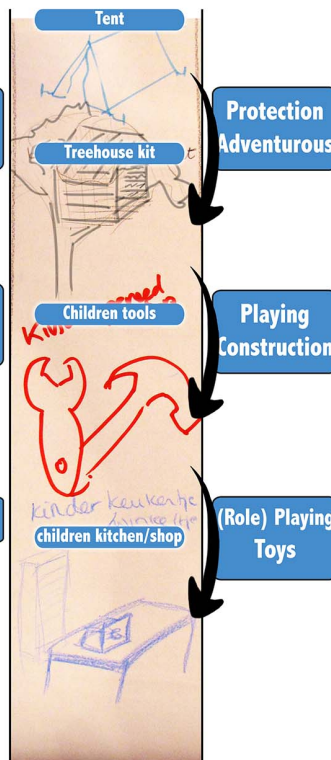
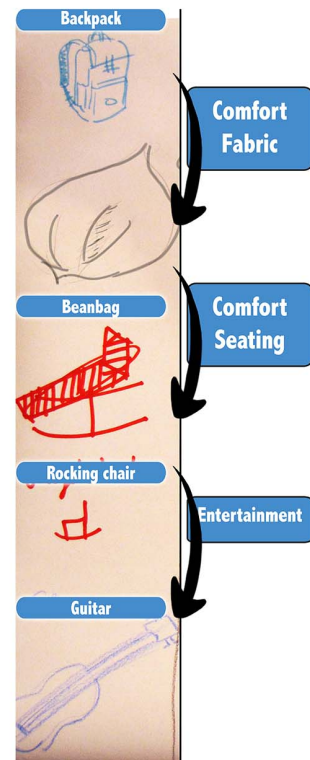
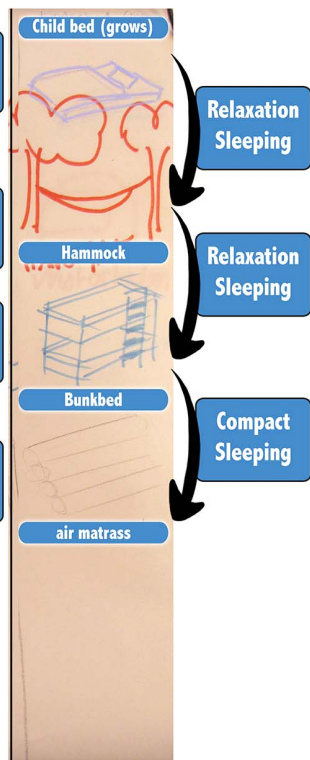
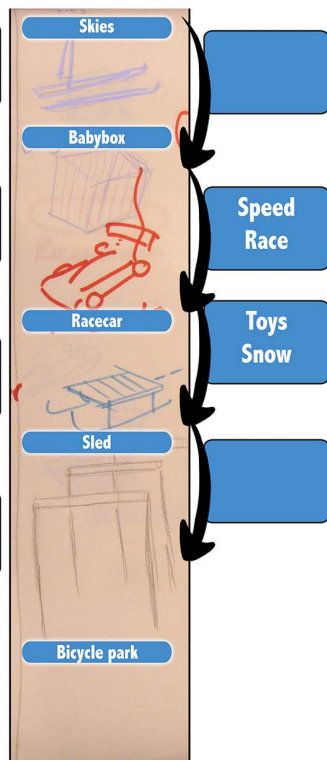
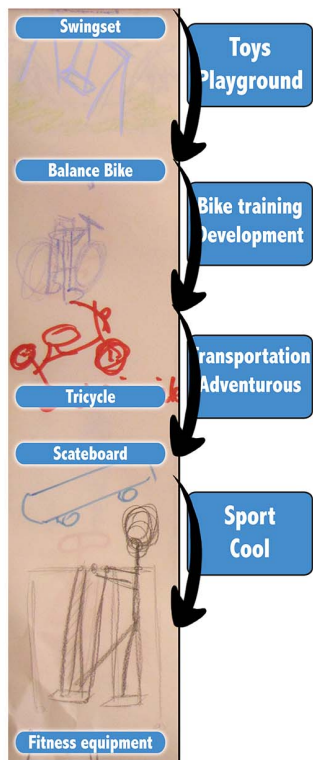
The group understood these attributes and was able to continue with them in the next step. Because this step was meant for the next step to start breaking these assumption and seeing what ideas come to mind when you blow these restrictions away. The provocative questioning step.

Provocative questioning

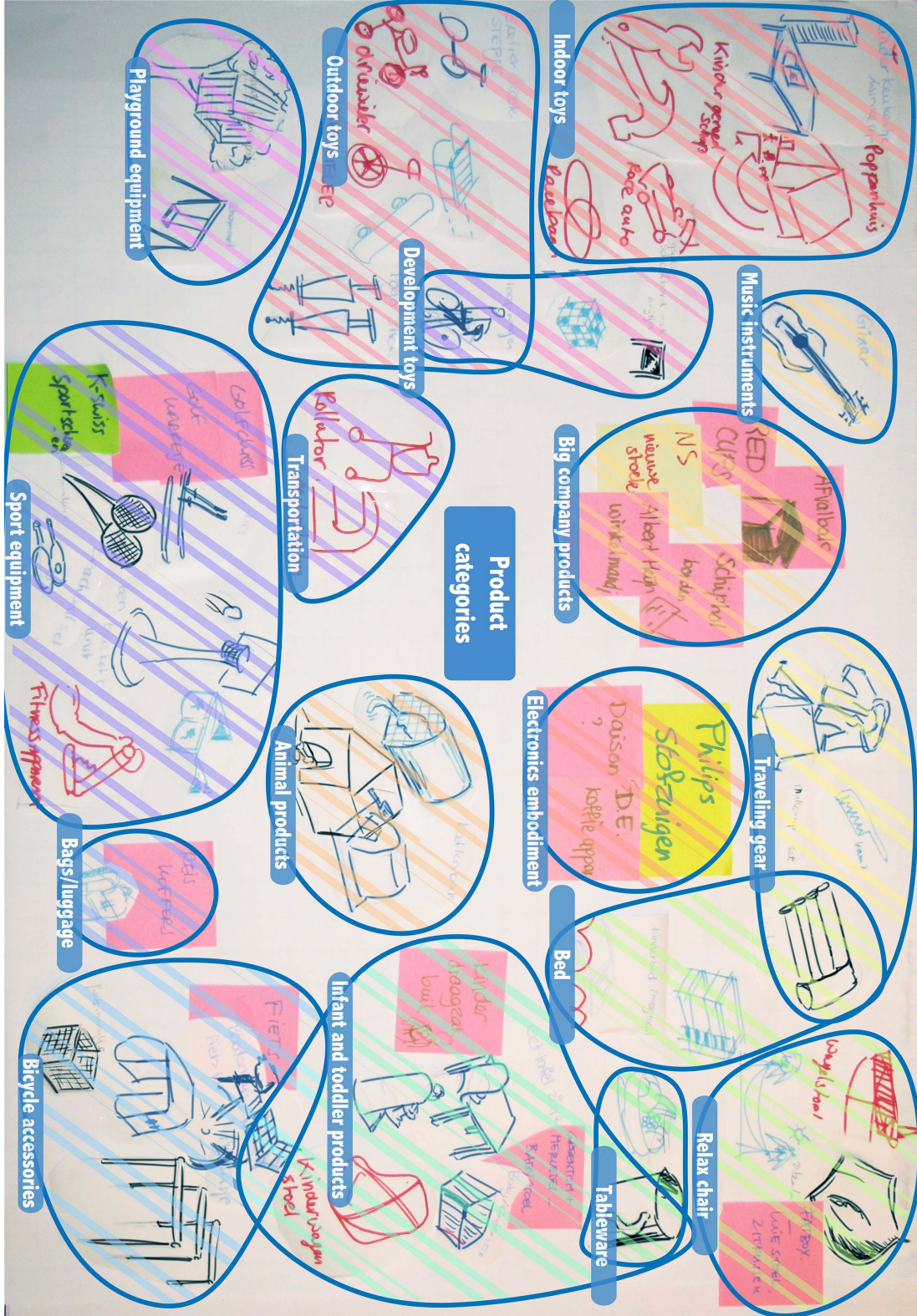
By reversing the attributes, like Greentom is a company not (only) making use of Green materials, the group was able to explore market ideas specifically breaking each assumption. Especially when not looking for the consumer market but for the professional market there was some interesting results, like building green embodiments for electro companies, or providing Schiphol with green luggage strollers. All results were afterward categorized in a map as can be seen on the next page.

Other questions that were asked during the session were:

- Which company could be selected for cooperation with Greentom?
 - And what has this company to offer?
- What luxurious products/extra/add-ons could be made by Greentom?
- Would the product be made for adult or elderly?
- What kind of product makes you think about the environment?



Link between each idea = Similarities



Future Perfect

The future perfect method was meant to draw how this could be visualized. Instead it turned out into a discussion among some of the participants because the session ran out of time.

This discussion let toward some interesting conclusions about how Greentom should grow.

Conclusions

To allow Greentom to grow logically this session decided the development of the Greentom products should first continue in a base line. Starting with this base layer in their current field, transportation and nursing industry.

Eventually Greentom can grow toward these (linked) markets, but it will need to grow in layers. For example when Greentom would first develop a balance bike or step, they can grow toward toys or even sporting equipment.

As second result the group decided that for product cycle with re-using component it was necessary to have a larger product portfolio. When a company only has one product their modules are limited and new modules will be needed for every other product. When a company has multiple products they are able to switch elements. What is important in such a system is that when designing second or third products they should all maintain a standard dimension and connection. Make them eventually more capable of switching between modules.

Last decision was the project needed focus. Focus more into dept. with the product ideas. The ideas weren't wrong; even a smaller cycle could be found with each of the ideas. For instance the cycle could start from a tricycle and be adjusted toward a balance bike or a step

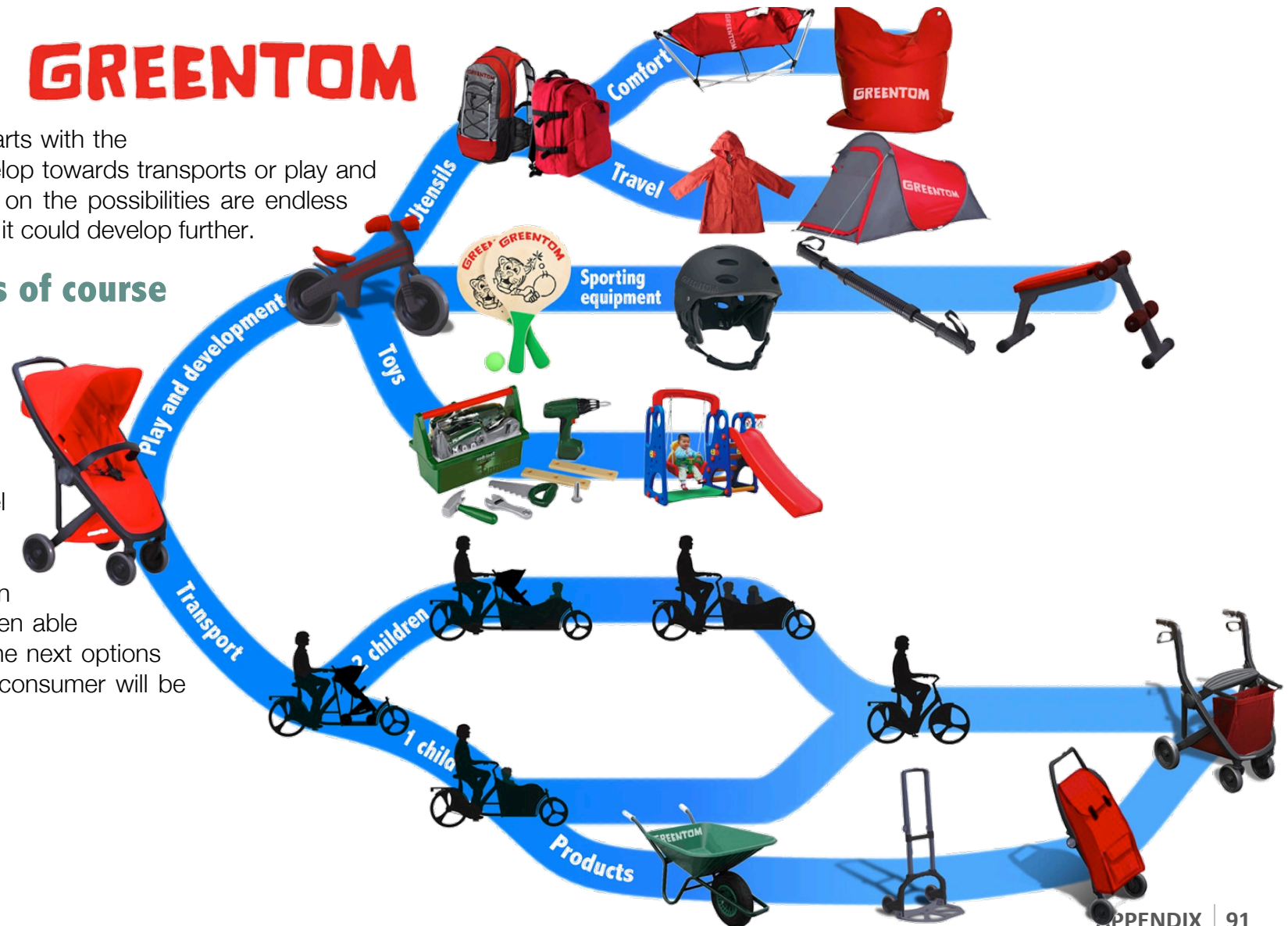
APPENDIX XII. Greentom development line

GREENTOM

GreenTom development line starts with the stroller and has options to develop towards transports or play and development sides. From their on the possibilities are endless and this is just an example how it could develop further.

Eventually the goal is of course again to develop a line from cradle to grave.

When building such a model Greentom can follow it's consumer and sees what path they choose. After a certain amount of time Greentom is then able to provide the customer with the next options in line. It will be likely that the consumer will be interested in these as well.



APPENDIX XIII. Sketches



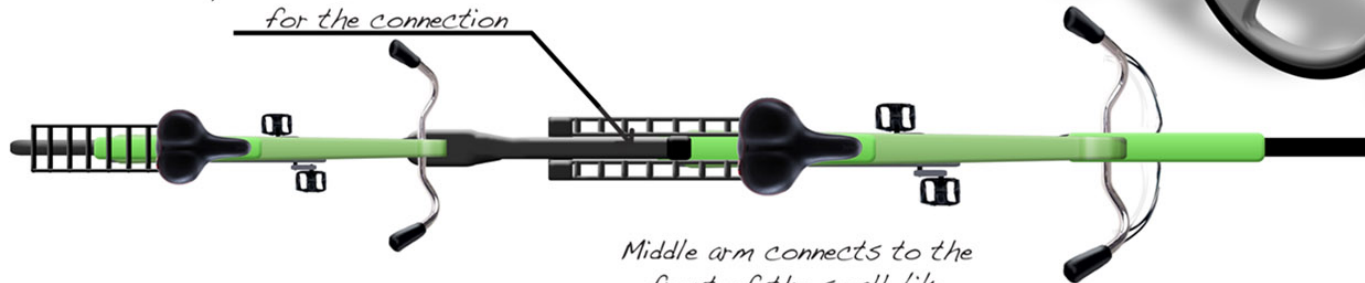
APPENDIX XIV. Concepts

Bike behind

A behind bike is no brand new kind of product, the innovation in this product is made in simplicity of its use. Besides the possibility to use the behind bike as normal child bike it's easily, in two steps, connected to the elderly bike, for example when making longer trips.

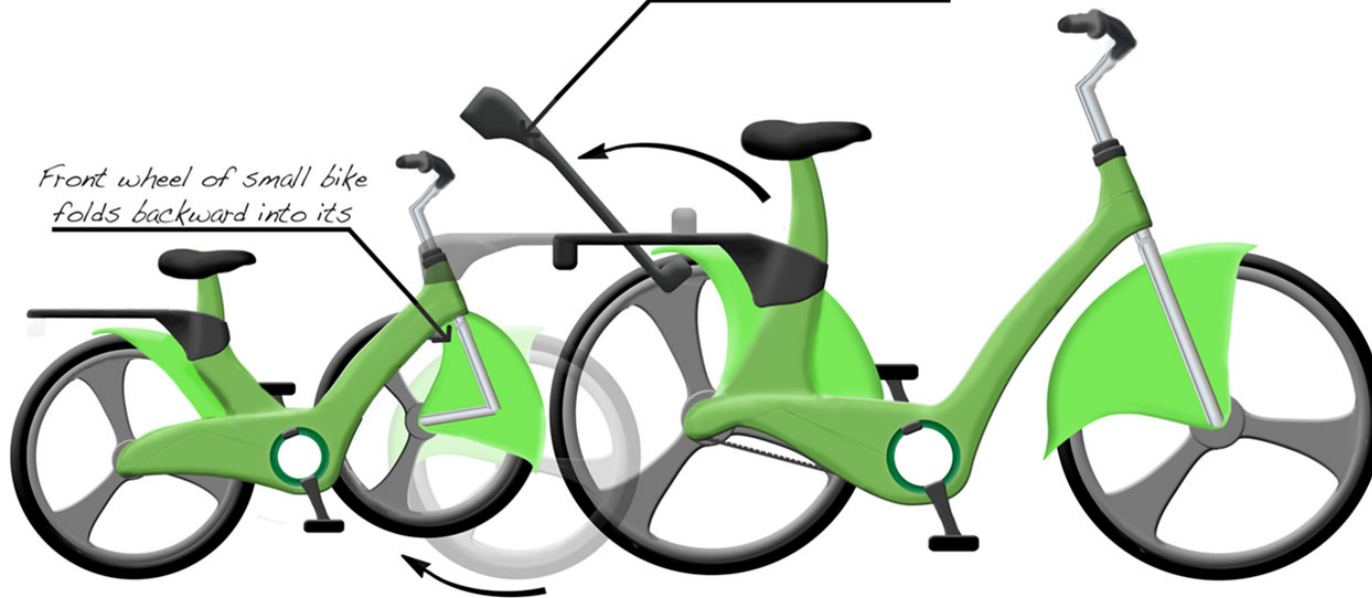


Only the middle (or outer) part of the carrier is used for the connection



Middle arm connects to the front of the small bike

Front wheel of small bike folds backward into its



Fold-it-under

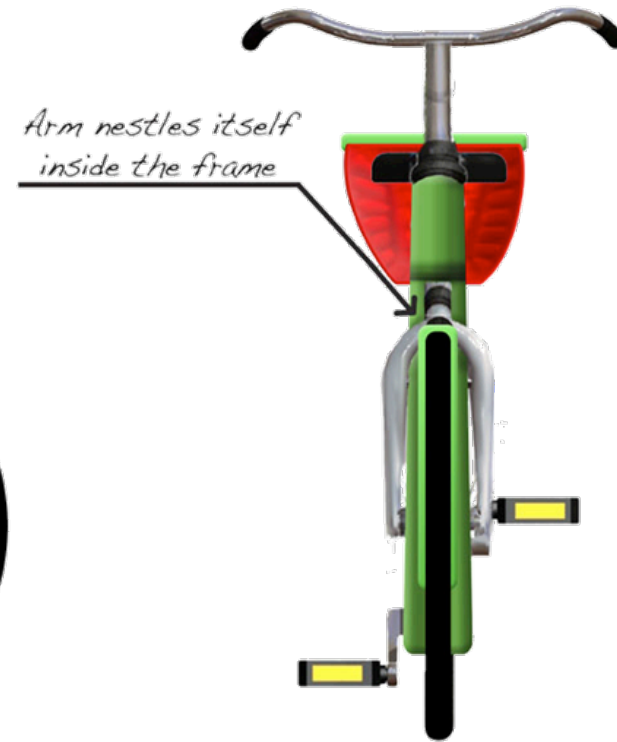
Fold-it-under is incorporated underneath the seat and in the rear part of the frame. In one motion he is pulled from the seat and uncovers the elastic seat. When folding it back the seat spans itself again underneath the saddle.



Fabric elastically unfolds underneath seat

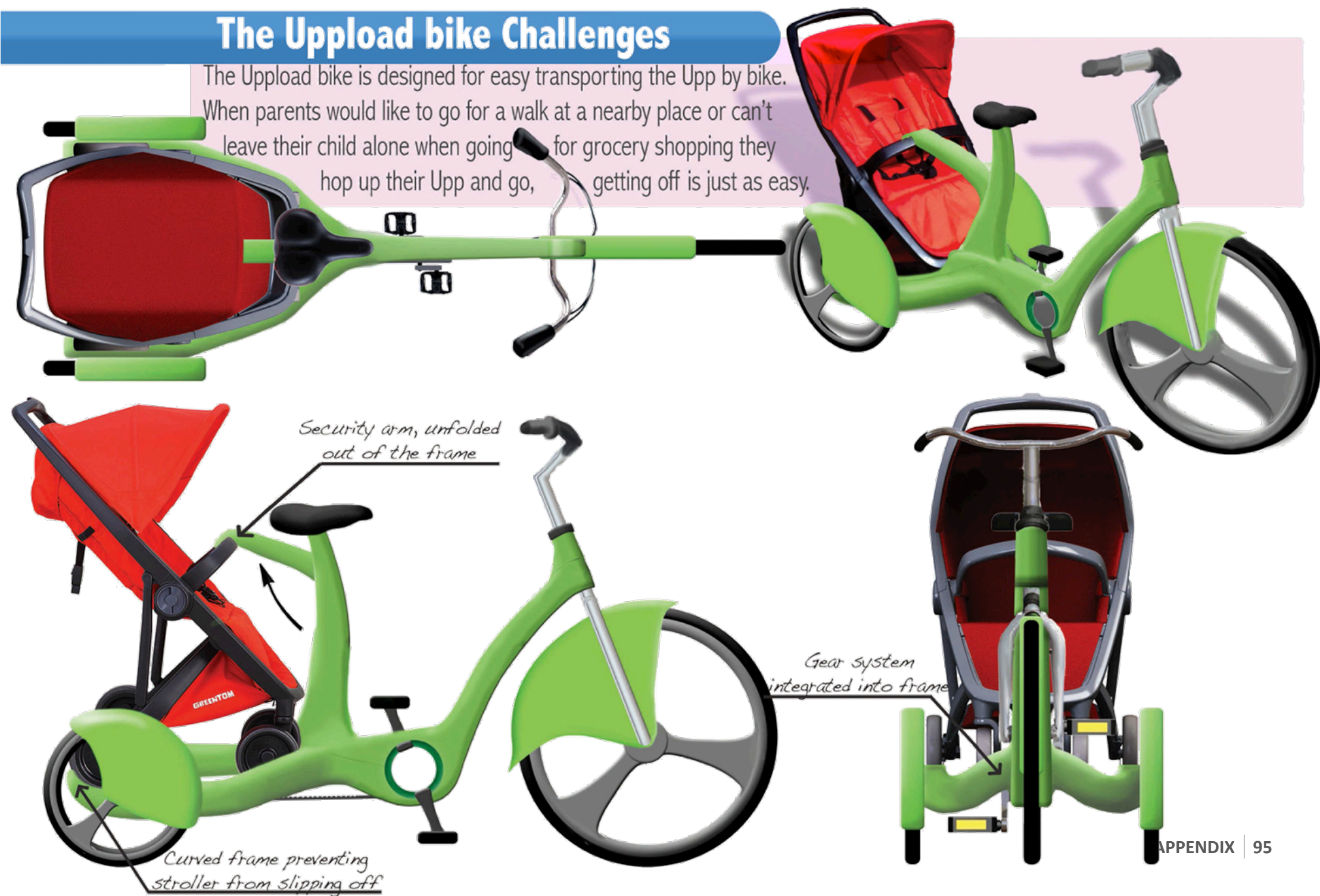


Arm nestles itself inside the frame



The Upload bike Challenges

The Upload bike is designed for easy transporting the Upp by bike. When parents would like to go for a walk at a nearby place or can't leave their child alone when going for grocery shopping they hop up their Upp and go, getting off is just as easy.



APPENDIX XV. Questionnaire - Concepts

Beste ouder(s),
Als eerste heel erg bedankt dat u me wilt helpen met mijn afstudeer stage. Ik studeer industrieel ontwerpen in Delft en voor mij afstudeer stage werk ik bij een bedrijf dat heet GreenTom. Zij willen graag nieuwe producten op de markt gaan zetten, momenteel hebben ze al een 100% milieuvriendelijke kinderwagen en we willen uitbreiden naar een product om je kinderen op de fiets mee te nemen.

Momenteel zijn er een aantal concepten bedacht en waarvan ik graag wil weten wat u ervan vindt. Vandaar deze enquête.
Hij is opgedeeld in drie onderdelen paar vraagjes vooraf om uw fietsgebruik te begrijpen, feedback op de concepten en een paar vraagjes naderhand. Als u op het eind nog verdere feedback heeft stel ik dat zeer op prijs.

Voorbeeld voor invullen van de vragen:

The diagram illustrates the questionnaire's layout with several annotations:

- Typen als vakje geselecteerd is**: Points to a selection box in the first question.
- Tab**: Points to a tab icon with the text "Voor eenvoudig doorgaan naar de volgende vraag gebruik de tab toets".
- Simply click the boxes**: Points to a grid of icons for rating.
- Slecht Neutraal Goed**: A rating scale header.
- Comfortabel**: A rating category.
- Geslacht voor:** A section for demographic information.
- Innovatief Veilig Comfortabel**: A grid of icons for rating different aspects.
- Geslacht voor:** A section for demographic information.
- Algemene indruk**: A section for overall impression.
- Te beschrijven als:** A section for describing the product.

Eerste vraag

Hoe oud zijn uw kinderen momenteel?

Uw persoonlijke fietsgebruik

Waar op de fiets heeft u het liefst de kinderen zitten?

-Click- en eventueel een tweede kind -Click-

Wat neemt/nam u mee op de fiets in combinatie met uw kind(eren)?

Wat is/was de voornaamste bestemming wanneer u met uw kind(eren) op stap gingen (kinderen op dezelfde fiets):

- o Bij reguliere activiteiten?
- o Bij speciale uitstapjes

Hoe vaak fietst u nog met kinderen op de fiets?

-Click-

Mijn grootste ergernis van kinderen meenemen op de fiets:

Het leukste van kinderen meenemen op de fiets:

De bonusvraag:

Zou u meer op de fiets in combinatie met de kinderen willen kunnen indien ja wat en wat belemmerd dat?

The questionnaire started with a few examples of the fill in and how to interpret the questionnaire. After the introduction the questionnaire continued with a few questions to determine if the participants are truly potential Greentom customers.

Then a few questions were asked to find the wishes and irritation from cycling with their children.

In the third part the three concepts were evaluated by number of factors; innovation, safety, comfortable, suited for and general impression.

Finally some questions were asked about the cycling experience of the children themselves. In between where some bonus questions which sometimes lead to some interesting insights.

The question can be found on the right side and the next page and the results can be found on the second next page.

The concepts we presented starting with the name, a short description and at least two pictures. Without giving too much information some simple questions were asked to determine which version was preferred.

Alleen als uw kinderen inmiddels zelf kunnen fietsen:

Tot welke leeftijd brengt/bracht u uw kind(eren) naar school?

Jaar of ☐ nog steeds

Hoe oud was/waren uw kind(eren) toen ze zelf begonnen te fietsen?

Jaar of ☐ nog niet

Hoe oud waren ze toen u ze echt niet meer mee op de fiets nam?

Jaar of ☐ nog niet

Wat was de voornaamste reden dat u ze niet meer mee nam?

-Click-

De bonusvraag:

Overige opmerkingen?

Dit was het einde van de enquête vergeet aub niet het document op te slaan en terug te sturen naar:

gijbsbraanker@gmail.com

Heel erg bedankt

Einde enquête

Concept 1: Bike Behind

Het eerste concept is een aanhang fiets zodat het kind kan mee fietsen. Er bestaan dergelijke vergelijkbare modellen maar dit model focust op het eenvoudig koppelen van de kinderfiets die tevens ook als reguliere fiets te gebruiken is.



Innovatief



Veilig



Comfortabel



Geschikt voor:

Kinderen van leeftijden

Meerdere kinderen

Gebruik zonder kinderen

Algemene indruk



Te beschrijven als:

Concept 2: Fold-it-under

Het tweede concept zit verwerkt in het zadel en achter stuk van het frame van de fiets. De slinger wordt onder het zadel vandaan getrokken en trekt zo een elastisch zijje met zich mee onder het zadel vandaan. Bij het opruimen spant deze zich vanzelf weer onder het zadel.



Innovatief



Veilig



Comfortabel



Geschikt voor:

Kinderen van leeftijden

Meerdere kinderen

Gebruik zonder kinderen

Algemene indruk



Te beschrijven als:

Concept 3: The Upload bike

Als laatste een concept voor het vervoeren van een kinderwagen. De kinderwagen is simpel achterop te zetten en te vergrendelen met een arm die in het frame zit verwerkt. Hierdoor is bijv. bij het boodschappen doen de wagen snel op de fiets te zetten en mee te nemen.



Innovatief



Veilig



Comfortabel



Geschikt voor:

Kinderen van leeftijden

Meerdere kinderen

Gebruik zonder kinderen

Algemene indruk



Te beschrijven als:

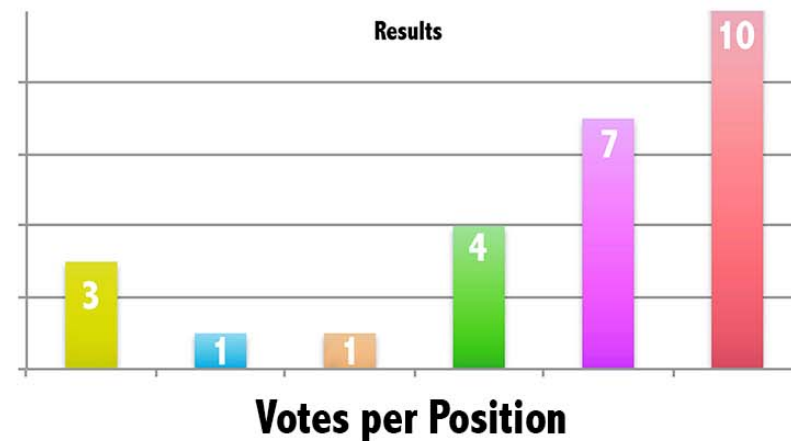
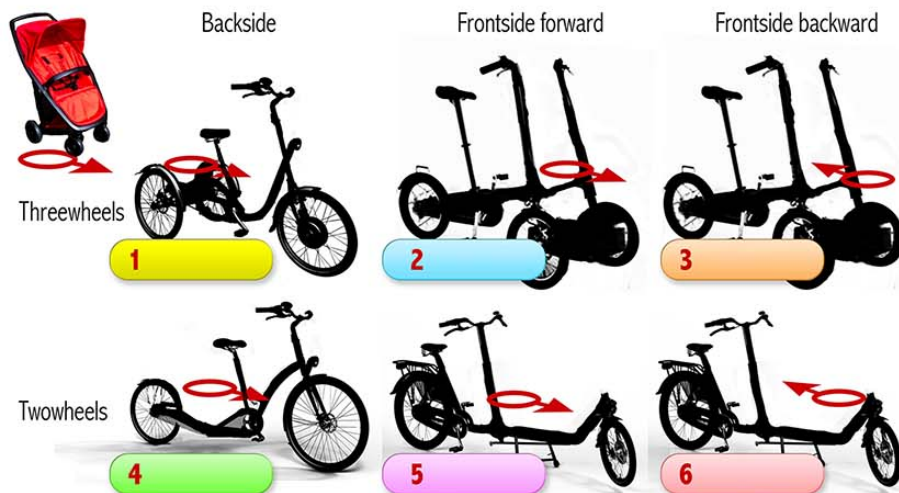
					Hoe kinderen mee nemen		Voornaamste bestemming	Bonus vraag	Concept 1							Concept 2																				
					eerste kind	tweede kind Other thing in combination			Regulier	Speciaal	Zou u meer op de fiets willen	Innovatief veilig	Comfortabel	Vanaf leeftijd	Tot leeftijd	meerdere kinderen mogelijkheid	Gebruik zonder kinderen	Algemene indruk	Overig	Innovatief veilig	Comfortabel	Vanaf leeftijd					Tot leeftijd	meerdere kinderen mogelijkheid	Gebruik zonder kinderen	Algemene indruk	Overig					
Anita	f	22, 18, 15, 5	0,167	11 year			School	a cycling day	Ja		4	4	4	4	Nee	Ja zou wel 1 kunnen	4	4		4	3	3	0,3	Nee	1	Misschien	2	4		5	5	5	0,167	Ja zou kunnen		
Astrid	f	2	0,75	5 year			School	Park/kindergronden	Ja		4,5	3	3	4	Ja met toevoeging	Ja zou wel 3 kunnen	4	4	Dat beide fietsen los te gebruiken zijn vind ik een goed idee. Maar toch zou ik het concept niet snel aanschaffen	5	2	2		5	Nee	Ja zou wel 1 kunnen	4	3	De vorm van het stoeltje lijkt niet veilig. Leuk licht concept, maar alleen voor grotere kinderen & op rustige wegen	5	2	4	0,5	4	toevoeging	
Daria	f	2	6	11 year			Boodschappen doen, markt, groenteboer, bakker	Een park of een zwembad			2	3	4	3	4	Nee	Ja zou wel 1 kunnen	4	Goed voor een paar jaar, maar kind moet ook zelf naast je leren fietsen!	5	3	3	4	5	Nee	Ja zou wel 1 kunnen	4	4		4	4	4	0	3	toevoeging	
Desidera	f	1	1,5		een buggy fietstassen, kinderzitje en handtas	de stad om te winkelen en supermarkten voor de kleine boodschappen	op visite	eigenlijk best tevreden nu			5	4	4		Ja zou wel kunnen	4	Misschien	2	4	Meerdere functies in 1	5	3	4		Misschien	Ja zou ik 2 doen	5	3		5	4	5	1			
Emilie	m	3	6 and 6	2 year	boodschappen eten luiertas daypack	winkelcentrum	speeltuin en merwelanden				4	3	3	6	Ja met 7 toevoeging	Ja zou ik 3 doen	5	4	volwaardig gebruik bestaat al: aanhangfiets, gebruiken wij al jaren. Er is ook een systeem waar je een gewone kinderfiets aan vast kunt haken zodat er geen aparte fiets aangeschaft hoeft te worden. Aanhangfiets werkte voor ons ideaal.	4	2	2	4	5	Nee	Ja zou wel 1 kunnen	4	2	Onduidelijk functionaliteit 2 irt dimensies	4	4	4	1	5	Ja zou kunnen	
Genarda	f	2	5	8 year	Bagagedrager	School/visite	rondje bos				2	5	4	3	5	Nee	1	Nee	1	3	4	2	2	1,5	Nee	Ja zou ik 1 doen	5		2	Je hem kunt invouwen!!	4	1	2	0	Misschien	
Kim	f	1	0,167		Boodschappen						3	3	3	5	8	Nee	1	Nee	1	3	5	2	2	0,2	0,6	Nee	Ja zou wel 1 kunnen	4	3	ik denk dat het voor een baby is en dan lijkt het mij niet zo veilig. Ziet er uit als een wiegje en hoe zit het kind vast? Wat als je fiets omvalt? Wegvouwen is vernuftig, dan kan de bagagedrager ook voor groter kind/boodschappen gebruikt	5	5	5	0	5	Ja zou doen
Lennard	m	3	3	5, 10 year	boodschappen bouw/tuinmateriaal camper	Boodschappen	Camperen				1	1	2	6	9	Nee	Ja zou wel 1 kunnen	4	instabiel en gevaarlijk en kind krijgt 2 rare balansgevoel op de fiets	4	1	3	0	2	Nee	Ja zou wel 1 kunnen	4	2	boodschappen gebruikt	4	4	4	1,5	8	Ja zou doen	
Louise	f	2	1	5 year	tassen	werk/ school	recreatie				3	5	4	4	Nee	Ja zou wel 1 kunnen	4	2		5	2	3	4	Nee	Ja zou ik 1 doen	5	2		5	5	4	0	Nee			
Manuela Maaike	f	2	2	4 year	luiertas boodschappen handtas buggy en mandje	Supermarkt visites en gezellige fietstochtjes Bij het boodschappen doen	kinderboerderij, speeltuin				4	3	3	4	8	Misschien	Ja zou ik 2 doen	5	3		2	2	2	4	9	Nee	Ja zou wel 1 kunnen	4	2		3	4	3	0	6	Ja zou doen
	f	2	7	14 year		doen	Soms	nee			4	4	4		8	Mischien	2		4	kan wel handig zijn	5	5	5		6	Misschien	2	Nee	1	5	Praktisch		5	Nee		

Concept 3				Welk uitstapje				Bonus vraag	Wanneer gaan kinderen zelf fietsen?				Bonus vraag
Levensduur Tot leeftijd meerdere kinderen mogelijkheid	Gebruik zonder kinderen	Algemene indruk Overig	Boodschappen Recreatie fietstocht op locatie kinderen wegbrengen Belangrijke aspecten	Slecht aan de ideeën	Grootste ergernis van kinderen op de fiets	Het leukste van kinderen op de fiets	Naar school brengen tot Zelf beginnen Heldemaal zelf Reden	overige opmerkingen					
Ja zou wel kunnen	4 Misschien	1	5 Geweldig idee	3 3 3 3	Functioneel en veilig	Het verkeer in de gaten houden Ze de omgeving laten zien	4 7	Werd te zwaar	Meerdere kinderen op/aan een fiets en (boodschappen-)tassen is wat ik wens, De bakfiets vervuld die wens voor ,mij prima, het nadeel is dat ik geen normale kinderwagen kan meenemen.				
Ja met 4 toevoeging	Ja zou ik 3 doen	5	Superhandig idee, Zou ik zo aanschaffen, maar hoe veilig is het in een kinderwagen zit 5 geen veilig frame.	3 3 1	Waar laat ik andere kinderen en tassen	de grote onhandige maxicosi en gebrek aan kinderwagen Dat ik niet flexibel genoeg was om nog goed overzicht te houden Lekker buiten gezellig samen op de fiets/ overal parkeren	4	Was niet meer nodig ze konden zelf fietsen					
Ja met 3 toevoeging	3 Nee	1	4 een hele investering in een drie-wieler! Het schijnt dat de afgelopen tijd een babyboom van meerlingen plaats heeft 4 gevonden.	3 1 2 2	Veiligheid	Relatieve vrijheid en snelheid van het bewegen in vergelijking met achter de buggy lopen De beleving van fietsen. Ze geniet echt van alles wat ze ziet. En mijn fiets zit voor beide erg comfortabel.	7 3 5	Was niet meer nodig ze konden zelf fietsen					
Ja zou wel 5 kunnen	4 Nee	1	Reisbak = praktisch ik zou met de fiets alleen niet op pad gaan dus is extra te 4 stallen moet een speciale fiets voor worden aanschaf, deze fiets lijkt op een invalidefiets. jonge kinderen kunnen op deze manier worden vervoerd. Kinderen van een paar maanden oud moeten tegen het verkeer in worden vervoerd: met rug de 2 andere kant op (nieuwe voorschriften)	3 1 1 1	Veiligheid	Een kinderhelm vind ik ook irritant voor haar. Zeker in de zomer met de hitte In de buitenlucht genieten met elkaar van de omgeving	5	Op de aanhangfiets gaat de jongste (5 jaar) soms nog als we een eind gaan fietsen. Maar de reguliere fietstochten fietsen ze zelf vanaf 4 jaar. Soms is het wel even peentjeszweten door de andere verkeergebruikers..... auto's rijden hard en kinderen blijven onvoorspelbaar.					
Misschien	2 Nee	1		3 1 3 2	Veiligheid	Zwaarder fietsen	3 4						
Ja zou ik 5 doen	5 Misschien	1	5 functioneel en veilig	3 3 3 3	Functionaliteit of het praktisch bruikbaar is de gebruiksduur van het product en de veiligheid	Je kan minder boodschappen/spullen meenemen op de fiets met kinderen erbij							
Ja zou ik 8 doen	Ja zou wel 5 kunnen	4	3 Tuctuc/riksjagevoel zou sterker kunnen, dan vind ik het hip (grotere laadbak oid) Anders is het een 3wielers voor volwassen alleen voor mensen met een handicap. Om een fiets speciaal bij een buggy te kopen gaat mij te ver.	3 3 3 2	gerbruiksgemak (multifunctionaliteit) en veiligheid	Instabiliteit fiets, naarmate ze groeien moet je weer een ander (duur, want veilig) zitje het balanceren tussen je spullen op de fiets krijgen en je kind op de fiets zetten	7 3						
Nee	Ja zou ik 1 doen	5	5	3 3 3 2	Veiligheid Of dat het er een beetje veilig uitziet, of dat het voor mij haalbaar is om ergens te plaatsen, en of dat het de design en praktisch	genieten van de natuur en de vrijheid	3						
Ja zou ik 6 doen	Ja zou ik 5 doen	5	3	1 3 3 3		Buggy meenemen en dat het zo verschrikkelijk zwaar is! Een beetje moeder fiets is al heel zwaar, twee kinderen er op en dat nog de nodige extra tassen etc. maakt het heel erg zwaar	4						
5 Nee	1		ietswat ingewikkeld	2 1 3 2	niet slecht	de veiligheid het plezier wat ze eraan beleven							

APPENDIX XVI. Questionnaire - Positions

	Children			Bicycle transport		Own perception		Visual choices		Bucket development into cargo bike	
	Amount	Jongest age	Other ages	Current	Ideal	Where would you place it	Would it help you	Which option	Why	Change of choice?	Number
1	2	2	4	Front and behind	Cargo bike	Front	Yes	6	Prefer to be able to see their child and better against weather conditions	No difference	5
2	2	8	11	Front and behind	Trailer	Behind	Yes	6	Would prefer to be able to see their child	No difference	
3	1	2		Front		Behind	Yes	4 of 5	5 seems safer but 4 would fit better in the shed	Rather at the front in that case	
4	3	1	3 en 7	Cargobike		Front		5 en 6	You want vision on young children and older children want to look forward.	Maybe than 1 because of the comfort	1
5	1	3		Behind			Not at the moment	1	More stable and better view on the traffic	No not for me	
6	1	3		Behind	Nothing different		Not really only use the stroller incidentally	4	Behind feels more stable and safe plus uploading takes less trouble.	I prefer not, don't want to be associated with cargo bike. Rather a bike as normal as possible	
7	1	0,7		Not yet	Front seat		Yes I think so	6	This version allows to let them watch you what makes it more personal	Would be nice so no difference	
8	1	4		Behind	Cargo bike		Never thought about it	5 en 6	From a certain age you want to swich and let her look forward plus this version is smaller than the three wheel bikes.	Don't want it because then it get so heavy	
9	1	5		Himself			Maybe	4	Behind the bike feel a lot more safe	No difference	
10	2	3	6	Behind and self		Front	Yes I think so	3	Stability and this way I can best communicate with my child	Yeah I would like it better that way	
11	1	2		Behind	Cargo bike		Probably maybe, I usually only use the stroller	6	Better against weather conditions		
12	1	0,5		Not yet	Front seat	Front	No, i have more than one child	5 en 6	Would like to be able to choose forward or backward	No difference	
13	3	0,5	4 en 6	Front and behind	Cargo bike		Never thought about it	1	Safer better view upon the traffic	Yeah maybe	5
14	1	1		Front			Yes	4	I don't want a three wheel bike but behind feels safer		
15	1	2		Behind	Cargo bike		Yes	1	I guess this is the safest place on the bike like I said before.	can the bucket be placed on the back?	
16	2	0,3	4	Not yet	Front seat	Behind	Don't know	5 en 6	Sometime I want to communicate other times its sightseeing	No difference	
17	2	1	3	Front and behind	Trailer	Behind		5 en 6	In front of the bike feels safer to me	No difference	
18	2	1	3	Front and behind	Trailer	Front	Maybe	5	Would prefer to be able to see their child	No difference	
19	1	3		Trailer			Would like to try	2	seems like the most stable version	Wouldn't want it it would become a dull bike	
20	2	2	5	Trailer		Front	I prefer a trailer	6	Two wheels are smaller and easier/lighter to ride plus I want to see my child	No difference	

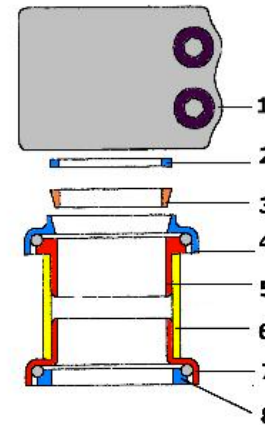
How and with what type of bike would you prefer to carry this stroller?



Note there may be assumed that the stroller fits and is safe approved.

APPENDIX XVII. Headsets

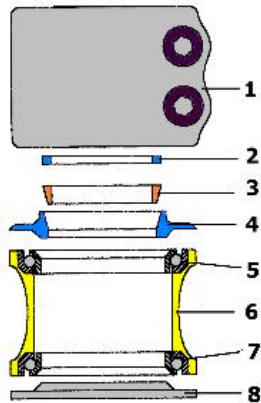
The interchangeability depends on the version of the headset. A classic ball head, here are two cups with bullets inside two conical, top and bottom who thus blocking each other. This version is thus a loose pin that you can set loose and can switch.



Draadloos (Ahead) balhoofdstel

- 1= stuurpen
- 2= tussenring
- 3= wig
- 4= bovenste stelcup
- 5= bovenste ingeperste conus
- 6= frame
- 7= onderste ingeperste cup
- 8= vorkconus

De speling wordt afgesteld door de stuurpen verder naar beneden te duwen getekende-centrale bout) en weer vast te zetten

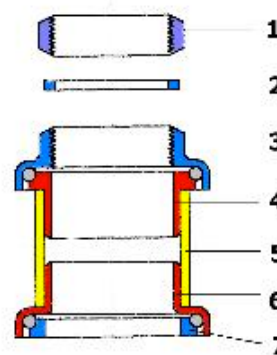


Geïntegreerd balhoofdstel

- 1= stuurpen
- 2= tussenring
- 3= wig
- 4= bovenste stelcup
- 5= lager cartridge
- 6= frame met getrapte boring voor de lagers
- 7= lager cartridge
- 8= vorkconus

De speling wordt afgesteld door de stuurpen verder naar beneden te duwen getekende-centrale bout) en weer vast te zetten

Or the headset version. This one seems using the same ball bearings. Yet it's just much lighter, easier and quicker to exchange because the front fork comes out entirely. This system is commonly used in mountain- and racing bikes.



Conventioneel balhoofdstel

- 1= borgmoer
- 2= tussenring
- 3= bovenste cup met schroefdraad
- 4= ingeperste bovenste conus
- 5= frame
- 6= onderste ingeperste cup
- 7= vorkconus

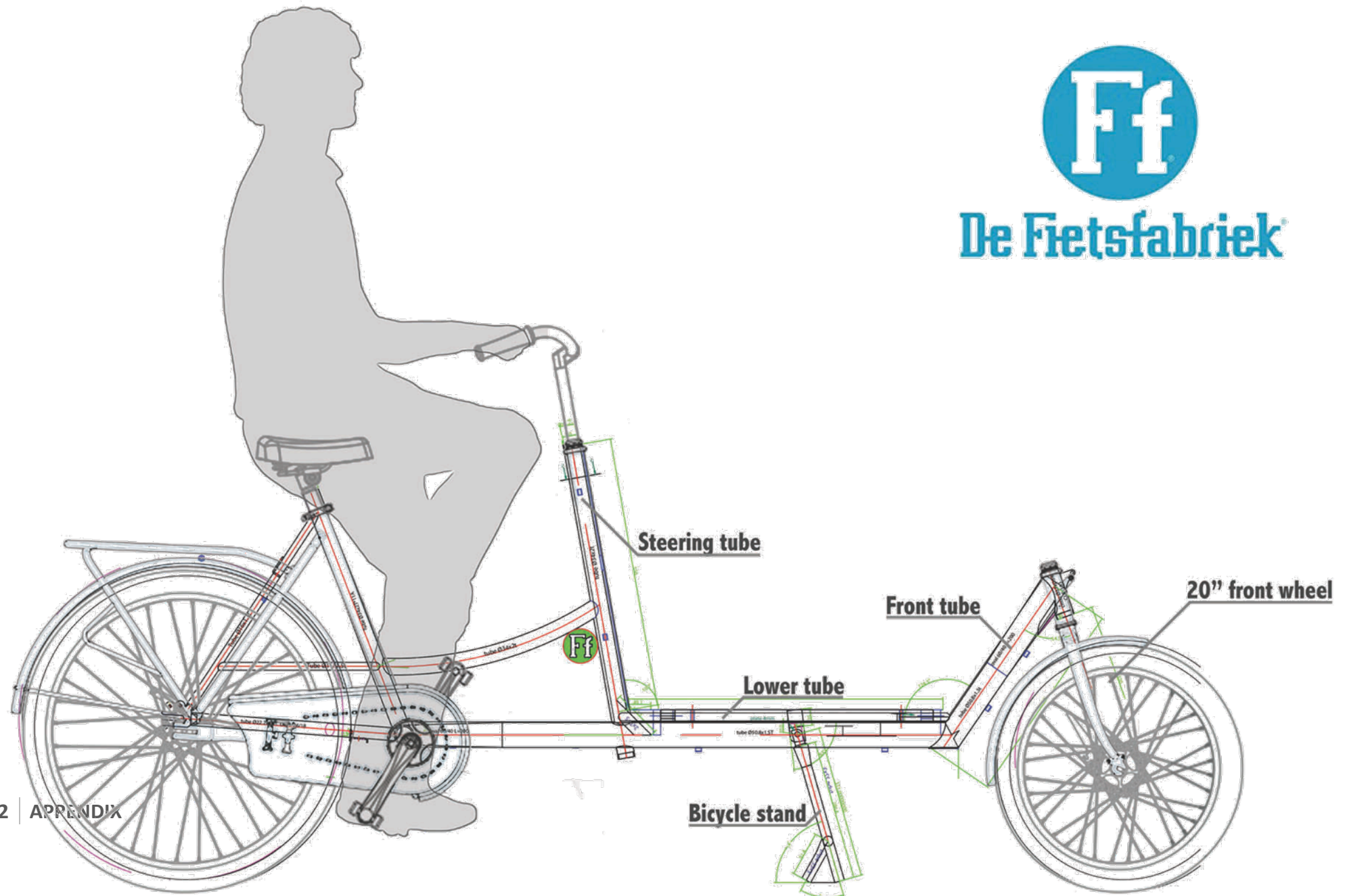
Source: <http://www.m-gineering.nl/balhoofd.htm>

Source: Bike repairmen at bike totaal

APPENDIX XVIII. Cargo bike

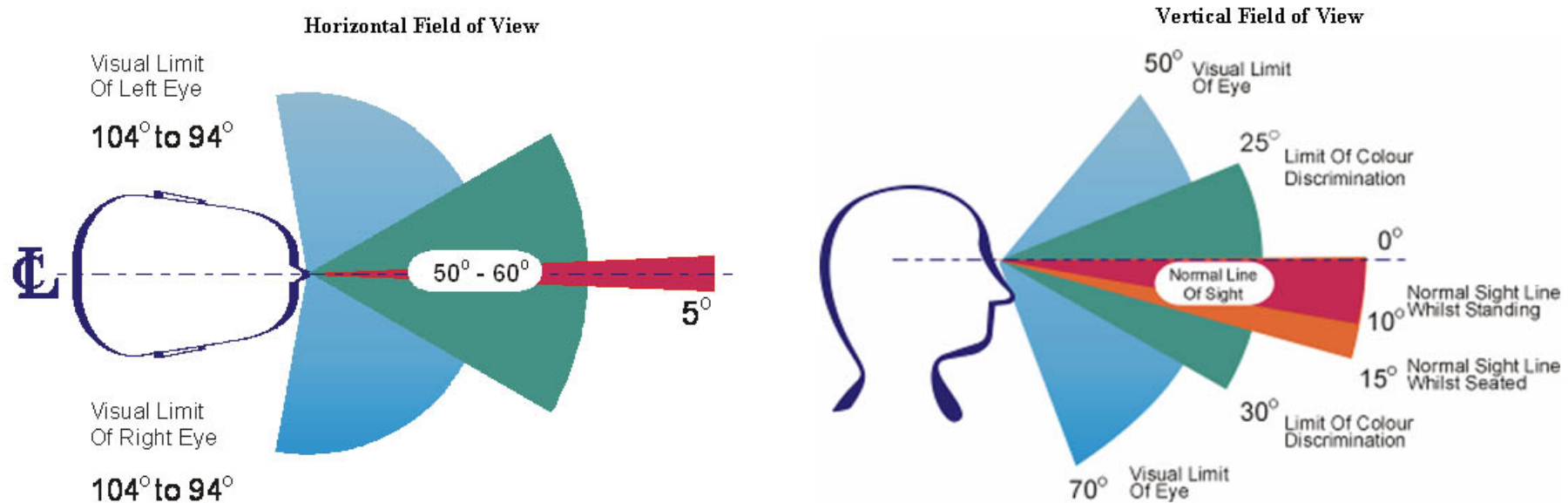


De Fietsfabriek



APPENDIX XIX. Eye sight

The visual limit of the eye is simplified in two fields the horizontal and vertical. For this project the limit was set on the limit of color discrimination. Reason for this is when someone is riding the bike most of the time you will only look forward. Most eye movement you will make is only in the horizontal field; in this field there is no obstruction from the stroller. Therefore limiting to the limit of color discrimination will be sufficient.⁴⁸



Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	FIGURES 10. 21 AND 10.22
Client:  CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer:  Halcrow China Ltd.  Environmental Resources Management as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

⁴⁸ http://www.epd.gov.hk/eia/register/report/eiareport/eia_1402007/For%20HTML%20version/Section10.htm

APPENDIX XX. Context Mapping

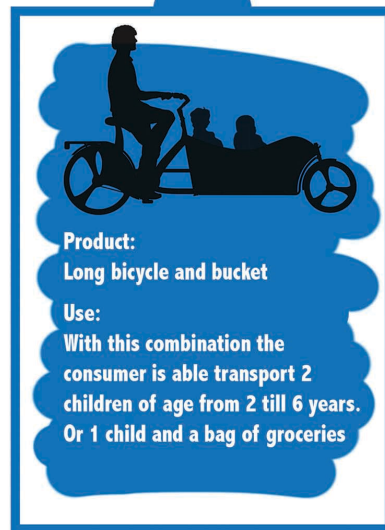
Family



Family



Product use



Here are all cards displayed that were used for the context mapping. The cards have four categories; Personas, Environment, Scenario and Product use. By creating logical combinations a product use could be chosen. Giving insight when which version for what task would be the best combination.

The family cards were created based on the life analysis to some average families and some variations on that. The families got a second card as well; this card showed them three years later.

There were three type of environments available, one family living in the big city Amsterdam, one in an average city Delft and one in a village.

The scenarios were normal day jobs, like going to the groceries or visiting friends for dinner. They included location (mapped) and time.

As product use all possible standard combinations were made for the first step of the cycle. Later this context mapping could include a three-wheel cargo bike as well for example.

Family



Family van Engelen:
Ruben (35, Entrepreneur)
Anja (33, mom)
-Max (5)
-Benjamin (2)
Family wish: More into the city

Environment



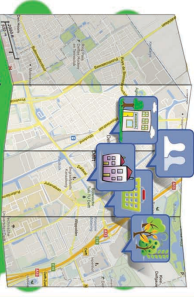
Home
Best friends - 4 Km
Park forest - 4,5 Km
School - 2 Km
Shopping centre - 1,5 Km

Family



Family van Engelen:
Ruben (32, Entrepreneur)
Anja (30, mom)
-Max (2)
Family wish: Second child

Environment



Home
Best friends - 2 Km
Park forest - 3 Km
School - 1,5 Km
Shopping centre - 1 Km

Scenario

Task:
Visiting friends for dinner
with the kid(s)

Location:
Friends house

Time:
17:30 - 20:30



Product use



Product:
Short bicycle and bucket

Use:
Transporting 1 child from 2 till 6
years old and possibly some
groceries. Or 2 small children.

Scenario

Task:
Doing groceries with children

Location:
Shopping centre

Time:
10:00 - 11:30



Product use



Product:
Stroller

Use:
For transporting a child from
6 months till 3 years old.

Family



Family Korenmolen:
Jasper (31, Aerospace engineer)
Kim (29, mom)
-Gonneke (4)
Family wish: Bigger house

Scenario



Task:
Bringing the child(ren) to
school and do the groceries
shopping.

Location:
School and shopping centre

Time:
8:30 - 10:00

Product use



Product:
Long bicycle, bucket and stroller

Use:
With this combination the
consumer is able transport 2
children of age from 6 months till
3 and from 2 till 6. Or 1 child and
a bag of groceries

Family



Family van Engelen:
Ruben (32, Entrepreneur)
Anja (30, mom)
-Max (2)
Family wish: Second child

Environment



Home
Best friends - 2 Km
Park forest - 3 Km
School - 1,5 Km
Shopping centre - 1 Km

Scenario

Task:
Doing groceries with children

Location:
Shopping centre

Time:
10:00 - 11:30



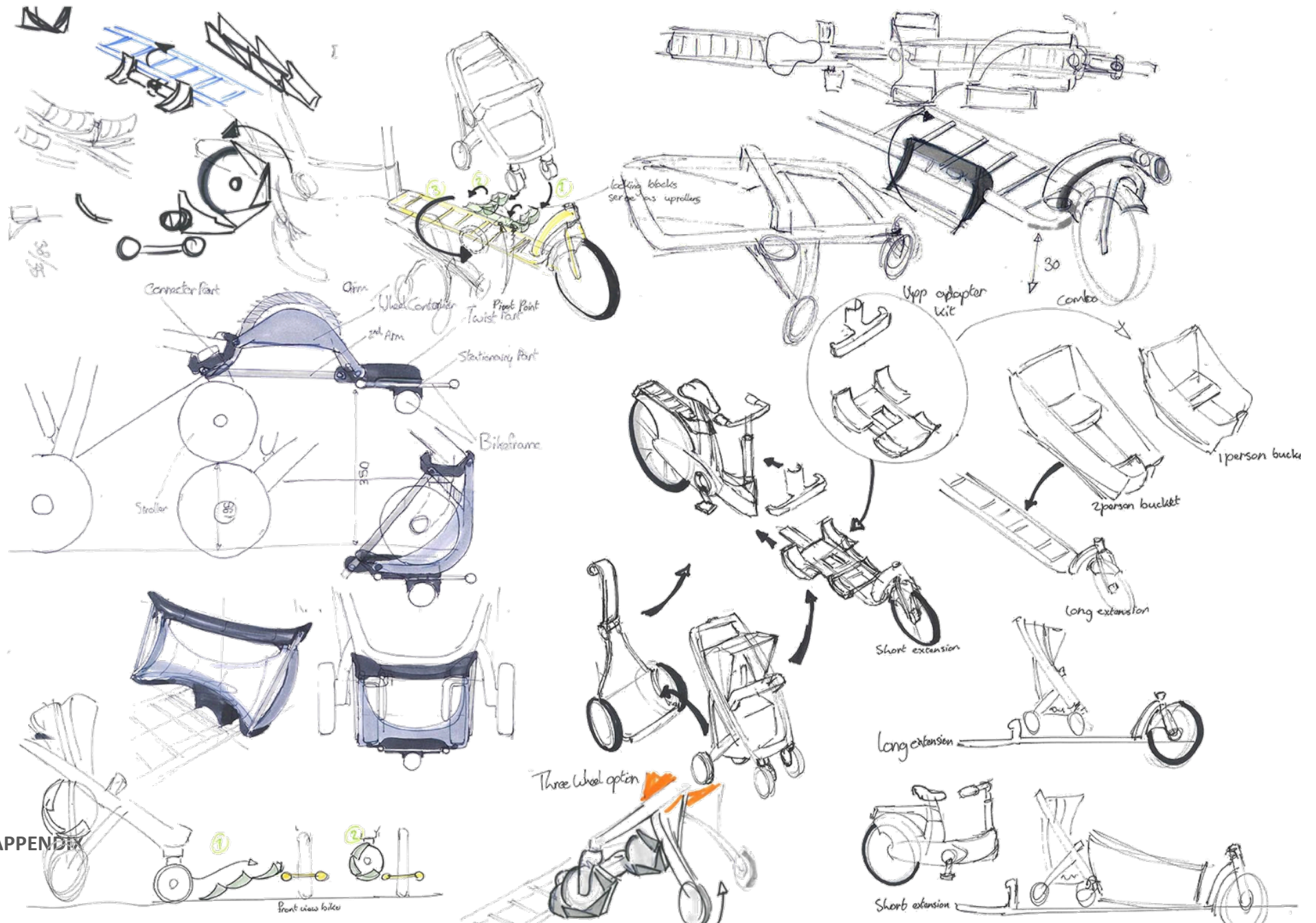
Product use



Product:
Stroller

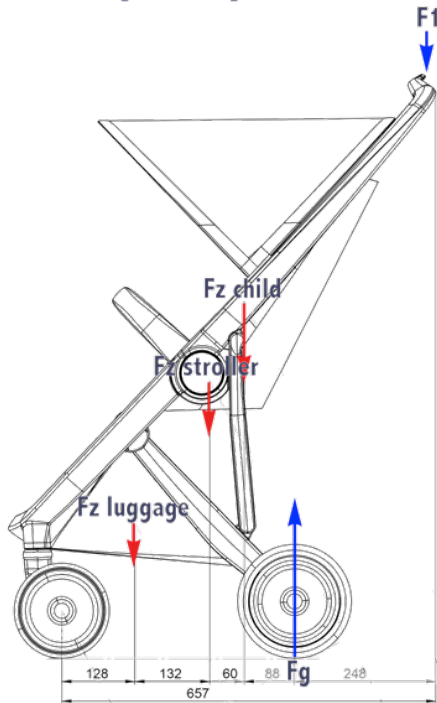
Use:
For transporting a child from
6 months till 3 years old.

APPENDIX XXI. Sketches



APPENDIX XXII. Uploading the stroller

Step 1: flip the stroller



$$F_1 = (F_z \text{ child} \times 88 + F_z \text{ stroller} \times (60+88) + F_z \text{ luggage} \times (132+60+88)) / 248$$

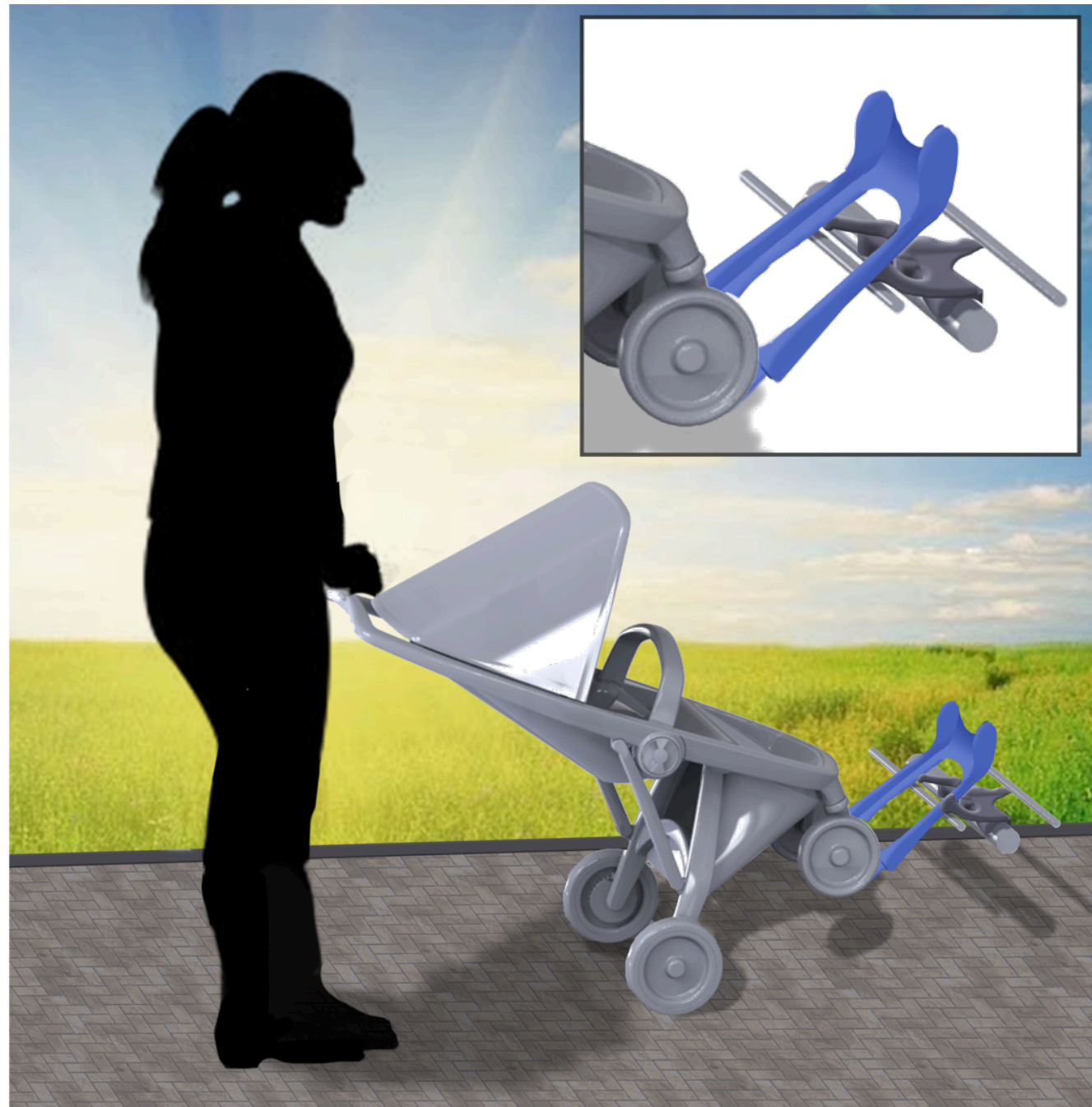
$$F_z \text{ child} = 150\text{N}$$

$$F_z \text{ stroller} = 73\text{N}$$

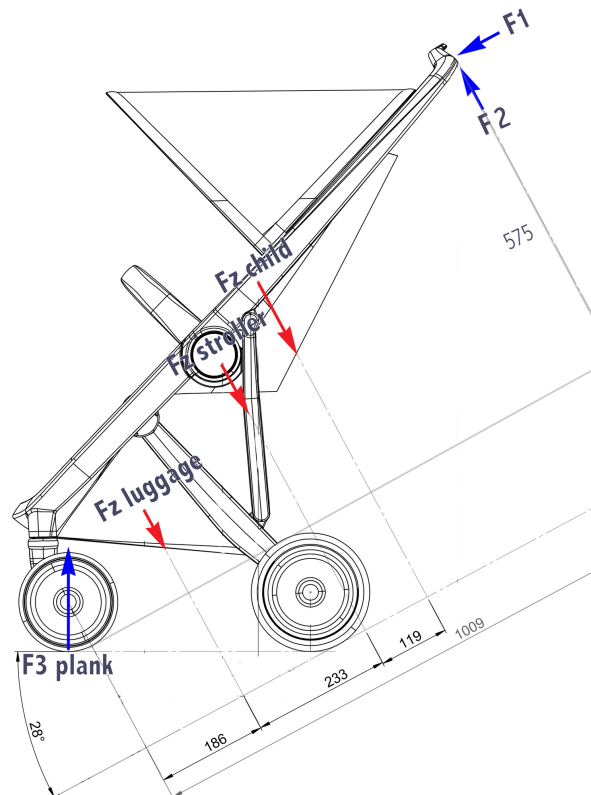
$$F_z \text{ luggage} = 25\text{N}$$

$$F_1 = (150 \times 88 + 73 \times 148 + 25 \times 280) / 248$$

$$F_1 = 125\text{N}$$



Step 2: Roll up the stroller



$$F1 = (Fz l + Fz s + Fz c) \times \tan(28,19)$$

$$F2 = (Fz l \times 538 + Fz s \times 419 + Fz c \times 186 - F1 \times 575) / 1009$$

$$F3 \text{ plank} = (Fz \text{ luggage} + Fz \text{ stroller} + Fz \text{ child} - F2) \times \cos 28,19 + F1 / \sin(28,19)$$

$$Fz \text{ child} = 150N$$

$$Fz \text{ stroller} = 73N$$

$$Fz \text{ luggage} = 50N$$

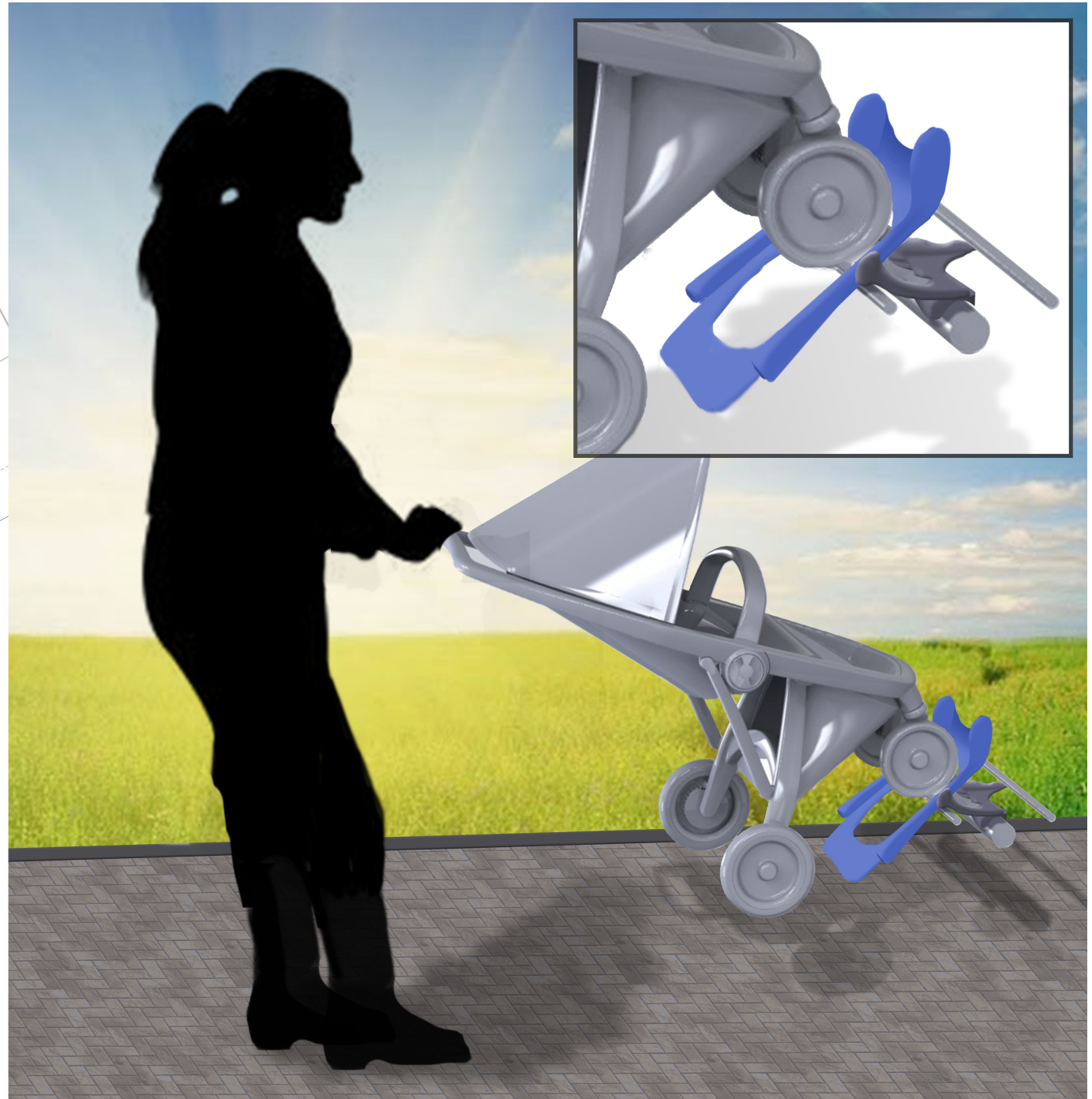
$$F1 = 273 \times \tan 28,19 = 146N$$

$$F2 = (150 \times 538 + 73 \times 419 + 50 \times 186 - 146 \times 575) / 1009 = 36N$$

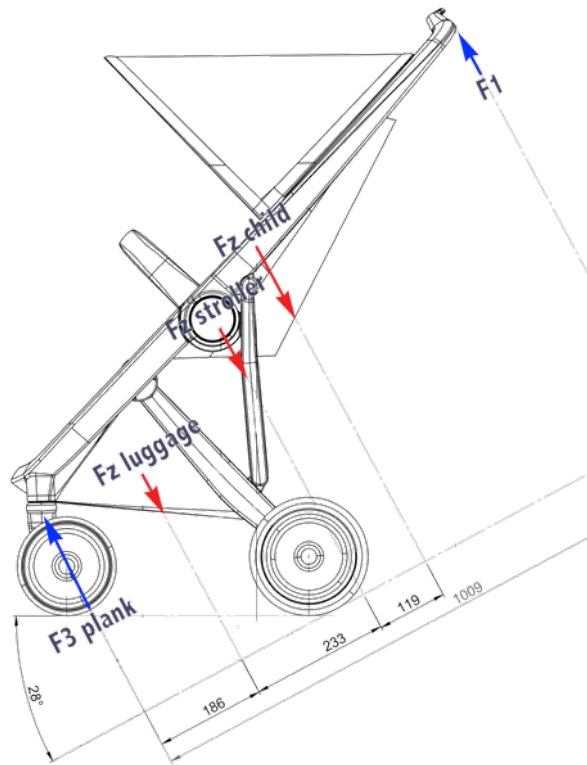
$$F3 \text{ plank} = (273 - 120) \times \cos 28,19 + 146 / \sin 28,19 = 520N$$

$$F_{\text{eval}} = \sqrt{F2^2 + F1^2} = 151N$$

$$\text{Female two hand push } P10 = 218N$$



Step 3: Seesaw flips



$$F1 = (Fz C \times 538 + Fz S \times 419 + Fz L \times 186) / 1009$$

$$F3 \text{ plank} = Fz \text{ child} + Fz \text{ stroller} + Fz \text{ luggage} - F1$$

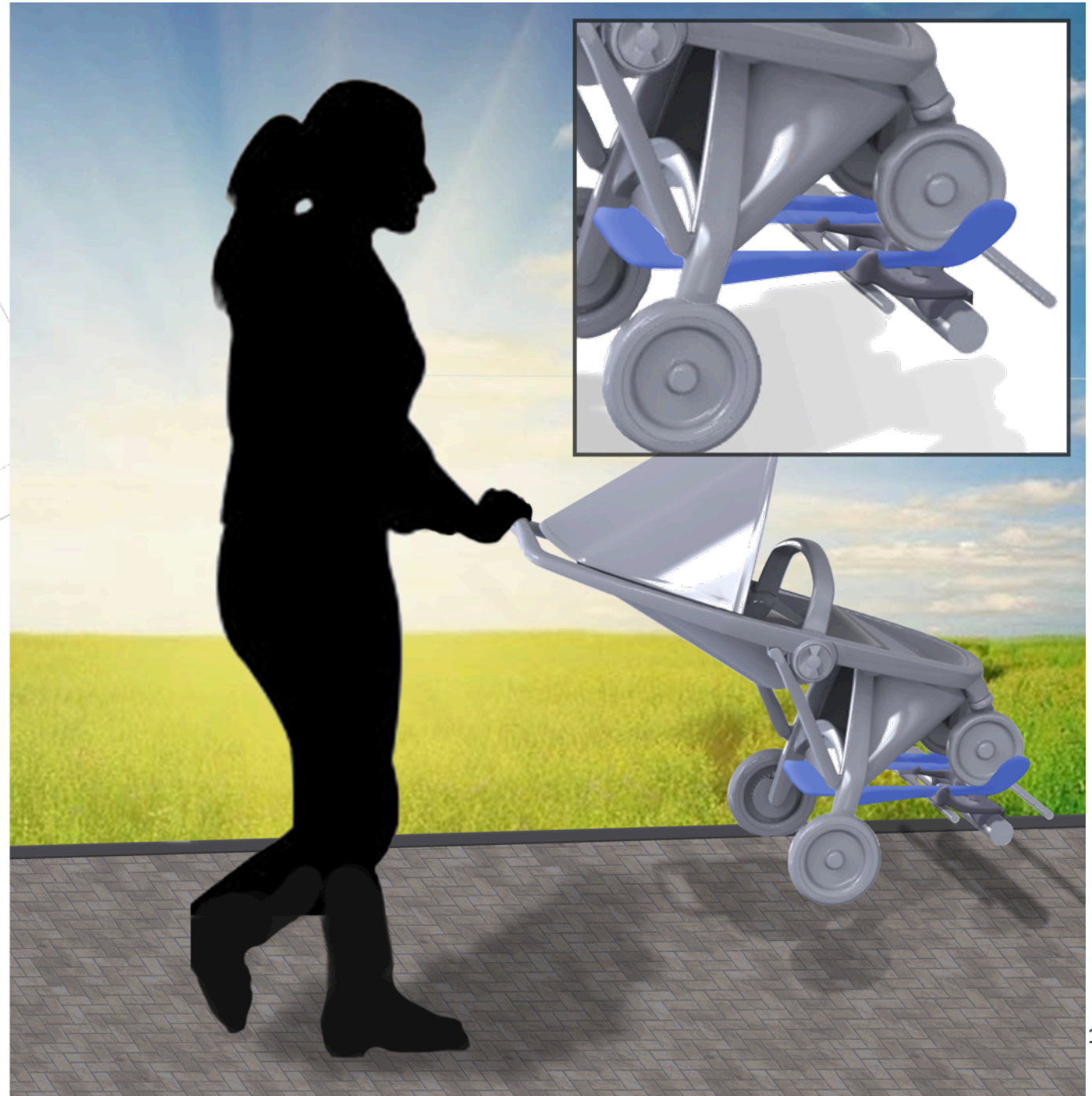
$$Fz \text{ child} = 150\text{N}$$

$$Fz \text{ stroller} = 73\text{N}$$

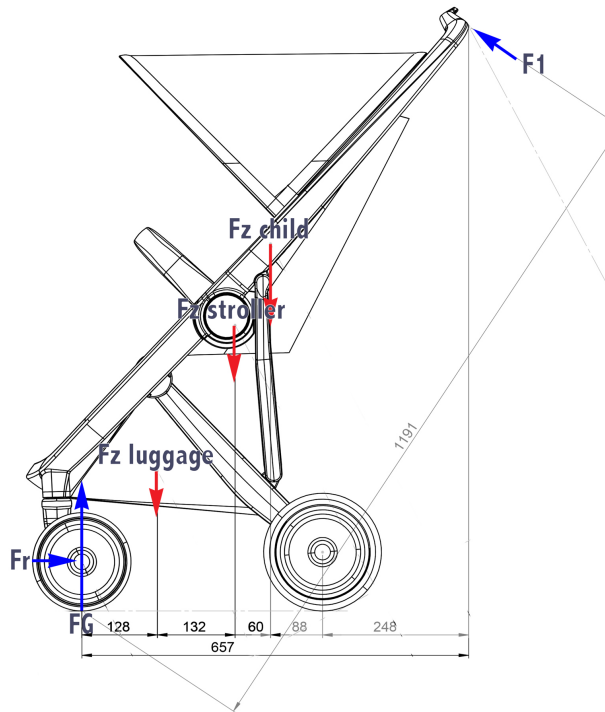
$$Fz \text{ luggage} = 50\text{N}$$

$$F3 \text{ plank} = 150 + 73 + 25 - 71 = 177\text{N}$$

$$F1 = (150 \times 538 + 73 \times 419 + 50 \times 186) / 1009 = 120\text{N}$$



Step 4: Elevate stroller



$$F1 = (Fz l \times 128 + Fz s \times 260 + Fz c \times 320) / 1191$$

$$Fg = Fz \text{ child} + Fz \text{ stroller} + Fz \text{ luggage} - \sin(36,45) \times F1$$

$$Fr = \cos(36,45) \times F1$$

$$Fz \text{ child} = 150N$$

$$Fz \text{ stroller} = 73N$$

$$Fz \text{ luggage} = 50N$$

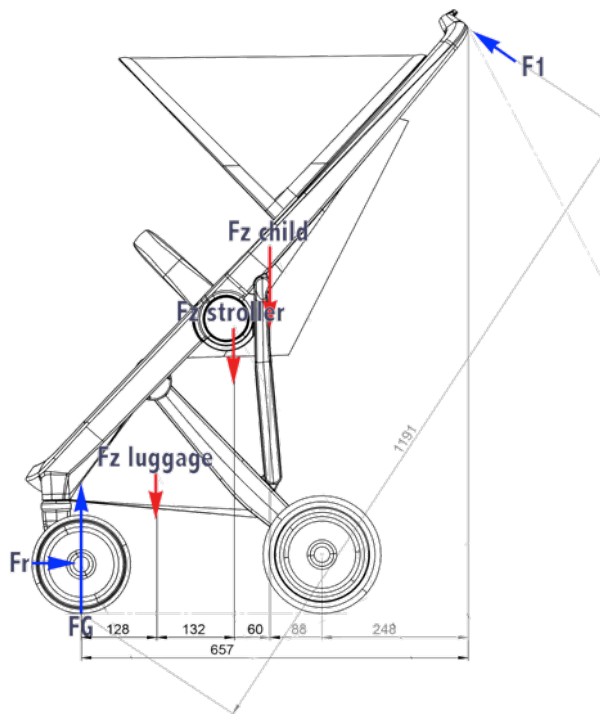
$$F1 = (50 \times 128 + 73 \times 260 + 150 \times 320) / 1198 = 62N$$

$$Fg = 150 + 73 + 50 - \sin(36,45) \times 43 = 237N$$

$$Fr = \cos(36,45) \times 61 = 35N$$



Step 5: Turn stroller



$$F1 = (Fz l \times 128 + Fz s \times 260 + Fz c \times 320) / 1198$$

$$Fg = Fz \text{ child} + Fz \text{ stroller} + Fz \text{ luggage} - \sin(36,45) \times F1$$

$$Fr = \cos(36,45) \times F1$$

$$Fz \text{ child} = 150N$$

$$Fz \text{ stroller} = 73N$$

$$Fz \text{ luggage} = 50N$$

$$F1 = (50 \times 128 + 73 \times 260 + 150 \times 320) / 1198 = 61N$$

$$Fg = 150 + 73 + 50 - \sin(36,45) \times 61 = 237N$$

$$Fr = \cos(36,45) \times 61 = 35N$$



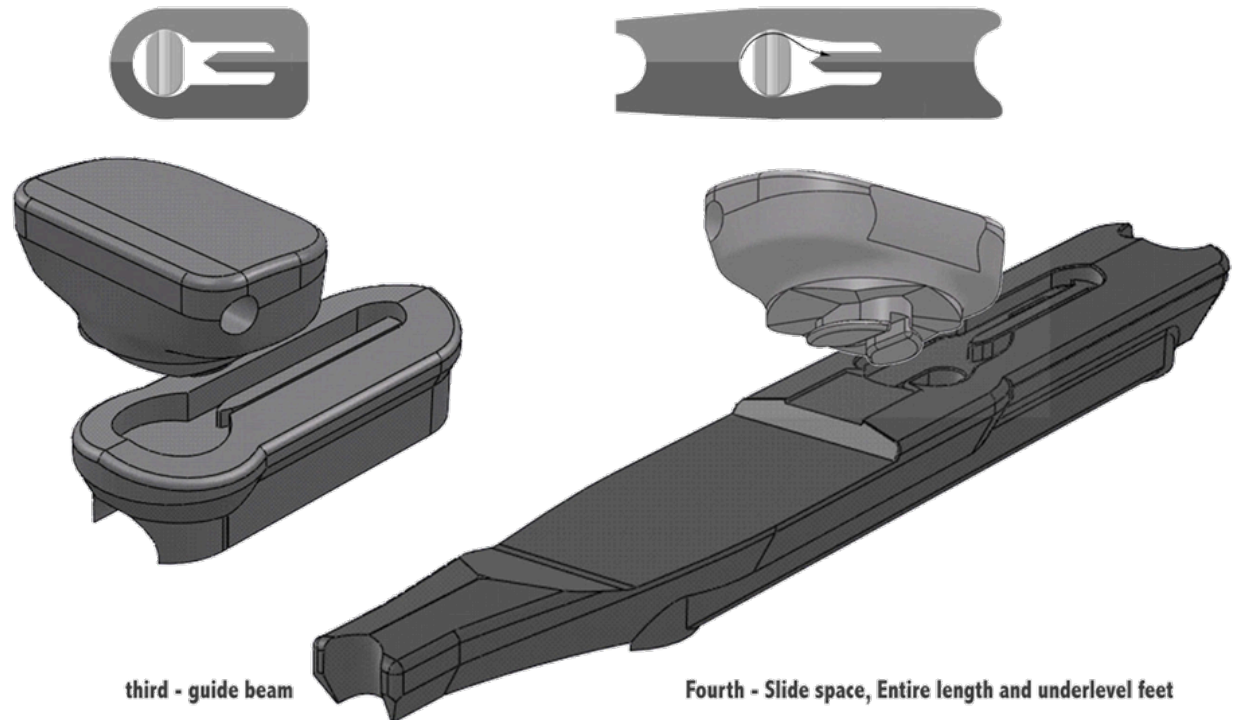
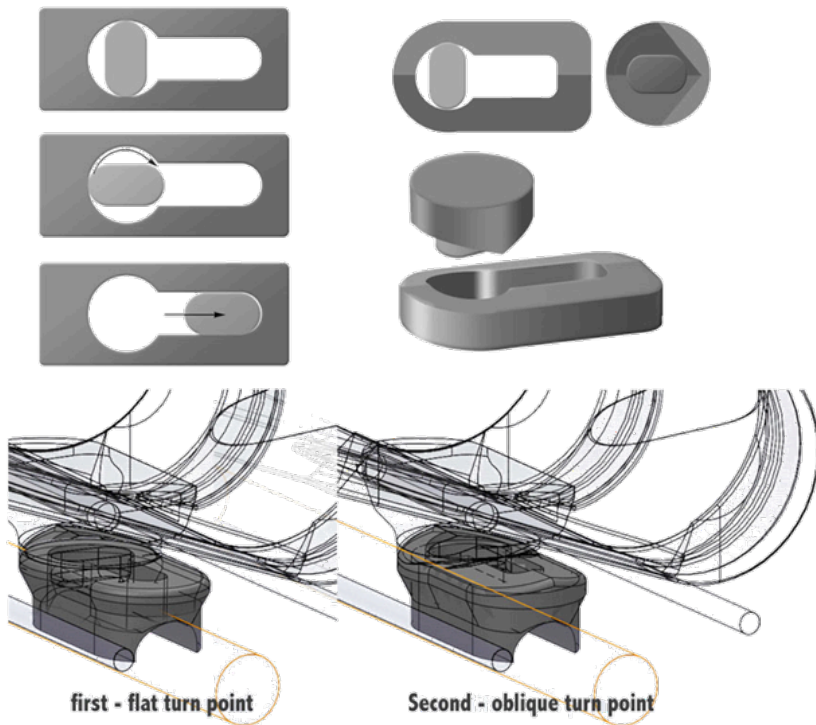
APPENDIX XXIII. Turning part development

Development of the connector part see figure below

1. The connector part needs to make the plate, pivot and slide. Therefore a mechanism was designed, based on a simple working principle. A round rectangle is able to turn inside a circular opening. When turned 90° it is able to shift into a slot.

2. To help the user guide into position the connector is made a little oblique, pointing toward the middle. The turn and twist part has the same form making it able to position it into 4 directions.

Turning and shifting



3. A guide beam was added to help the twist part turn and find the slot.
4. Because the stroller is unable to turn 90° a rounding was made, giving the turn and twist part space for earlier shifting. The connector was made longer to fit and fixate the entire bike frame. Also the connector got a bottom level for holding feet of the turn and twist part.

APPENDIX XXIV. Prototype

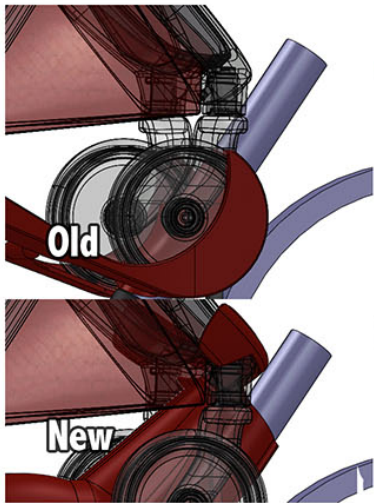






APPENDIX XXV. Product details

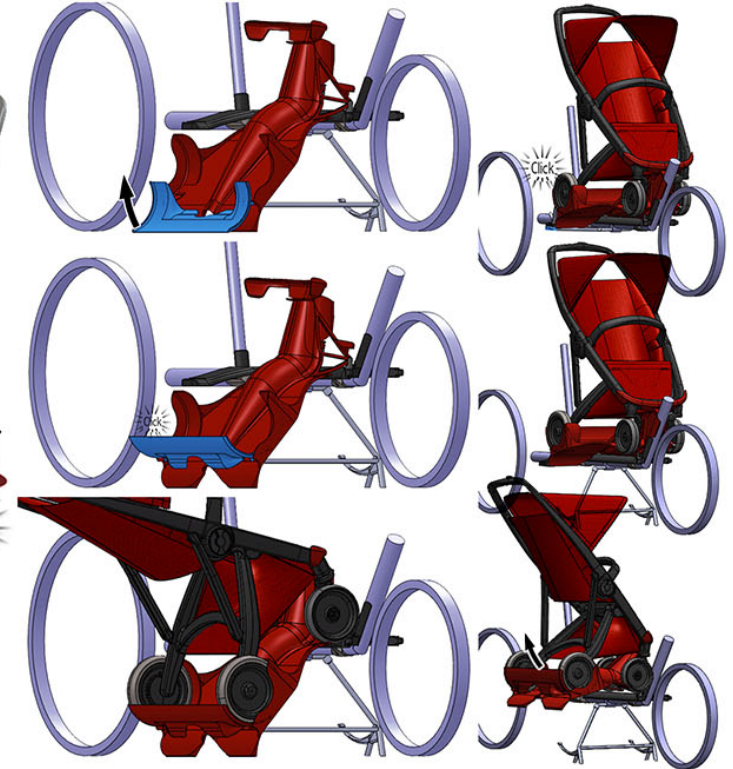
Front connection



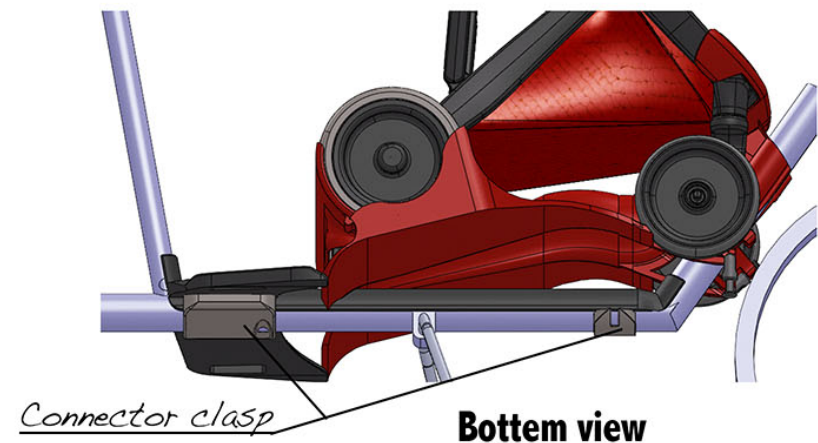
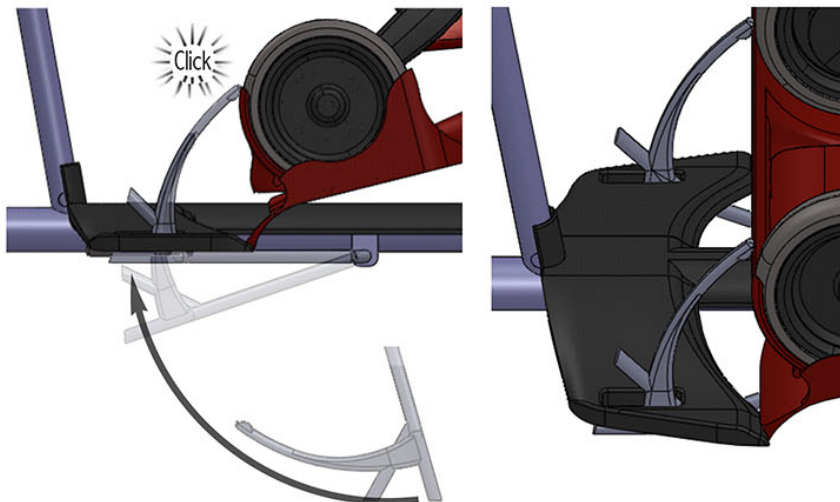
Loading the Basic version



Loading the One way turn version

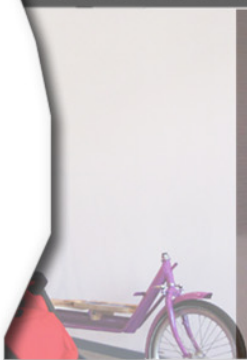
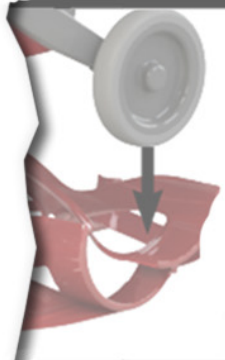


Bicycle stand lock

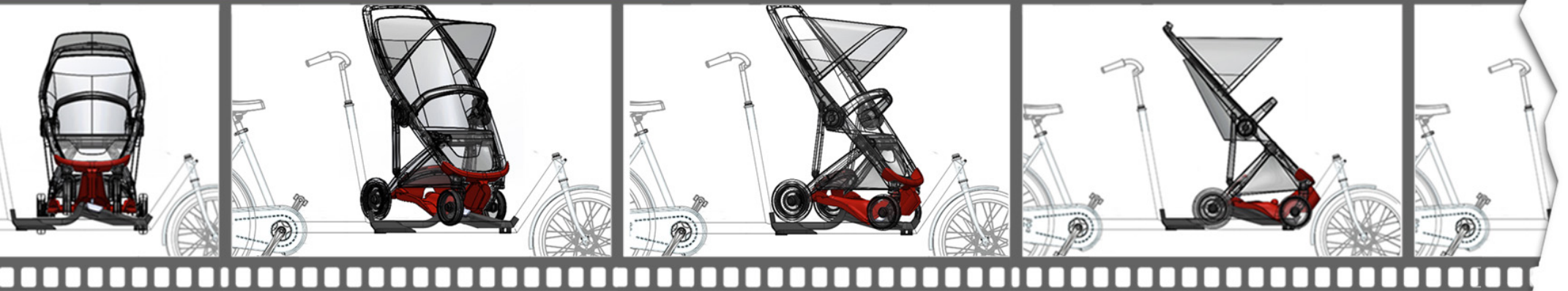


Bottom view

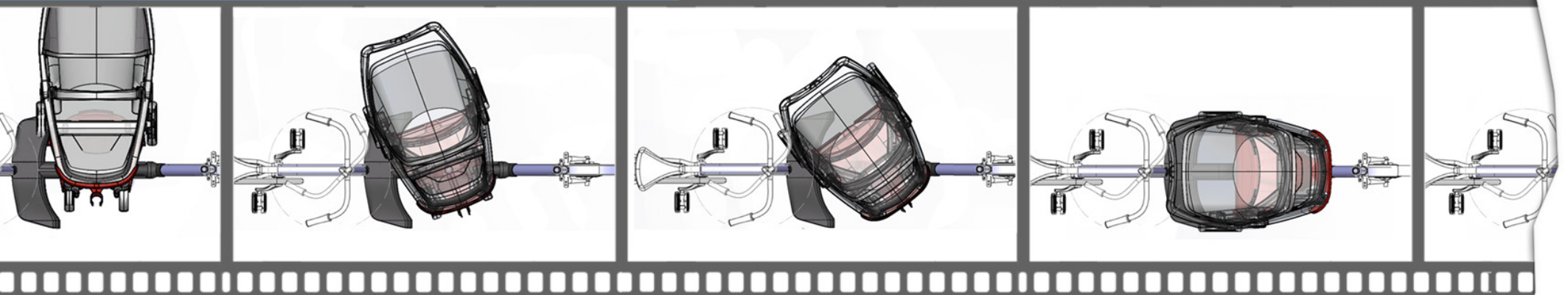
Basic-version



Deluxe-version - Front view

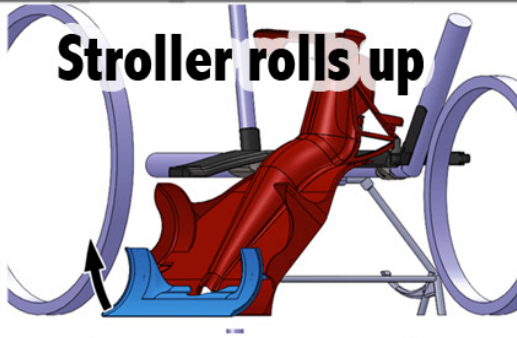


- Top view

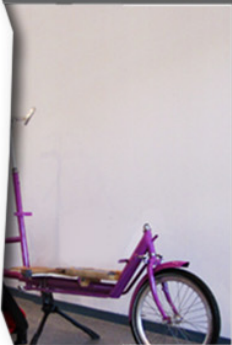
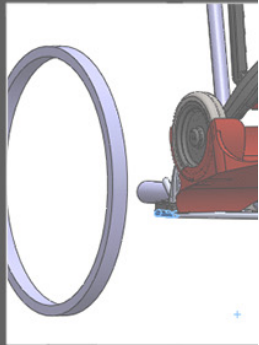
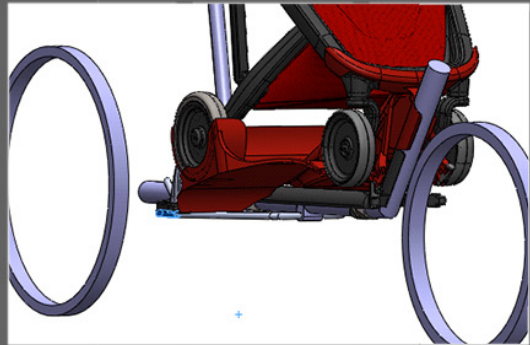
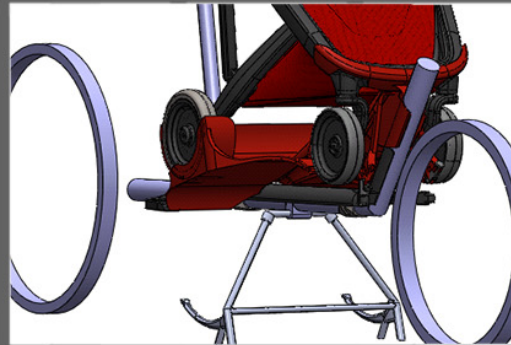
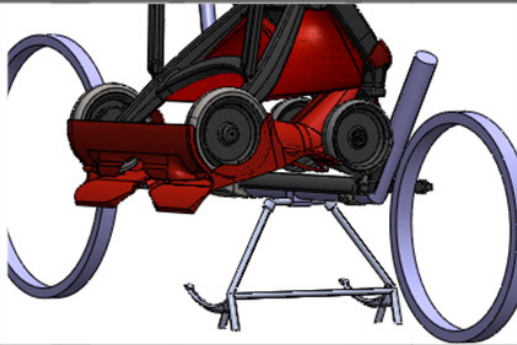
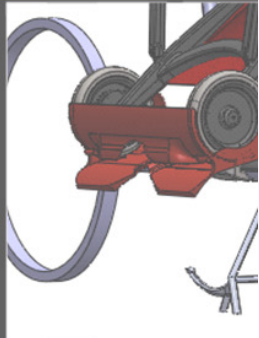
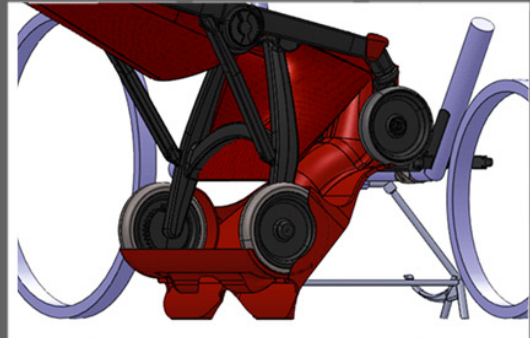
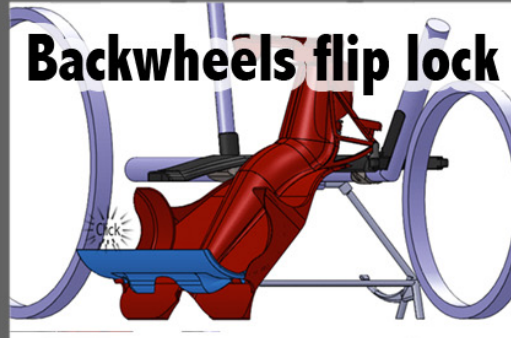


One-way-turn-version

Stroller rolls up



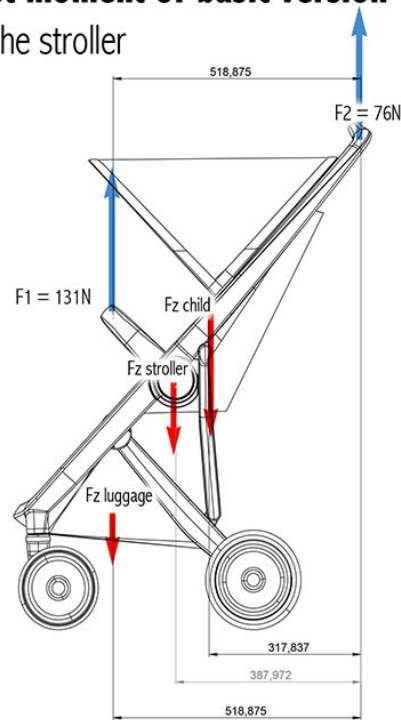
Backwheels flip lock



APPENDIX XXVI. Force limits

Heaviest moment of basic version

Raising the stroller



$$F1 = (317 \times Fz C + 388 \times Fz S + 519 \times Fz L) / 518$$

$$F2 = Fz C + Fz S + Fz L - F1$$

Fz child = 150N
Fz stroller = 73N
Fz luggage = 50N

$$F1 = (150 \times 317 + 73 \times 388 + 50 \times 519) / 518 = 197N$$

$$F2 = 150 + 73 + 50 - 197 = 76N$$

1 hand pull 197N

-0.77

population: DINED 2004 (20-30 years), female
measure: 59. pulling force 1 hand (N)

mean: 240 N
standard deviation: 56 N

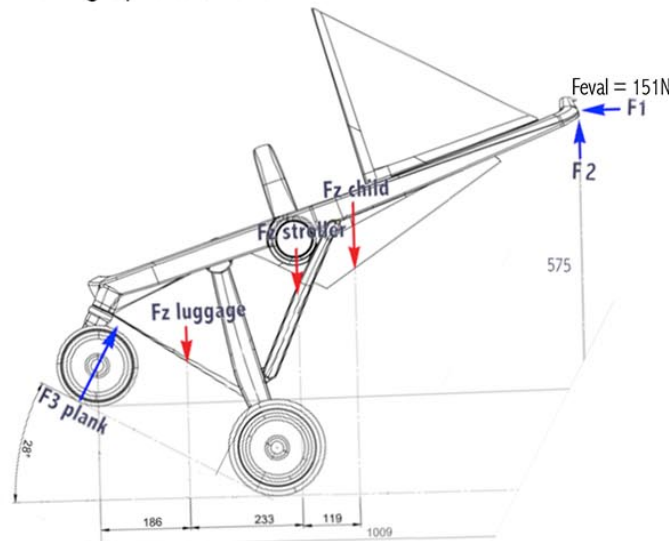
120

percentile: 22.13
measurement: 197 N

Pull 1 hand (20-30 yr) female

Heaviest moment of Deluxe and first design

Rolling up the stroller



$$F1 = (Fz l + Fz s + Fz c) \times \tan(28,19)$$

$$F2 = (Fz l \times 538 + Fz s \times 419 + Fz c \times 186 - F1 \times 575) / 1009$$

$$F3 plank = (Fz luggage + Fz stroller + Fz child - F2) \times \cos(28,19) + F1 / \sin(28,19)$$

Fz child = 150N
Fz stroller = 73N
Fz luggage = 50N

$$F1 = 273 \times \tan(28,19) = 146N$$

$$F2 = (150 \times 538 + 73 \times 419 + 50 \times 186 - 146 \times 575) / 1009 = 36N$$

$$F3 plank = (273 - 120) \times \cos(28,19) + 146 / \sin(28,19) = 520N$$

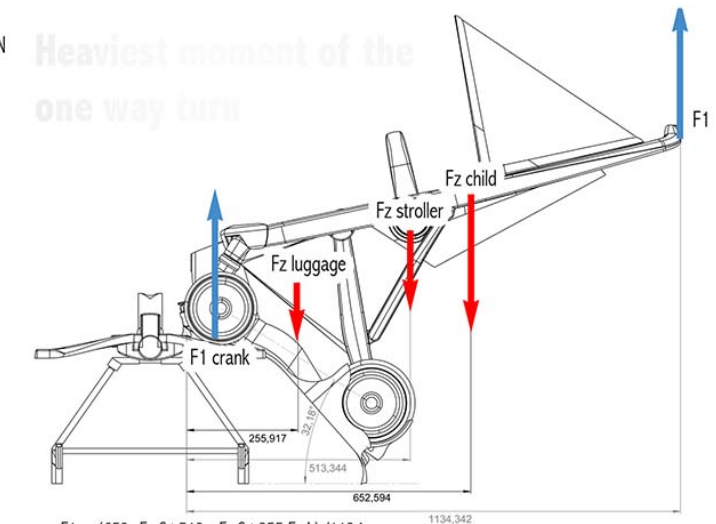
$$Feval = \sqrt{F2^2 + F1^2} = 151N$$

Female two hand push P10 = 218N

1 hand push 75N

Heaviest moment of the one way turn

Lifting the stroller



$$F1 = (653 \times Fz C + 513 \times Fz S + 255 \times Fz L) / 1134$$

$$F2 crank = Fz C + Fz S + Fz L - F1$$

Fz child = 150N
Fz stroller = 73N
Fz luggage = 50N

$$F1 = (150 \times 653 + 73 \times 513 + 50 \times 255) / 1134 = 131N$$

$$F2 crank = 150 + 73 + 50 - 131 = 142N$$

1 hand push 65N

-1.64

population: DINED 2004 (20-30 years), female
measure: 58. pushing force with 2 hands (N)

mean: 333 N
standard deviation: 90 N

5% 95%
percentile: 1.6
measurement: 140 N
percentile: 2.1
measurement: 150 N
measurement: 185 N
percentile: 5

Push 2 hand (20-30 yr) female