SOCIAL DESIGN PROJECT

Redesign of a wheelchair

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0

PREVIOUS PHASE

Preliminar research

0.1 INTRODUCTION

Justification and reasons of the project

This project arises from the idea to stop creating new needs instead of solving the existing problems nowadays. Inspired by other projects under the label of Social Design, it is time to start thinking in all the people around the world, not just worried in earn money or marketing (in terms of industrial design).
Of course, those aspects matter as well, but we live in a society where we need to take care of us, starting by the environment. And if there are some differences between countries our duty is to try to vanish them or at least to make these differences smaller.
My goal in this project is to research, study and analyse; social, economic and political problems in countries less advantaged than us. Therefore, I would like to design a product which can improve the quality of life of disabled people in those countries.
In Europe, disabled people are integrated in society. Their environment is adapted to them and they have the same opportunities as everybody to work.

Unfortunately, this story is very different for other countries like in Asia, Africa or South America. Regarding this, my aim is to integrate this people in their society, try to increase their self-esteem and adapt their world to their obstacles. Taking into account their economic problems and their culture.

As a distant aim I would like to start spreading this philosohy and make people involved in this kind of projects.

Cases of Social Design

The shoe that grows by Kenton Lee

WHY A SOCIAL DESIGN PROJECT?

Because thankfully, the more and more designers are collaborating in this kind of projects to change and improve the world, making it more fair and more equal for everybody. Social design can be defined from different points of view. Sometimes it is a humanitarian notion that guide professional practice , in other cases design acts like a change tool.

An actual case is the sandale designed by Kentol Lee and it's called "the shoe that grows", it helps more than one million of children in the world.

The shoe has two sizes (big and small) and can grow until five sizes more due to its design.

This project was carried by ***Because International***, a NGO who helps the most disadvantaged countries all over the world. *(26 April 2015)*

Hippo roller

Every day, millions of women and children in developing countries are forced to carry heavy loads of water for long distances, typically in heavy 20L (kg) containers on their head.
In just one day, lots of hours of their time is consumed for the most basic of human needs which is **collecting water.**

The Hippo Water Roller is a simple and efficient way to collect much more water, much more easily and in less time. It collects 5 times more water than a single bucket by simply rolling it along the ground.
It was specifically designed for use in tough rural conditions.

Some tangible results:

Reduces long-term injuries caused by carrying heavy loads of water and gives women and children more time for education and economic activities.

Those good examples show that this project can be succesful and provide a good change in our society.

0.2 BRIEFING

1. Objectives and goals

The objetives in this project are to develop a solution for disabled people in South America.

The project will focus in a specific product, because it will be easier to have a concrete product and goal for the ideation phase. It is needed to study all the possibilities, functionalities and all the problems which can be found in the daily life and environment. The main focus is to improve the quality of life of disabled people in those countries.

It will be a redesign of a wheelchair but it is also important to briefly analyse as well all the products in touch or linked with wheelchairs.

2. Budget and schedule

On the other hand, at least but not less important to make this product affordable regarding their economic situation and of course soustanaible.

As it is a final year project, there is no budget defined but in economic aspects (as discussed later, the final product need to has an appropiate price).

In terms of the schedule, we have a frame of 4 months. The project needs to be started at the end of March, and it finishes at the end of June (see below a specific plan and schedule).

3. Target audience

Our clients to reach are disabled people of South America, it is a quite delicated profile of users because of a several challenges and obstacles they need to overcame everyday.

4. Scope of the project

The scope of this project is to end up with a realistic idea, doable and efficient. Not just a final concept.

Of course some requirements will be desirable like (aesthetics and soustainability) while other will be essential like functionality, durability, quality etc.

5. Available materials

This aspect is designer's choice, noting that the price should be adequate. It is obvious that the product can not be designed in expensive materials like carbon fiber, glass fiber, etc.

6. Overall style

The style has to be modern but simple, timeless, minimalist.

It is not desired to have additional items or pieces if the use is not expressely justified, i.e., not ornamental elements.

7. Methodology and tools

The methodology is a design process, i.e. : Research, ideation, conceptualisation and final design.

Respecting the tools would be secondary research based on internet, scientific papers, statistical data, a,so analog and digital 2D and 3D design.

0.3 PLANNING

Schedule and goals to achieve

This project has to be 30 ECTs (1 ECTs is equivalent to 25 hours of work so it is needed to invest 750 hours of work i.e. more than 6 hours per day).
The time planned for this project is less than 4 months (from March until June, the tasks will be divided by phases and weeks:

PREVIOUS PHASE

9 March > Previous phase done and corrected + start designing Dossier

16 March> Conclusions of previous phase+Definition target group+ keep desiging Dossier

MARCH

FIRST PHASE

23 March > Market research of products involved

30 March> Shape and ergonomic analysis + correct first phase

SECOND PHASE

6 April > Conclusions phase I+Brainstorming+ Sketching ideas

16 March> Presentation of the concepts+ Evaluation and justification of the concepts

APRIL

SECOND PHASE

20 April > Shape analysis (3d models)

27 April> Shape analysis (3d models)

THIRD PHASE

4 May > Development of the concept+ Creation CAD model

11 May> Product attributes+Research of materials

MAY

THIRD PHASE

18 May > Regulations and requirements+ Estimation of costs

25 May> Starting with renders

FOURTH PHASE

1 June > Design and definition of the packaging

8 June> Design of the brand manual and instructions (if required)

JUNE

FOURTH PHASE

15 June > Final set up of the product

22 June> Correct all the project

0.4 PREVIOUS INFO

List of the countries involved

This is a selection of the countries are involved by these problems in their society and because of their similarities they are grouped due to the project will be focused on them:

-Argentina
-Bolivia
-Brazil
-Colombia
-Costa Rica
-Chile
-Cuba
-Ecuador
-El Salvador
-Guatemala
-Haiti
-Honduras
-Mexico
-Nicaragua
-Panamá
-Paraguay
-Peru
-Republica Dominicana
-Uruguay
-Venezuela

Atmosphere analysis

Rio de Janeiro, photo free of rights from www.morguefile.com

The needs of the people are interactive which means the subject and the environment are interacting each other.

The disability implies a limitation, a boundary, so they need to be defined, located and taken place in the interaction man-environment.

Disability also affects society, reflecting a social question which involves the whole population (inclusion and exclusion).
Latin America is committed to a model of incomplete development because they have focused on macroeconomic stability in short and medium term. Aside from structural problems, including equity which is the most urgent. [2]

We live nowadays in a world where reign violence because of a social, economic and political crisis which punish harshly wide social sectors. Including a huge amount of human beings who are the most vulnerable like: children, women, disabled and elderly.

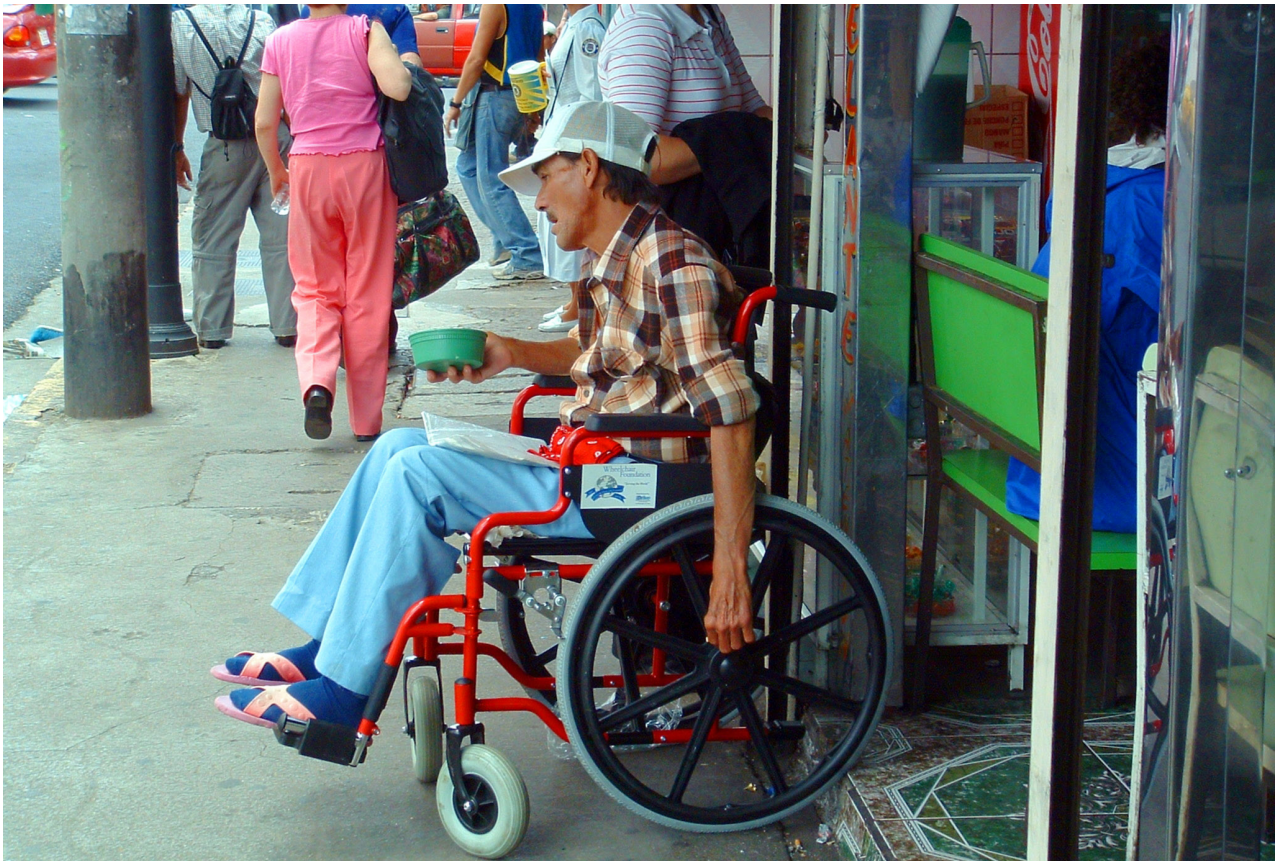
- Hospitals

Universitary Hosital of Caracas picture from: www.maduradas.com

Nowadays, one of the main issues in South America are the conditions of the hospitals.

Some articles declare a lot of unacceptable facts which are provoking a crisis in hospitals. For example, in Venezuela doctors have stopped surgery due to the lack of inputs (compresses and anesthesia). Therefore, The Institute of Hematology and Oncology at the Central University of Venezuela stopped offering specialized care to patients with cancer since July 16, 2014.
Moreover, the termination of at least 15 surgical specialties at the University Hospital Caracas.

In addition, Venezuela is now the Latin American country where people have to pay from their pocket money the highest percentage for health services, while the healthcare system is in critical condition, with a shortage of medicines and supplies more than 60%[2]; deterioration of hospital; public expenditure poorly executed, exodus of health



Hosital of Costa Rica picture from: www.morguefile.com

professionals, and the return of endemic and epidemic diseases that are causing increases in mortality rates, several experts agree.

These are quite worring problems to latin american society, but in terms to the disabled people living in these countries they have an extra barrier: physical obstacles.

The main barriers that disabled people have to fight daily are: physics or in terms of accessibility across architectonic obstacles.

For example: lack of ramps, no accessible toilets, no reserved parking.
Also, the disposal of the furniture is not at all adapted to their needs, even the width of the doors and corridors is sometimes not enough for a wheelchair.

Also the high of the counters for customer service, the size of the elevators, the signposting, the right lightness, light alarms for hearing disabilities, there is nothing in Braille.

Pictures from Fonseca, Honduras

Pictures from Fonseca, Honduras

These pictures are taken from a professional who works in this hospital located in Fonseca, Honduras.

In this page there are observed the indoor atmosphere. With a naked eye it seems that the doors have the adequate width and there is no physical obstacles.

Respecting outdoor ambient, is obvious that disabled people will need help or they will be forced to overcome some physical obstacles like stairs.

But on the other hand, we can observe in the second picture a slope, so at least it seems they are in the way to encourage inclusion of disabled people.

- Structural barriers

Earthquake Peru, 2007 from www.elmundo.es

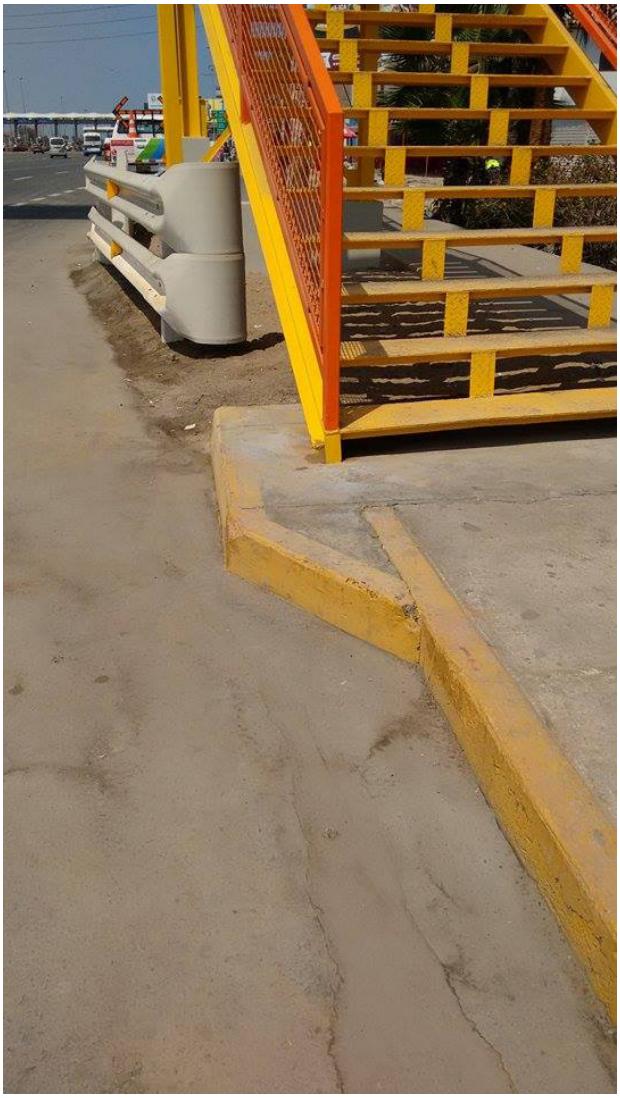
It refers to the difficulties created by us that hinder or cancel interpersonal relationships, undervaluing some components of this society.

A visible manifestation are the architectural and urban barriers, those difficulties created by the man who, somehow, forget the particularities of much of the population: the elderly, pregnant women, people with disabilities, etc.

The stairs and slopes without options (ramps, elevators), revolving doors pretty narrow, inadequate health services for people in wheelchairs, loose tiles in the sidewalk, are some examples.

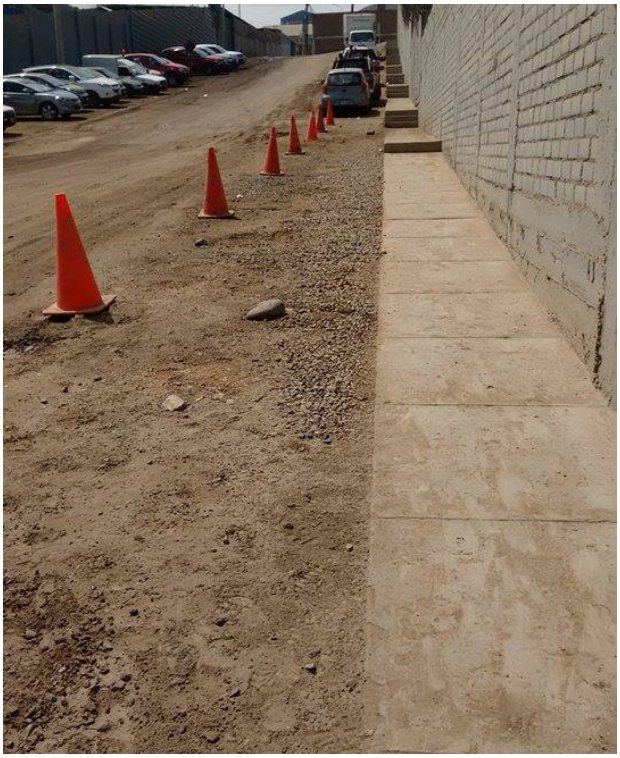
There is a very long list to full, that transform this structures in real barriers for people with disabilities.

-Challenges disabled people need to face in Peru

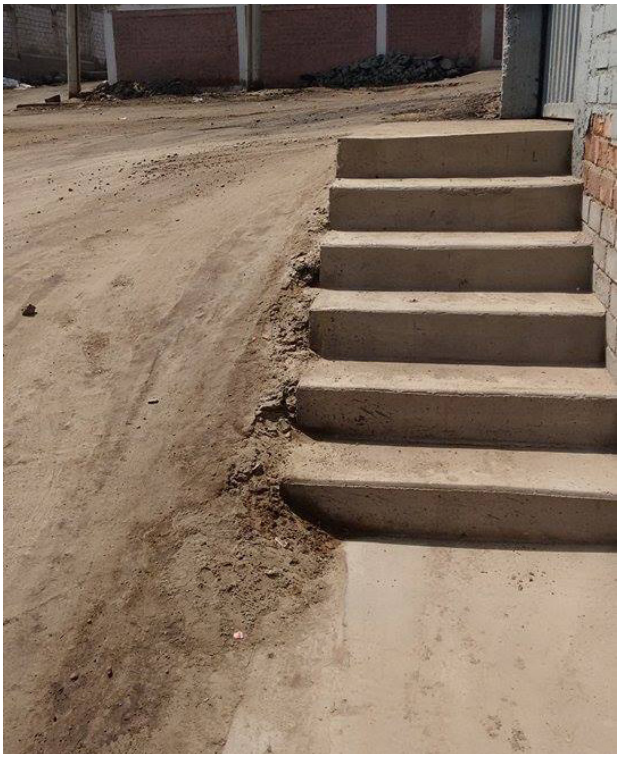


Villa el salvador, altura kilómetro 20 de la panamericana sur, Perú

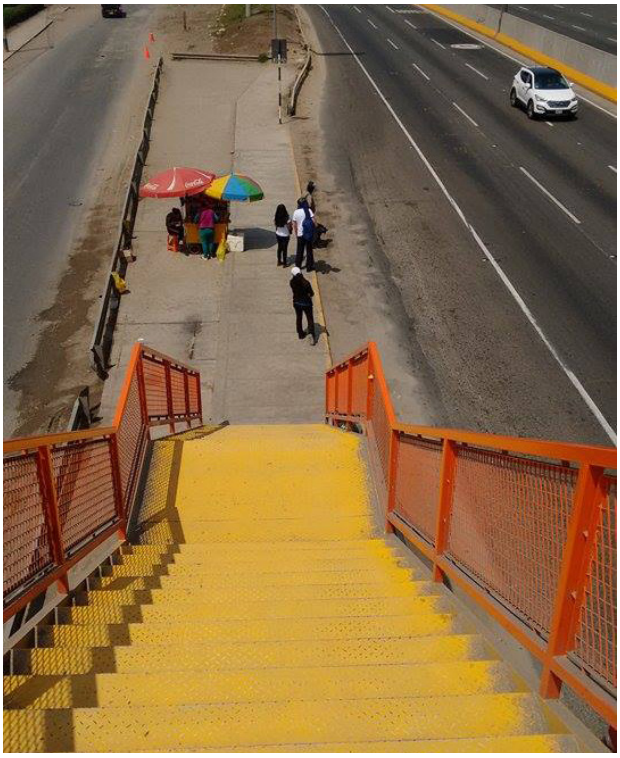
Benavides, Miraflores, Lima



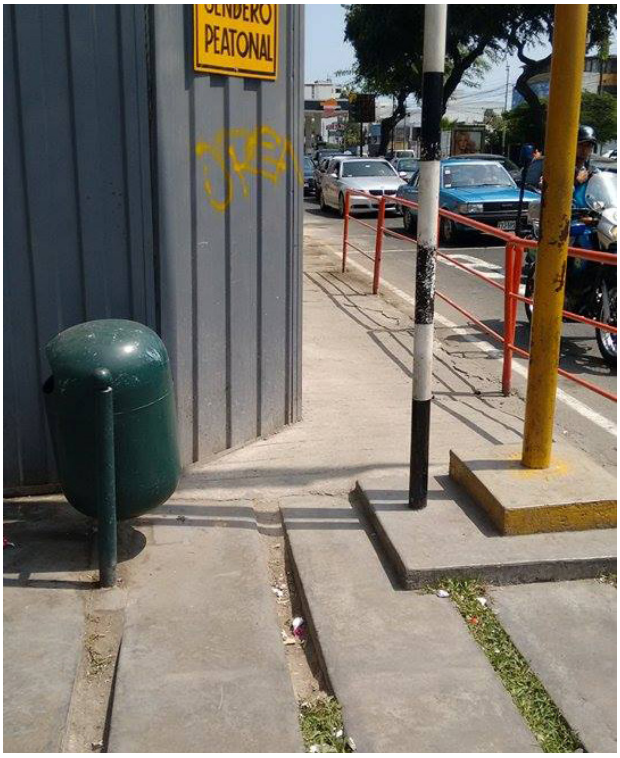
Villa el salvador, altura kilómetro 20 de la panamericana sur, Perú



Villa el salvador, altura kilómetro 20 de la panamericana sur, Perú

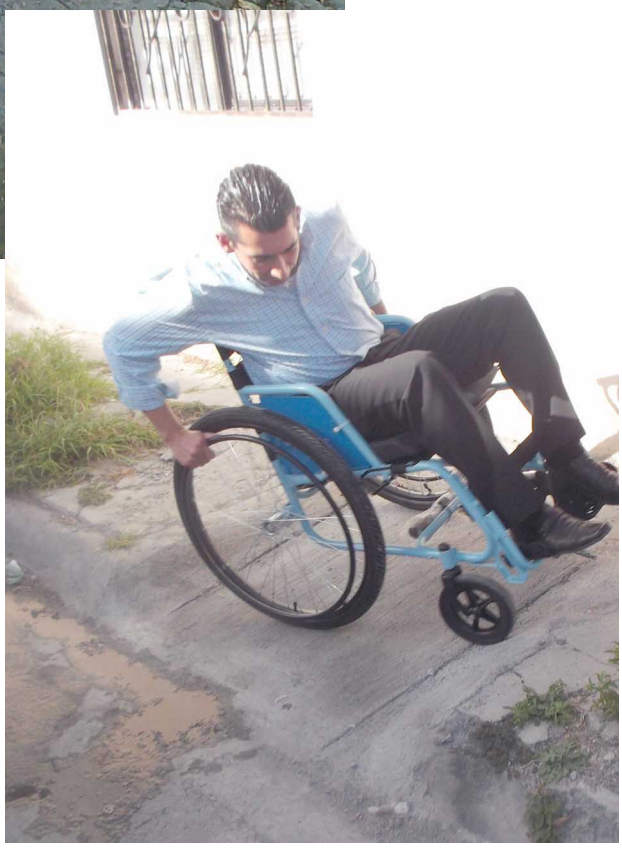


Villa el salvador, altura kilómetro 20 de la panamericana sur, Perú



Benavides, Miraflores, Lima

Sidewalk of Cali ^



City of Cienfuegos ›

- Schools

School of Guate

Latin America and the Caribbean are close to universal basic education, according to a report analyzing 2008 data released by the regional office of the United Nations Educational, Scientific and Cultural Organization (Unesco).

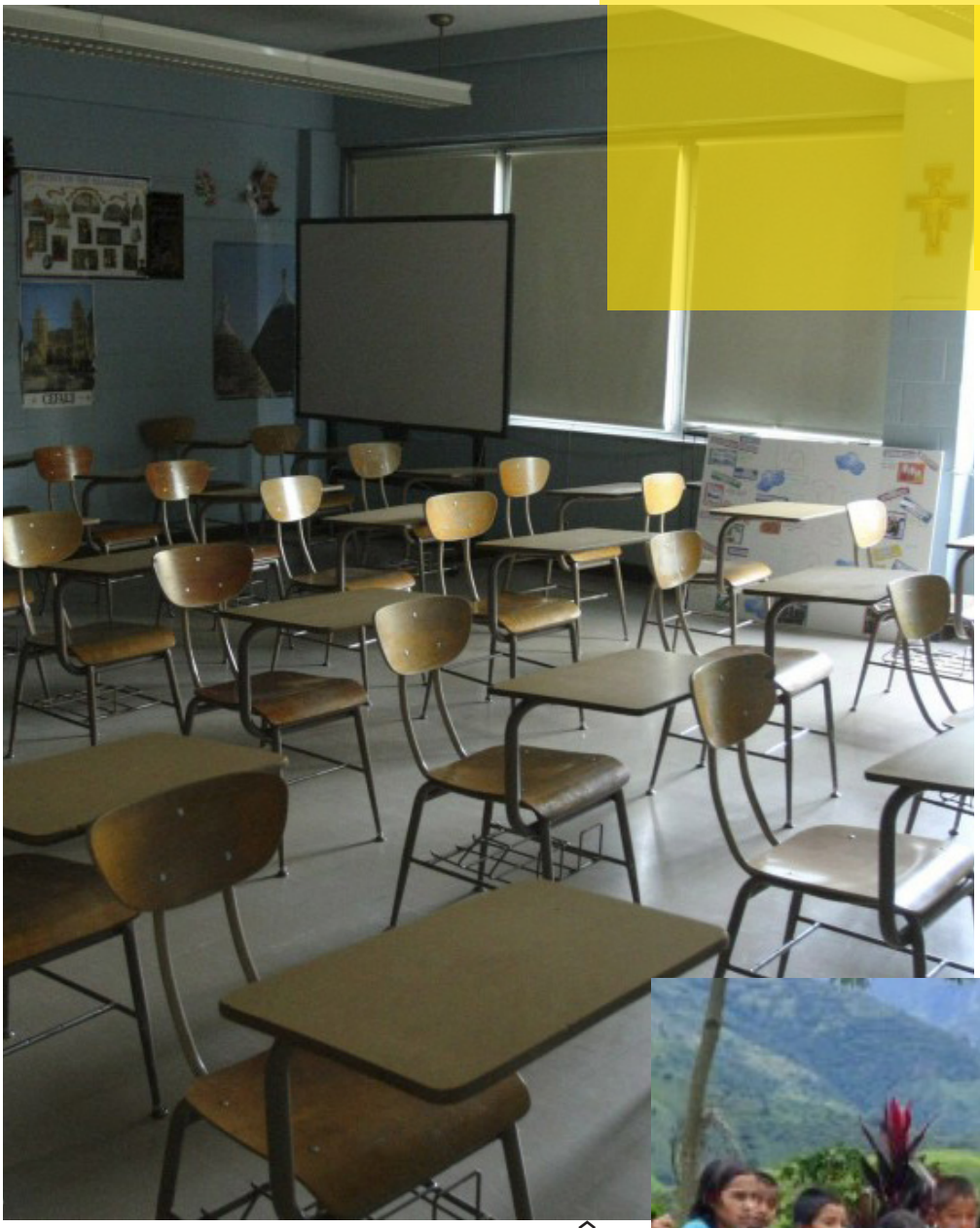
The study also declares (Monitoring Report Education for All Global) that for every 100 Latin American and Caribbean aged to go to primary, 95 the children would be enrolled in 2008.

It's quite encouraging but it also warns that" it will be many children still out of school in the region".

Respecting structural barriers for public transport and schools is nearly the same, the vehicles are not prepared for the needs of the people, the wide of the doors is not enough, there are not ramps or slopes.

No tables or chairs designed for these necessities (which is not so difficult to change, it is just to make it higher and wider).

These additional difficulties are easily avoidable but are created maybe in terms of aesthetics or economic reasons, but it demonstrates that they are unaware of this part of the



School in Ecuador

Caribbean Education

population.
It is pretty important those aspects to be able to provide an independent living which is essential for a plenty happiness and psychological balance.

Regarding social problems

Public Transport Peru, 2009 from www.numero-zero.net

There is a social discrimination treating them like if they would be kids and not like capable people (in the majority of the cases) who can decide by themselves about their own life.
Therefore, it exists a wrong behaviour and attitudes too much protective by their family, neighbours, friends, and in general by the rest of the society.

This way, they are rejecting any ability to decide by their selves decreasing their self-esteem and their independency.

Respecting political and public services it's a big drama for disabled people. The reason is that the government barely contribute to their development in terms of positive discrimination for their social inclusion.
From this point of view, they barely invest on social basic service concerning mobility and displacement (accessibility in public transport or urbanity setup), policy which increase and favour labour inclusion and their professional formation.

Technology analysis

In most countries of the world began a reorientation aimed at the pedagogical and technological updating, respecting diversity of each region in terms of levels of technical development, medical, scientific and education.

According to WHO, 15% of the world population is affected by some physical, mental or sensory disability that hinders their personal development and social, educational or occupational integration. This percentage is equivalent to 900 million people (which is almost twice the population of Latin America). [2]

There is therefore a growing global concern which wants to eliminate as far as possible these disadvantages by means of specific actions (surgery, rehabilitation, etc).

UNESCO international reports (European Commission-1996) while recognize the educational and cultural potential of new information technologies and communication, warn of the major latent load of inequality and marginalization.

And whereas most developed nations (which account for 20% of the world's population) account for 90% of all Internet users, it is evident the opportunities offered by globalization are distributed very unevenly by the cult of market competitiveness that people with disabilities can access.[3]

Globalization has allowed us to bridge the gap and made reality communications and transmission of information between people with disabilities anywhere in the world, representing a significant potential for development and promoting wellness in conditions of social equity. However, far from reality the spread of this development, globalization has exacerbated in some Hispanic regions because it has increased inequality.

The adaptive technology can reduce the impact of disability and meet the right to the quality of life of people with special needs and also get to influence the economy in Latin America since a significant number of disabled people could begin to emerge as executives of their own companies through Telework (working from a place away from headquarters of their home by means of a telecommunication system).

Economic analysis

There are some countries that have strived quite a lot in terms of competitiveness like Panama. They have invested in infrastructure, created innovative business models to attract new international companies. As a result, Panama has developed a thriving economy based on services. This way, Latin America's efforts make possible to drive econonomic dynamism, innovate for social inclusion and environmental sustainability.

In addition, South America has vast natural resources and important human capital. It is shown its financial resilience with economic growth for the last ten years, and despite complex economic points of view, it is now open for a better investment hosting different industries.

Brazil, for example, had invested $121 billion in the area of strategic partnerships with private sector. [4] In Mexico they have reformed labour laws, education and strategic economic sectors which has open new opportunities in the field of energy, communication and manufacturing industries. It is an inspiring model that could be used to improve the situation of other countries.

But of course there are still remaining structural challenges. Latin American countries must diversify their drivers of growth. Commodities exports represented 60% compared with the 40% ten years ago. [5]They have also substituted local manufactured goods by imports (China), affecting the region's manufacturing ability and competitiveness.
This can open a chance for the adoption of new regional industrial policies to promote enhanced specialization, increased value added and improved value chains.

To end this analysis, economic integration initiatives like Pacific Alliance are positive examples of political methods that will improve the achievement of more efficient flow of goods and services.
In terms of competitiveness, the region must modernise its infrastructure and logistics, reduce transportation costs and risks. All of these steps require sufficient financial resources that implies innovative public and private investment models, refreshed resources, increased revenue, etc.

However, it is essential as well to analyse the minimum salaries en South America; which are in average 330 $[6]

Resources

It is crucial to analyse the technological development and institutional infrastructure in terms of economy, which enables businesses to commit to a country and gives investors the certainty they require for the long term.

It is obvious that South America must bring new technologies and develop enhanced public policy for the innovation on the business model due to it will transcend the status quo and develop a more advanced economy.

South America has several agricultural products: vast mineral wealth and plentiful freshwater. It also has rich fisheries and ports on the Caribbean Sea, Atlantic Ocean and Pacific Ocean. The continent's economy is based on the export of natural resources .

The mining industry is one of South America's most important economic engines. The continent contains about 1/5 of the world's iron ore reserve (mostly in Peru and Chile). The iron and steel are used in fields like construction and machinery throughout the world. [7]

South America posses some deposits of oil and natural gas, which are drilled for energy and fuel. Oil and gas extraction is the dominant industry of Venezuela, with major deposits found around Lake Maracaibo and the El Tigre region.

South America's economic growth over the last half-century has prompted its cities to expand rapidly. These cities, however, often suffer from insufficient transportation and utility systems, pollution, and unregulated residential growth.

Lima, capital of Peru, has a population of almost 9 million people and accounts for about 1/4 of Peru's total population. [8] It also has the largest export industry in South America. Lima and the port city of Callao are also the most important fish trade centres in Latin America.

Unfortunately, they have also certain infrastructure problems (Lima and Sao Paulo for example): heavy traffic congestion due to unreliable public buses.
To end up this chapter, South America hosts a big amount of engineering marvels, which most of them are connected to manage the continent's natural resources. The Itaipu Dam (Paraguay-Brazil border) generates more hydroelectric power than any other Dam in the world.

0.5 SOURCES CONSULTED

From the Previous research

>>Cases of Social Design:

http://www.cnet.com/es/noticias/estos-zapatos-crecen-conforme-van-creciendo-los-pies/

http://hipporoller.org/

>>Atmosphere analysis:

http://www.elmundo.es/elmundosalud/2007/09/07/neurociencia/1189185270.html

http://elpueblo.com.co/hacen-falta-mayores-inversiones-para-los-discapacitados/
(Interesting article)

http://www.elsalvador.com/mwedh/nota/nota_completa.asp?idCat=75014&idArt=7866848

http://infomaxorg.blogspot.co.at/2013_01_01_archive.html

https://agenda.weforum.org/2014/03/three-big-issues-facing-latin-america/

http://www.plataformaarquitectura.cl/cl/760348/clasicos-de-arquitectura-hospital-regional-de-taguatinga-joao-filgueiras-lima-lele

http://www.lapatilla.com/site/2015/03/31/ministerio-de-salud-admite-fallas-en-adquisicion-de-divisas-para-insumos-y-equipos/

>>Social analysis:

http://www.sinergia-web.com/archivos/Discapacidad_A-L.pdf
Document: Disability in Colombia: Challenge for Inclusion in Human Capital

http://www.colombialider.org/wp-content/uploads/2011/03/discapacidad-en-colombia-reto-para-la-inclusion-en-capital-humano.pdf

http://necesitodetodos.org/2013/04/latinoamerica-se-acerca-a-universalizar-la-educacion-primaria-unesco/

>>For economical analysis:

https://agenda.weforum.org/2014/03/three-big-issues-facing-latin-america/
http://www.americaeconomia.com/economia-mercados/finanzas/conozca-los-montos-de-los-salarios-minimos-de-la-region

>>For technology analysis:

Foundation Iberolatinoamerican Cooperation in special education and technology adaptative informationment:

http://www.ufrgs.br/niee/eventos/SICA/2008/pdf/Memoria%20de%20Solvencia%20de%20FREE%202008v2.pdf

>>For resources analysis:

http://education.nationalgeographic.com/education/encyclopedia/south-america-resources/?ar_a=1

Other sources:

Asking to people who are currently living in Lima and work for disabled people.

References:

[1] Hector A. L. Rojas "The situation of disabled people in Peru"
[2] Omar Lugo "Patients pay the collapse of the health system in Venezuela" April 2015
[3] [4] Lic. Ricardo A. Koon "The technologic impact in disabled people"
[5] [7] Marisol Argueta de Barillas "The three big issues facing Latin America" The World Economic Forum on Latin America 2014, Panama City, Panama, runs from April 1st-3rd.
[6]Conozca los montos de los salarios mínimos de la región
[8] Article from National Geographic "South America Resources"

1

FIRST PHASE

In depth analysis

1.1 CONCLUSIONS

Regarding the previous research and facing the next phases we need to focus in the most important problems and come up with the ideation of the solutions which can provide our product or our service.

The aspects more relevant to study are the social and atmosphere analysis.

Goals to achieve a better quality in life of disabled people:

-Arrange the physical obstacles in their daily life, hence, streets, dimension of doors, height of tables, public transport, etc.

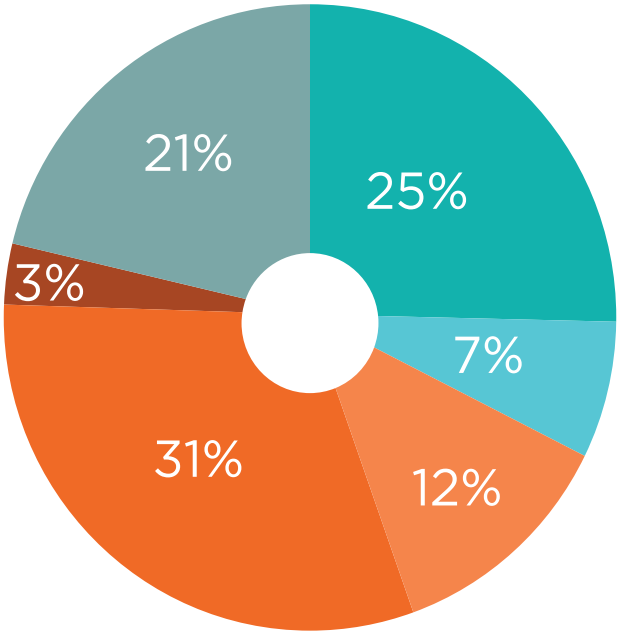
-Dissolve the social interpersonal differences specially in terms of work.

-Without neglecting their economic problems and it has to be a soustainable solution for the environment.

Limitations:

-Apprenticeship 25%
-Relationship 7%
-Communication 12%
-Movility 31%
-Self-care 3%
-General tasks 21%

[1]



Graph n° 1. Percent of people registered in terms of their limitations

Another important aspect is the health exclusion; the access to goods, services and opportunities performed to meet the needs of health is not only a basic human right, is also a key element for Human Capital building.

It requires that goods, services and health opportunities are distributed so that people reach and maintain a state of health that can generate and maintain the social fabric and productive platform.

1.2 TARGET GROUP

Definition of the target group

The target group in this project it is focused, as it was commented on disabled people who do not have the same opportunities as in other countries. The aim of this project is to improve the quality of life as much as possible in terms to be the most similar as it is for everybody.

The goal of this project can be also summarized in the word EQUITY. Everybody has to have the same rights, possibilities and opportunities.

Definition of disability:

Disability is the consequence of an impairment that may be physical, cognitive, mental, sensory, emotional, developmental, or some combination of these. A disability may be present from birth, or occur during a person's lifetime.

Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Thus, disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he or she lives.

1.3 MARKET RESEARCH

This analysis will define all the relevant items for our target group; it will serve as an introduction for the next analysis in terms of ergonomics and shape. First of all, let´s group all our typologies of products and (if required) services and define their functionalities in terms to face the next step in the design process.

-Wheelchair: it is the most common product, which enables mobility. Vehicle which empowers people who have difficulties or inability to walk.

-Bed items: products which help them or their assistants to stand up or to catch things which are not close to them.

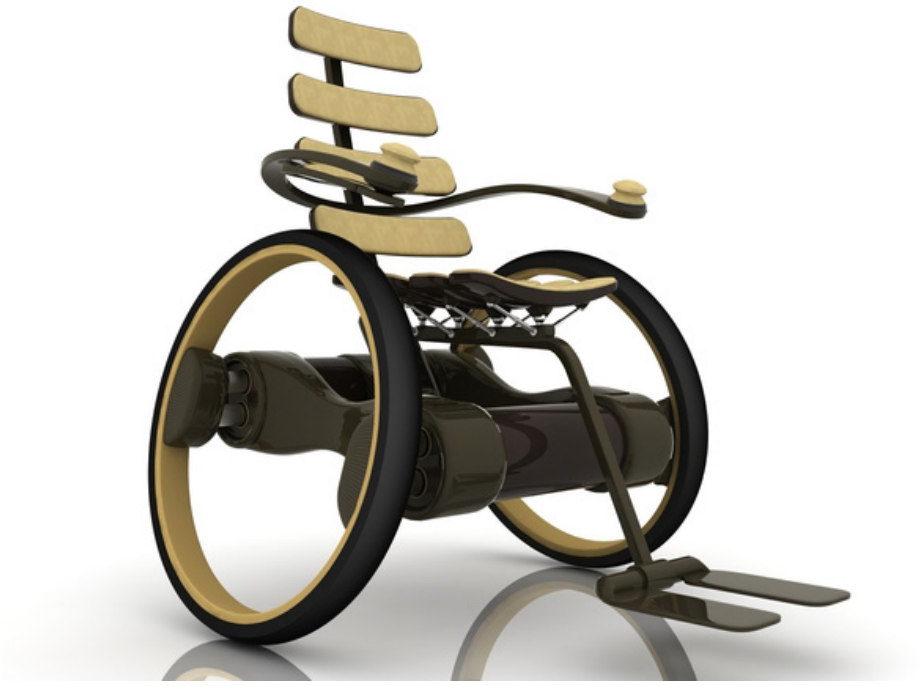
-Bathroom infrastructure: items who allow them to be the most independent when they need to go to the toilet.

-Rehabilitation items: products which help them to recover their mobility and have a medical aim.

-Crutches: a support used by an injured or disabled people.

-Sport items: it can be interesting to analyze those products which enable the user to be involved in sports.

1. WHEELCHAIR



In terms of wheel chairs, it has been defined the next groups:

-Manual
-Electric
-Sport wheelchair
-Children's wheelchair
-Concept design of wheelchair

-Manual wheelchair

Hospital Buenos Aires, 2014 from www.lanacion.com.ar

This chair was found in Buenos Aires (at the Hospital Doctor Cosme Argerich).

It has shocked the population but they argue that it is a donation and they accept it even though the chair it's really ugly it's very useful. Baldino Perez confirmed that 550 of these chairs were donated in 2009 by the NGO (a Free Wheelchair Mission). It also insists the official, "the same pattern seen in other locals hospitals."

Hospital Perú, 2014 from www.discapacidadonline.com

The same case happened in Peru.

They say that 700 specialized wheelchairs will be donated and more than 30 specialized equipments.

This donation will be made by the association "United Hearts Persons with Disabilities".

Wheelchair from Ciapat

Wheelchair from Ciapat

This model has been seen in a website of a Buenos Aires' shop and is the best in the family Tilite because of its features:
-it's the lighter product of the brand
-it absorbs vibration
-high resistance due to the shape and materials
-ergonomic seat with more than 7 positions

This wheelchair is from the same website but it has other funcionalities like:
-ability to fold
-reclining until 180º
-bimanual brakes with automatic retractable system
-area for the neck

-Electric/Motor wheelchair

Jazzy 600, Electric wheelchair found at http://electric-wheelchairs-review.toptenreviews.com/

The big difference in this tipology of product is the independence provided to the users.

It has a battery and the seat are more confortable, they are heavier as well and the price is increased (from 1500 € to 2000 € more or less)

Cirrus Plus HD, Electric wheelchair found at http://electric-wheelchairs-review.toptenreviews.com/

This wheelchair also have manual breaks for people who feel more confortable at this point.

Another important aspect is the duration of the battery, because it determines the amount of use or distance you can travel on a single charge. Some chairs come with long-lasting batteries, whereas others are only intended for regular amounts of travel around the house.

Scooter from Handicap Travelers

This type of electric wheelchair is also called scooter and it's conceived for those who prefer to move independently a company (For Handicap travelers) offers rental scooters, which will ease your visit to the most interesting places, tours in a confortable way.

(Cancún, Puerto Morelos, playa del Carmen).

It has to be common in these countries that disabled people can not afford an electric wheelchair and that is the reason why this company offers this service.

-Sport wheelchair

Handy bike from Quickie found at www.sunrisemedical.co.uk

The best sport wheelchair models are designed by this company (Quickie). They are focus on innovation for the spirit of competition.

Their high performance sport wheelchairs and racing handcycles raise the bar for perfect driving characteristics. Ultra-light material, high performing technology and efficient ergonomics.

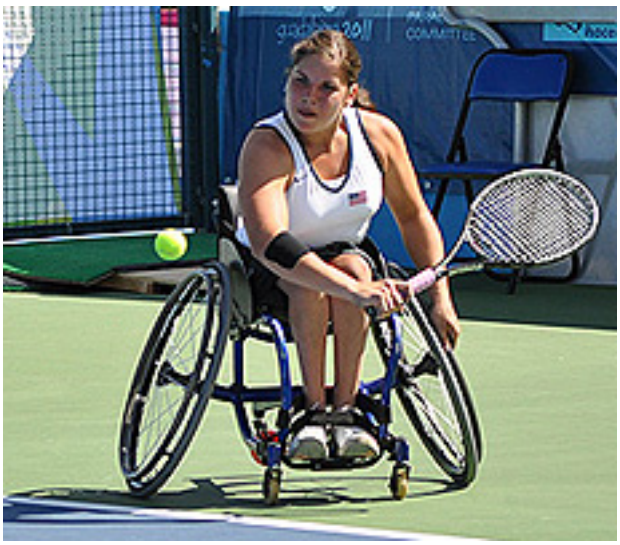
This model is the award-winning QUICKIE Shark RS hand bike (the choice of champions).

The Shark RS's new innovative frame is designed to allow for the best individual positioning and performance.

The Shark RS hand bike was voted Best Product of the Year 2013 at the Plus X awards.

^ *Carbon wheel*

Sport Wheelchair from Quickie



Tournament Wheelchair from USTA

This wheelchair is intended for basketball some of its features are: lightweight, adjustable, high-performance frame built for manoeuvrability and power.

Tennis and basketball wheelchairs are almost the same.

One of the differences are that it can be possible to find a tennis wheelchair with a little front wheel which offers great ease rotation and a compensating balance system.

Sport Wheelchair from Corima

Wheelchair racing chairs with carbon wheel enables speed, security and resistance.
The front wheel helps the direction while the rest generate the motion by the movement of the arms.

They have to be thin but strong, that is why the carbon is a good material.

-Children's wheelchair

Wheelchair by The Renfrew Group and the NHS

Chair4 Life is aimed at maximising mobility and independence for disabled children as they grow into adulthood.

This wheelchair is still a concept which basically enables adapt the wheelchair to the growth of the children.

The seat grows with the child via the implementation of ISO Mount- a universal modular docking system that attaches the seat to the chassis lift mechanism allowing swift replacement of successive seating modules.

The shapes are more ergonomic than the rest of wheelchair.

Zippie Simba Wheelchair from www.sunrisemedical.co.uk

Wheelchair from Krabatt

The ZIPPIE Simba is the lightest but rigid wheelchair for children in this company (Sunrise medical).

It's more discrete than the other example and some of its features are:

-Push handle are height adjustable
-Foot abduction provides for space for the kid.
-Flip-flap footrests for easier transfers.

Krabatt Sheriff is an adaptive wheelchair designed by Krabatt.

The child sits on a saddle seat, which separates the legs from each other. The abducted hip position provides an open angle of the hips which tilts the pelvis forward into a neutral position.

The result is a very stable position that reduces the need for upper body support.
Beautiful and original design.

-Concept design wheelchair

Foldable wheelchair designed by Jack Martinich

Mobi electric folding wheelchair incorporates self-balancing technology that positions and keeps the user in the centre of gravity while balancing on two wheels.

The elimination of the need for castor wheels leads to more compact and manoeuvrable vehicle.

It has rechargeable lithium ion batteries.

But maybe for the back the shape is not enough confortable.

Sidewinder wheelchair designed by Jordan Meadows Design

NEWS concept designed by Ju Hyun Lee

The “Sidewinder” is considered the Harley Davidson of wheelchairs because of its redidesign in shape and aesthetics.

It adds a sense of style and desirability to the devices of war veterans. Designed to maintain or reflect the individual personality of the user, the stylish wheelchair can be customized through an array of seat inserts, wheel constructions and frame finishes, allowing a personalized ride to the user.

The NEWS wheelchair enables standard and manual wheelchairs to be motorized because they are too expensive.

So NEWS (New Electricwheelchair) is conceived to be attached to a normal wheelchair.

CARRIER Robotic Wheelchair designed by Julia Kasinger

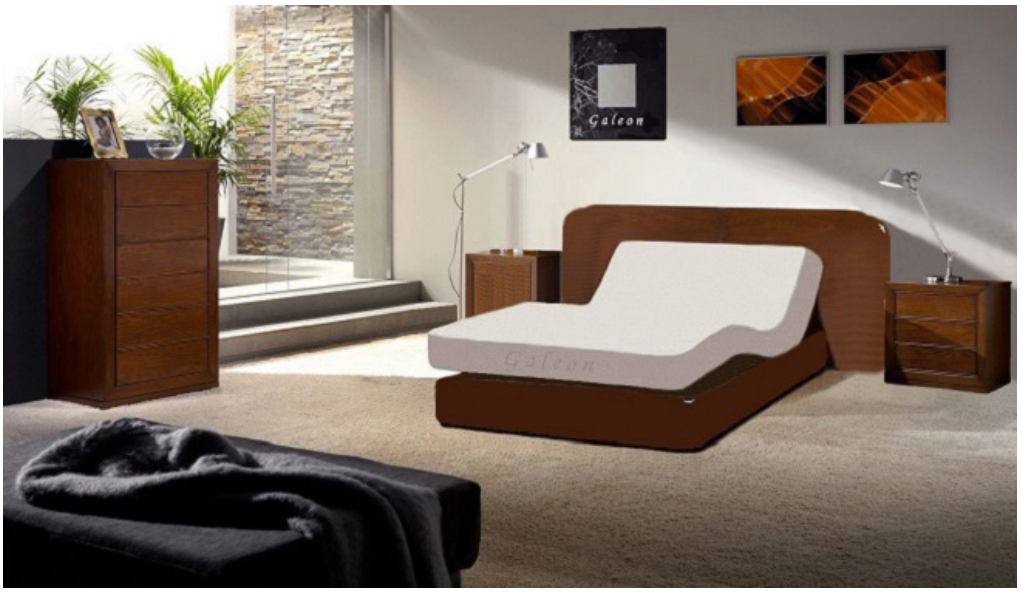
Carrier robotic wheelchair is a concept wheelchair of the future.

It enables 5 different positions depending on the situation required:

-Seat change
-Over stairs
-On the toilet
-Standing position

2. HOME ITEMS

Bed items



Some disabled people who do not have 100% movility need an articulate bed which improves access and movility.

It is quite important not to place the bed next to the wall of the room, also the best option is to choose medium height beds.

It is also suitable to place the switch near by the bed and to choose low closets.

Also, there are some items which hang from the roof of the room to help the incorporation of the user when it is time to go to sleep.

There are interesting beds as well which can slip and recline.

Bathroom items

The bathroom is a room staples should be enabled for use by all people living in the house.

Recommendations:
-In the shower is very important to install a handrail and do not forget that we also put a hose to manually apply the water.

-Accesible height and place for drawers, sheves etc.

-Have space to be able to turn 360º from a wheelchair.

-The door should open outward to allow for emergencies can be opened freely.

-Make sure that the floor is not made of slippery material.

-The light has to be bright and dim according to the criteria of need.

-All bath accessories (soap, towel, etc.) must be installed at a height not exceeding 120 cms from the soil.

3. CRUTCHES

There are two types regarding the gripping position (armpits or wrist).

It's a light product with ergonomic shapes. Those gripping from the armpits are much simpler formally and occupies less space, but conventional crutches have more aspects that can be studied to achieve ergonomic improvement.

They also offer greater security because the sequence of use.

Conventional crutches cover a wide range of variants.

In terms of materials are typically always use the same, without hardly changes in this aspect.

But in the next pages are quite the most innovative crutches examples on the market (or still as concepts).

Crutche designed by Egle Ugintaite

This crutch is called "The Aid" designed by Egle Ugintaite and it's the first prize in the contest FUJITSU design award.

It's more a cane which helps blind or elderdy people or people after trauma, lack of confidence to leave the home, causing them isolation and depression.

It's intended to orient and avoid them to be lost provinding a confident feeling and of course a physical support.

The crutch has an integrated browser and a sensor on the side of the wrist that works as a device that monitors the pulse, temperature and blood pressure.

Crutches found in www.gearfuse.com

Crutches designed by Yong-Rok Kim

This other two examples have second funcionalities like: separable and the ability to make a seat and rest.

They are more attractive than the conventional and the shapes are more ergonomic and confortable.

1.4 CONCLUSIONS

Ergonomic & Shape Conclusions

Those objects generally are really geometric so it makes the user be less close to the product, therefore they are colder in terms of materials, i.e., steel, iron...to ensure durability but in the other hand they are not confortable for the user.

Ergonomic shapes are far away from reality or we can observe it just in quite innovative concepts but not products which are existing already.

They are very complex (a huge number of pieces) and composed by structures specially by bars, so the aesthetics is very unlikely. The colors are always cold, to be coherent with the materials used.

Normally there is no second functions in those objects due to the complexity of the process. But, it is obvious that those products can be improved at least in the next aspects:

-Weight (Ligther)
-Functionality (separable, foldable, reclining, for rehabilitation, etc)
-Ergonomics (dynamic, more confortable, better materials)
-Intuitive (interface)
-Simplicity

Generic Conclusions

From the previous research it is obvious knowing their social and economic problems that those products are not suitable for the user.

Some of the reasons are maybe: the price, or the difficulties to find it (few shops, implies few offer, so high price),or the maintenance.

So, we should ask us: How would be those products more useful for the user?

-The wheelchairs can be cheaper
How? Because of the materials, optimizing design, etc.
-They can be maybe manufactured in situ
-Provide other functionalities

1.5 EXPERIENCE

One of the best ways to understand how our target group feel is to be in their skin, it means to live the experience they have to live everyday and face all the challenges.

This way, we can approach closer their problems, because we have already lived them. And it will be easy to design the possibilities to enhance their quality of life.

It is proposed to do the next tasks during the day:

1. Go up a slope without any help
2. Go to the bathroom
3. Go to the library or study room
4. Look up the grades
5. Go to the elevator

At the end of the day, we need to give some feedback and see the main problems and solutions.

It was really hard to go up because
you need a really high strength
in your arms. You are really hot
because of the big effort, and there is
no place where to put your clothes.
Sometimes, you feel you lose the
control of the chair and you can not
align the wheels.
I can not imagine how hard can be
with a heavy bag full of books behind
myself.

>> In some areas you struggle to pass or you have to choose a long way to go to the library/ study room

>> If you also wear glasses and you forgot them it's quite hard sometimes to read the advertisements or grades.

>> Computer room in this case was adapted to my necessities cause my legs were fitting under the table and my arms were relaxed on the keyboard.

>>Open and close doors was not really easy but at least it was possible, the width of my chair fited with the dimensions of the door.

>> To study was not really confortable due to the height of the table.
If you need to spend a lot of time, you have a lot of pain in your back and neck due to the position.

>> This task was the most difficult without any doubt, I can not imagine in bathrooms that are not “adapted”.

The espace was not enough, it was not possible to turn, but the bars were really helpful. On the other hand I didn’t have any problem with the doors and the corridor was quite capacious.

CONCLUSIONS

It was a very interesting experience facing my project, life is really difficult when you are in a wheelchair and it is good to know from this perspective, not just doing analysis, all their problems.

In this example, the environment is quite friendly and adapted for disabled people, so now there is an additional challenge try to imagine how would you do without all this measurments (bar, good dimensions, good status of floor, etc)

-Hard to transport additional weight
-Sometimes hard to control
-Some furnitures are inconfortable for the user
-Huge physical effort to enable motion
-Strange and forced positions sometimes (studying, open doors, you need to stretch a lot your body)

1.6 SOURCES CONSULTED

From the Market research

>>Wheelchairs:

https://www.cilsa.org/paginas_php/ot/4010/misiones.php

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http://www.lovethesepics.com/2012/09/35-wildly-wonderful-wheelchair-design-concepts/

>>Bed and Bathroom items

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http://disenodebanos.com/diseo-de-baos-para-discapacitados/

http://interiorismos.com/como-adaptar-dormitorio-personas-mayores/

>>Crutches:

http://blogs.lainformacion.com/futuretech/2011/06/09/no-hace-falta-ser-un-rey-borbon-para-llevar-una-muleta-futurista-como-%E2%80%9Cla-ayuda%E2%80%9D/

http://www.nopuedocreer.com/quelohayaninventado/5878/muletas-asiento/

References:

[1] Julio Cesar Gómez Beltrán "Disability in Colombia: Challenge for the Inclusion in Human Capital"

2

SECOND PHASE

Ideation

2.1 CONCLUSIONS

Market research enables to know what are the products available for our target group.

It's interesting if we can aswer the following questions to face the next step:

-What are the needs of disabled people from South America which are not solved?

-How can we improve the offer of the existant market?

-What are the main problems of our target group? (We can analyse first in general disabled people, and then focus in people who live in Latin America

Respecting the conclusions from the previous market research, the principal problems to solve are:

-Manual and Electric Wheelchair are heavy and (Electric) quite expensive

-Wheelchairs are not a soustanaible product because of the recyclability of its materials. Although it enables to have a long durability

-Except concepts, wheelchairs nowadays do not have other funcionalities or innovative solutions

-Wheelchairs and the installation of the room and bathroom should fit together

The needs of disabled people arealso social: to be the more independent possible, to be able to go to work (need to resolve problem public transport, streets, infrastructures)

Their family and friends need also to open their mind and let them be more independent, decide by themselves and choose their own way to live.

Requirements for our concept:

-Light
-Soustanaible
-Confortable
-Double funcionalities
-Recyclability
-Provide independence to the user
-Adaptable to the environment

This conclusions are really useful do describe in the next pages our specifications of our product.

2.2 REQUIREMENTS

Specification of product

Before the ideation phase, it is needed to specify the requirements which has to accomplish our product:

1. ATMOSPHERE:
The atmosphere is quite wide, so it means that the product should be suitable to all possible situations and environments.

2. GENERAL INFORMATION:

The main goal of the product is to enables motion in disabled people, trying to make their life easier and allow independance.

3. REQUIREMENTS:

Funcionality:
It is a critical requirement, being essential to the optimal functioning of the wheelchair and at least a minumum acceptable.
Being an orthopedic product will have to express from the outset security in the development of activities, providing a friendly and confortable use.
As added functionality would be very interesting second functions to increase the value of the product.

Environment:
A very important aspect to consider, and it is closely related with toxicity, texture of materials and recyclability.

Respecting the boundaries of the wheelchair redesign, it has to follow obviously a soustanaible, fair and respectful with the environment line. It is needed to be aware to work with the materials and manufacturing techniques the most commited with ecology problems, thus providing a further value to the product.

Packaging

Specification desirable, develop a compelling, distinctive, lightweight packaging from the rest.
But if it is possible to fit at maximum the product, modular designed, aiming to improve and facilitate the transport of the product and decreasing costs.

Size

It absolutely influences the use with the user, it has to accomplish the rules of antropometric table to reach the more people possible. Hence, must be regulated.

It's also linked with some of the problems studied in the previous phases like: the width of the doors, elevators, and all those cases where the user can not finish his action properly.

Aesthetics

Desirable but not critical, aesthetics is a product differentiator and is the detonant which makes choosing one product over another.

But in this case as it is maybe an orthopedic object is more important other aspects like cycle life of the product, durability, confort, functionalities etc.

We can achieve aesthetic by innovating in shape, colour and materiales. Forms tend to be timeless futuristic but also to extend the maturity cycle of the product.

Materials

Critical requirement, considering it has direct contact with the user, it has to be lightweight, easy to handle, good fit for existing mechanisms, to have differentiation areas.

Therefore materials will attempt to low the price of manufacturing processes,performing it in series.

Limitations of the material:
in endurance weight 150 kg, impact, deformation, waterproof and show stability with the strength and stiffness material.

It important to emphasize that it is a safe and reliable product, as it will be of a medical nature.

Ergonomics
The product is the one that has to suit the user. Has to be simple in regulating the product and to have an easy and intuitive interface concerning as well all its functions.

We need to avoid postural loads, forcing the user to adopt naturally, avoid painful back or buttom aches by changing maybe materials and shapes.
Also we have to study ideal angles helping users in their daily tasks.

Consumer
Multi-product, it will have to be able to fit all potential users and also enable them to perform each activity correctly.

Quality and reliability
It is an essential requirement because it is a staple, it's expensive and have to provide safety and welfare to its users.

It has to be a product of high quality and reliability, those aspects are the most demanding aspects, ergo this requirement is the most relevant for the design of the product.

Lifetime
Wheelchair are more or less 5 years which it's quite little due to the price of the product. [1](Found in several instruction manuals of Wheelchairs, see sources).

Our product has to last more time to be fair with the consumer and provide a better service. This short lifetime can be justified because of their several impacts or because of technology goes so fast that they are outofdated too soon.

Installation
The assembly required has to be easy, avoiding small parts handling or also may take such action in the store where the product is purchased.

Maintenance:
If the product is a wheelchair it is needed to check the air or tyre flats

in the wheels, the assembly (if it is required of the pieces).

Also to check the aligment of the wheels, clean the axles and lubricate the castor housing bearings.
To end up, it is also important to revise the brakes, which can be very dangerous. The brakes are held firmly to the frame in the correct position.

Cost of the product

It is desirable that the product has a good value for the user.

Giving top priority to safety and high quality of the developed product.
It is a product that no matter when it is necessary, pay more money for but concerning the countries we are focusing it is an important aspect due to their economic problems. So we need to leverage resources to economize its price.

Manufacturability

Minimize the number of pieces that make up the product, make them as large or manageable as possible and use materials that it is possible to implement the mass production to produce a cheaper product.

Automatable process is completely linked to the production series of products.

Competence

There is no a large competition although there are a lot of companies which provide services and items for disabled people around the world. But not in the regions where is located our target group.
There is no monopol in any patent either a compelling product which shine more than the rest.

The evolution of this product (excepting concepts) has been minimal, staying in small ergonomic changes.

Differentiation ability enables to convince the user, producing a striking design. Like for example focusing in ergonomics improvements for adaptation to the person, improvements during use, other functionalities, price...

2.3 PROBLEMS

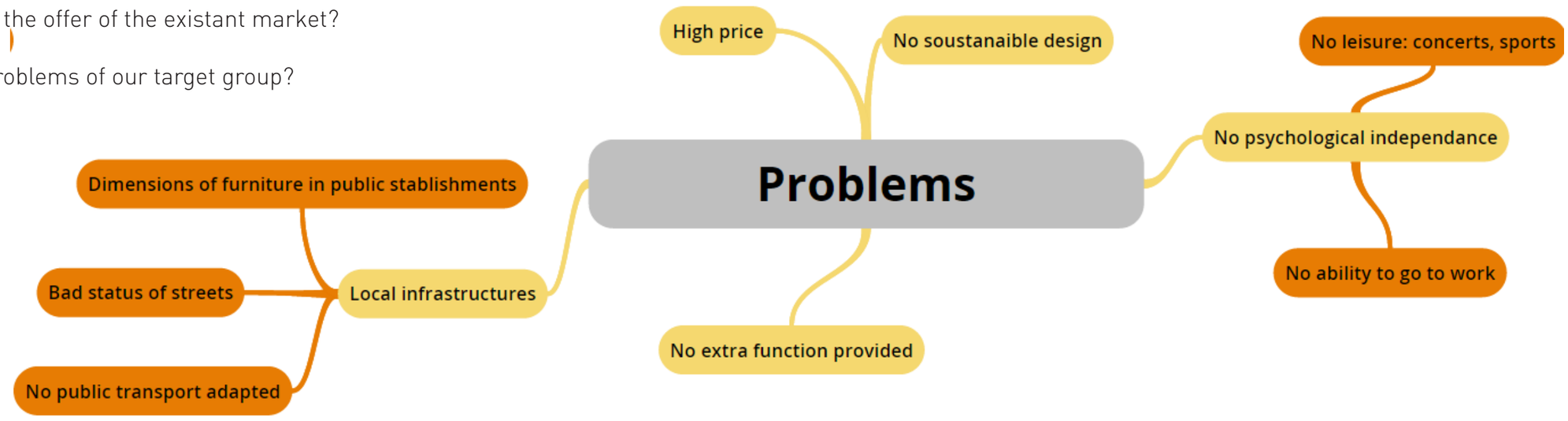
MIND MAPS

With all the gathered information, we need to focus on the analysed problems trying to group all together and think about ways to resolve them.
Let's answer our previous questions in a visual way for a deep understanding:

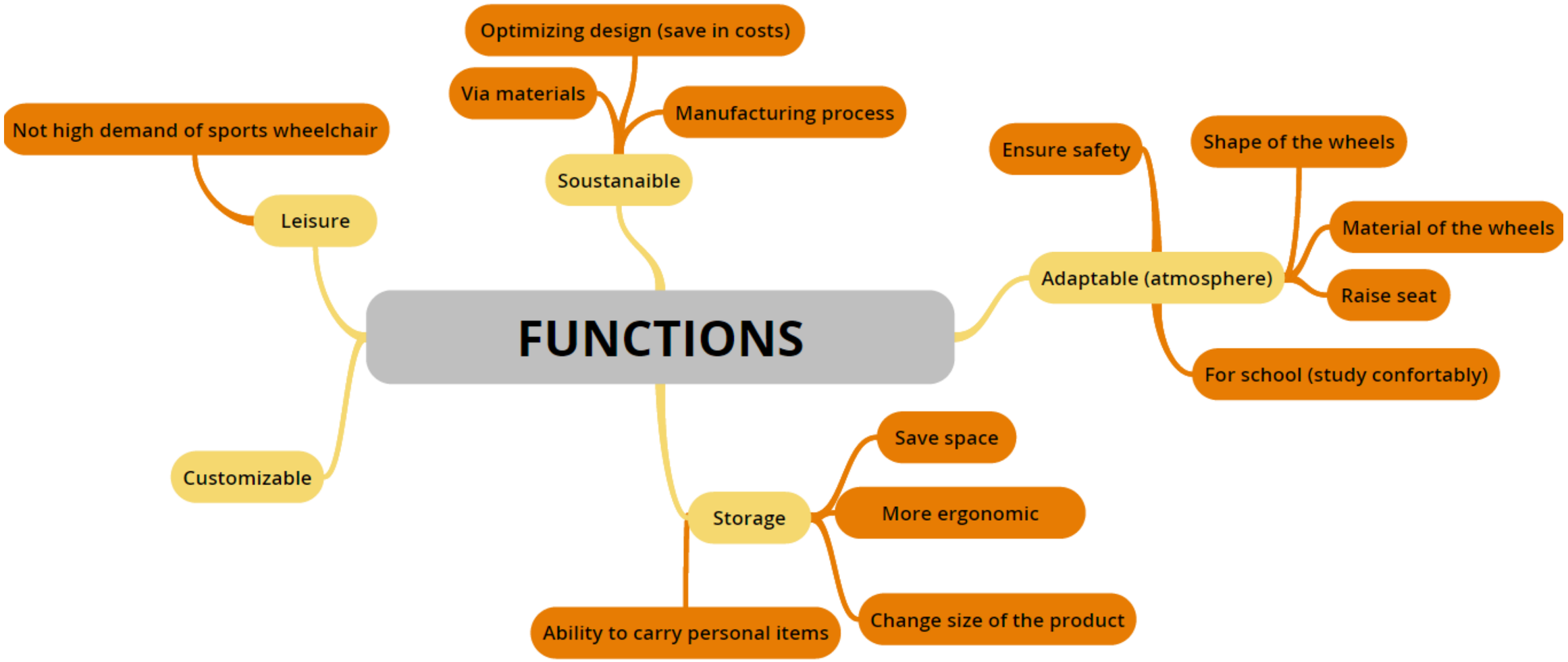
What are the needs of disabled people from South America which are not solved?

-How can we improve the offer of the existant market?

-What are the main problems of our target group?



HOW...?


FUNCTIONS
Not high demand of sports wheelchair
Leisure
Customizable
Optimizing design (save in costs)
Via materials
Manufacturing process
Soustanaible
Storage
Save space
More ergonomic
Change size of the product
Ability to carry personal items
Ensure safety
Shape of the wheels
Material of the wheels
Adaptable (atmosphere)
Raise seat
For school (study confortably)

BRAINSTORMING

Once we have defined the problems, it is useful to use as a tool a Brainstorming to see how we can approach our problem and which are the available options.

How can we design a chair which enables...?

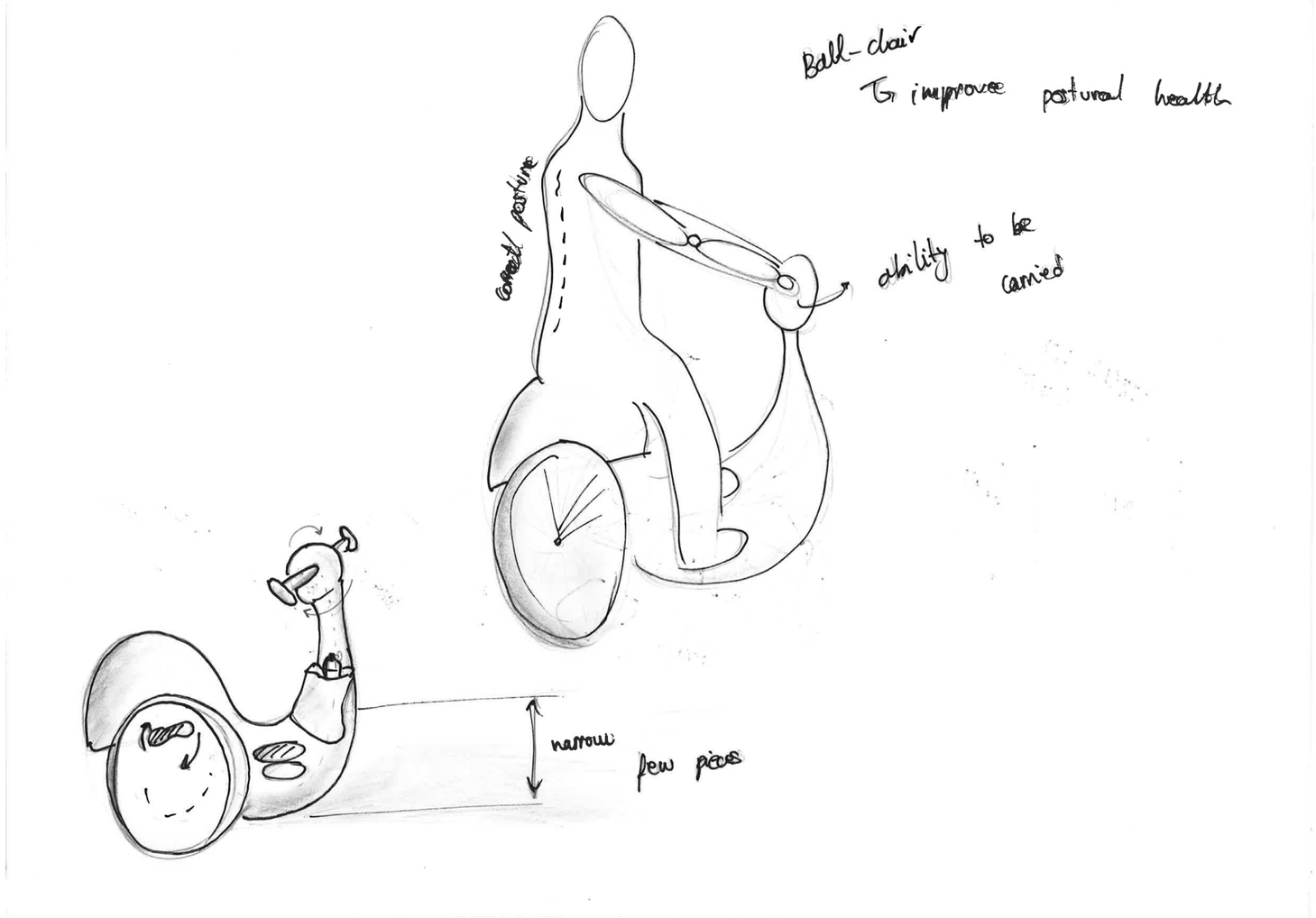
-To raise up the user
-Which can be folded
-Which has ability to store, storage
-To dress up by themselves
-To go shopping alone
-Improve safety
-Decrease price
-Promote paraolympic sports
-To be integrated in their environment
-To be attractive in shape and materials
-To increase confort
-To keep the user active
-To improve health care, health postures
-Make it affordable

Those ideas can be achieved by...

-Change the shape of the wheels
-Optimise design, make the user build the chair
-Material foldable (textil), design which enables stretching the product
-Change angles in the wheels (to make it sportive)
-Improve brakes
-Study back positions
-Enables motion while the movement of the user, keep him active

FIRST IDEAS

Presentacion of some ideas conceived in the first contact (ideation phase)



IDEA 1

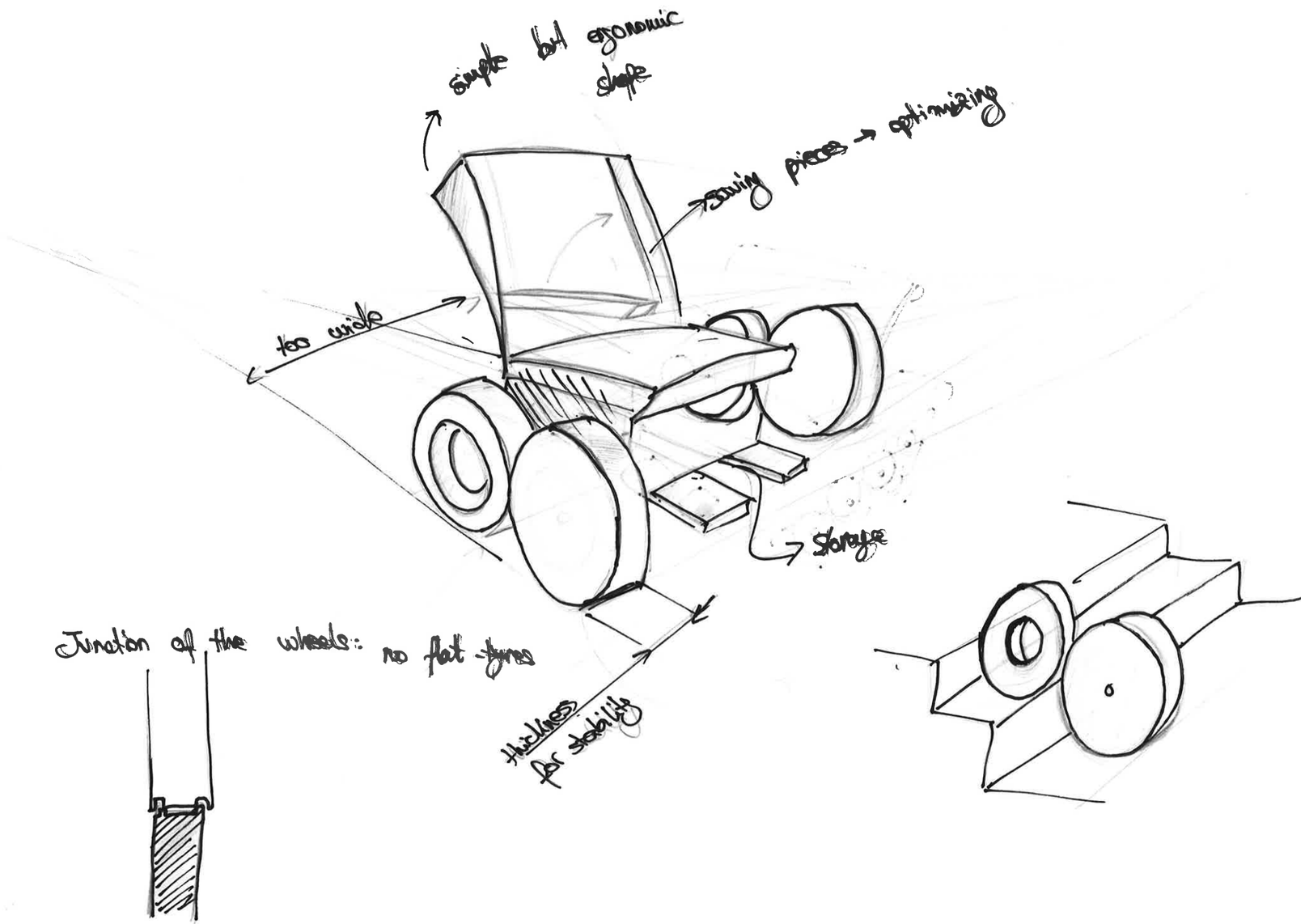
The idea of this sketch is to improve the posture health of the user while he is active.

Its dimensions also enables to be adapted to the analysed environment because it is more narrow than conventionals wheelchairs.

Therefore, it has few pieces, so the costs should decrease.

One of its funcionalities is that if the user does not want to work out, he can also be carried out by the same handlebar. In addition, it has also space for storage.

The user is seat down in a ball which avoids you to have bad postures and exercise their equilibrium

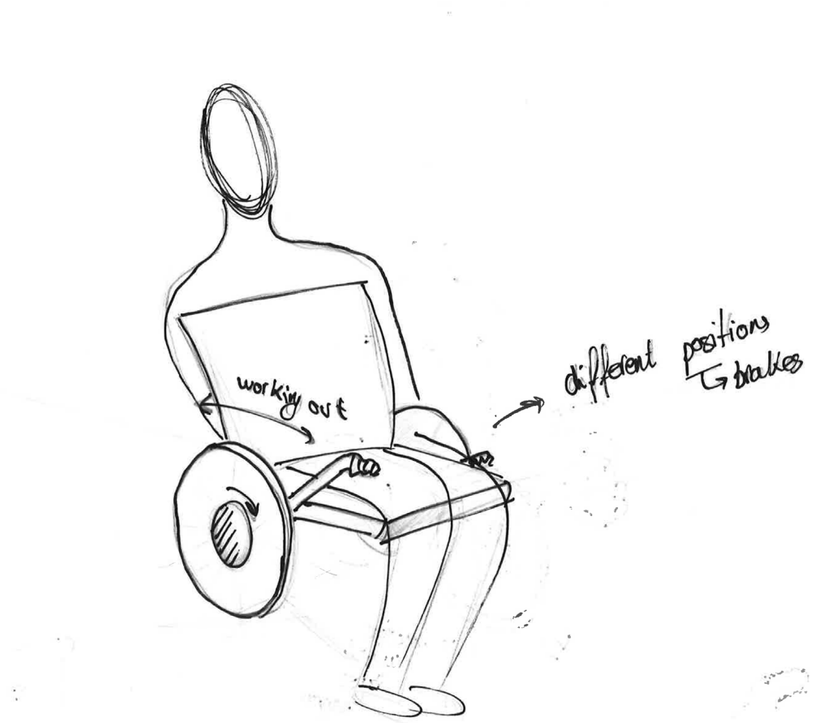


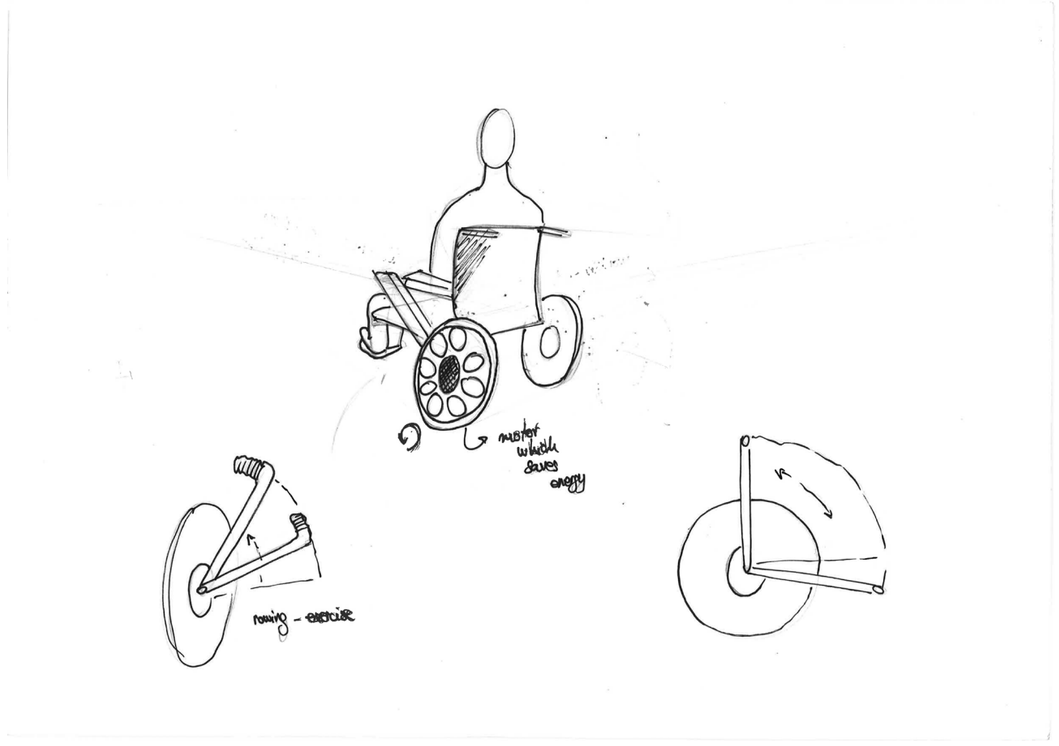
IDEA 2

This idea is conceived specially to resolve the problems in the street.

Thanks to the junction of the wheels, the wheel chair is more steady and it enables to come over obstacles, even stairs.

There is also some space reserved for personal items.



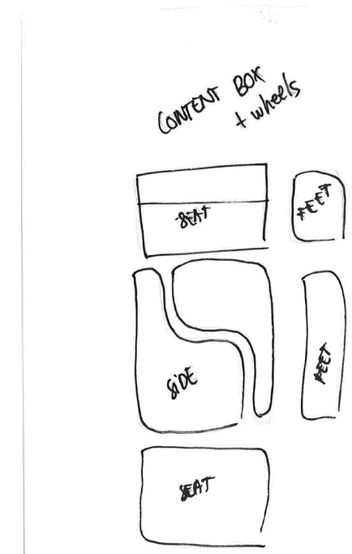


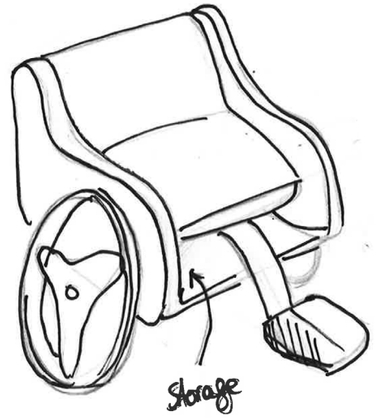
IDEA 3

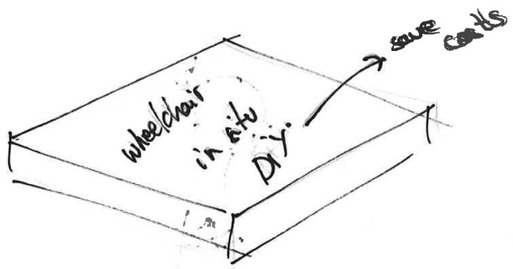
The improvements in this idea compared to a conventional wheelchair is that is an hybrid between electric and manual but it's very soustanaible.

The reason is that the user work out (in a rowing motion and a motor installed in the wheel saves the energy. When the user does not want to keep working out, he can use the energy saved to enjoy the ride.

This concept keeps the user active and also takes care of the environment.







IDEA 4

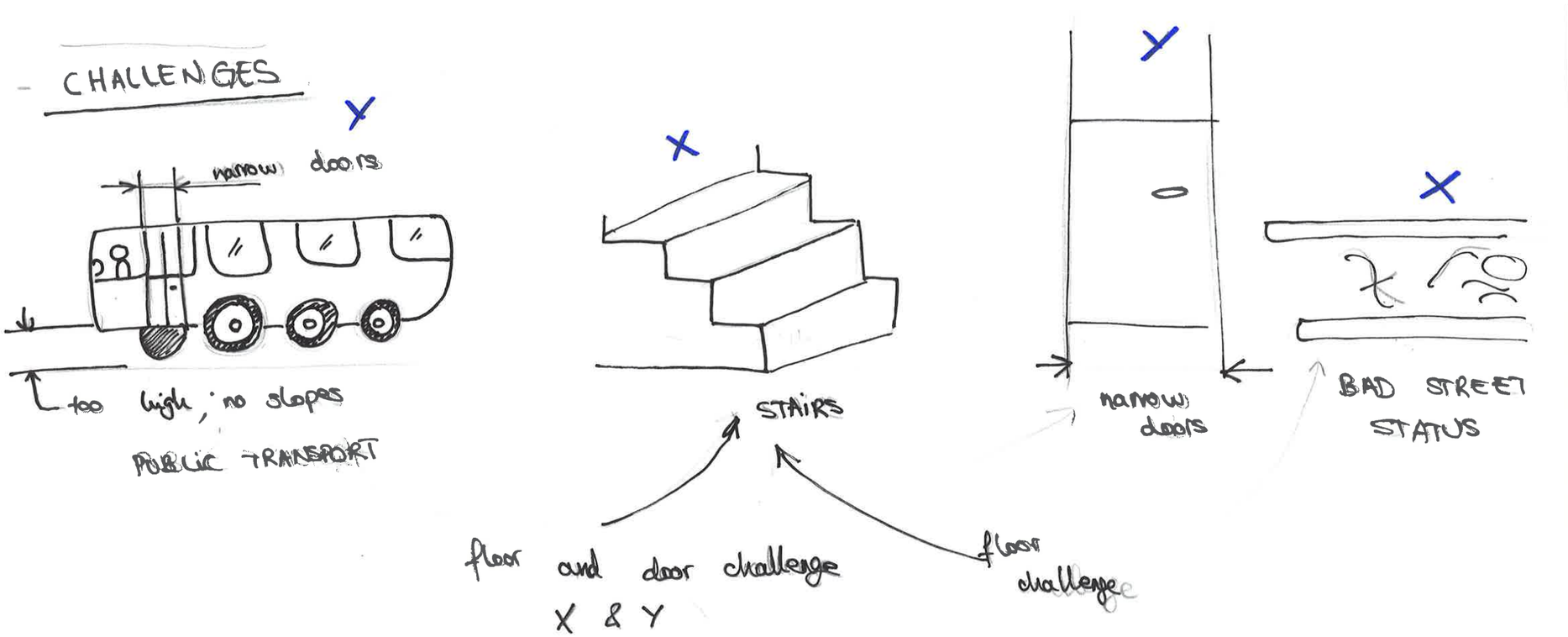
The last one is a business idea focused on saving costs for our target group.

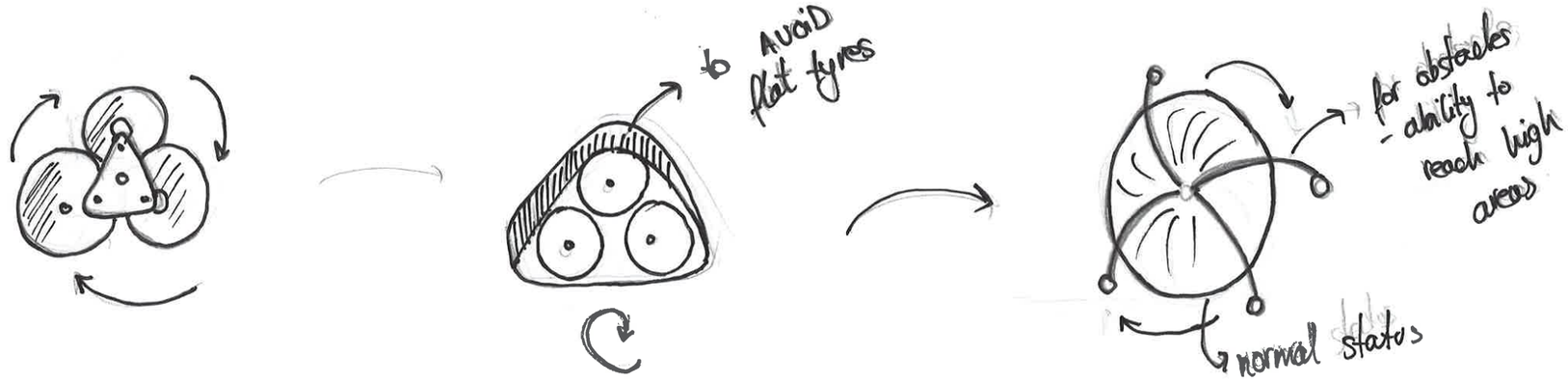
It deals with an online business where you can command your wheelchair and build it up at home. This way the company and the user save a lot of money and make it available for a lot of countries.

The materials are also warmer and softer than a conventional chair (thinking maybe about wood or bamboo which have a lot of resistive properties and provide a nice contact) .

CHALLENGES

...they have to come through

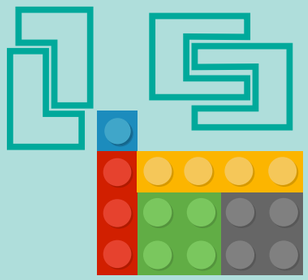




INDEPENDANCE/SELF STEEM

<<PRICE>>

Modular pieces



Use little wheels

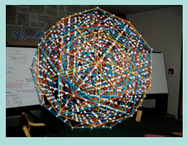
Used couch/bed for seats/back

Or bigger ones...

(No flat tyres)

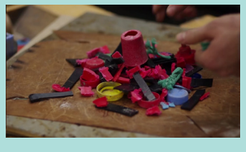
Structures

(Structural cardboard)



Other:

All in plastic (made of rubbish)

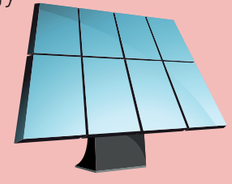


<<OVERCOMING BARRIERS>>

Mobility/ Articulation

Observe the nature

Empower soustainable energy



INDEPENDANCE/SELF STEEM

SIMMILARITIES AND PATTERNS

-USED PARTS
-RECYCLABILITY
-MODULAR PIECES
-SIMPLE PIECES, EASY MAINTAINANCE
-LIGHT BUT RESISTANCE
-AFFORDABLE
-CHEAP AND SOUSTANAIBLE MATERIALS

<<PRICE>>

FOR WHOM?

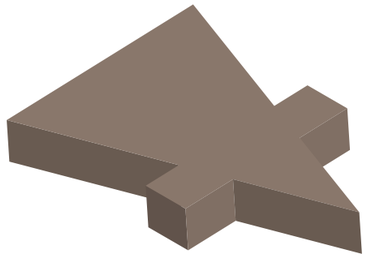
-DEPENDANT PEOPLE
-LOW ECONOMIC CAPACITY
-LIKELY WARM TEMPERATURE
-WIDE RANGE OF AGE

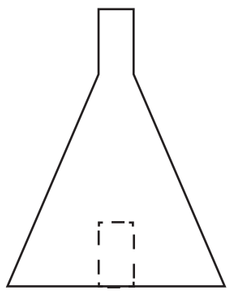
-SAFETY AND ARTICULATIONS
-ROBOTIC INFLUENCE
-EMPOWERING ENERGY, (SOUSTANAIBLE WAY)
-HIGH QUALITY LIFE

<<OVERCOMING BARRIERS>>

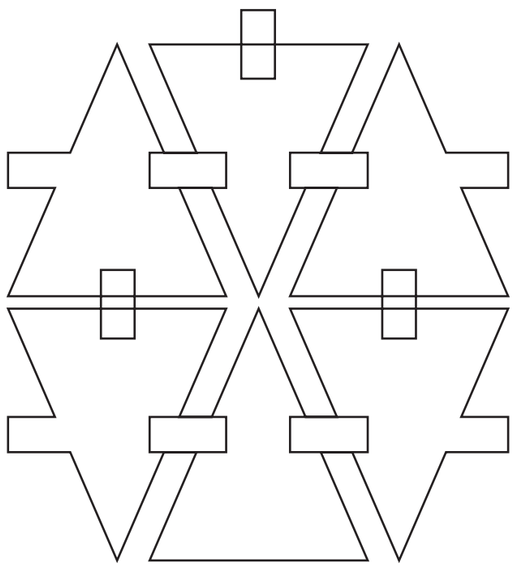
FINAL CONCEPTS

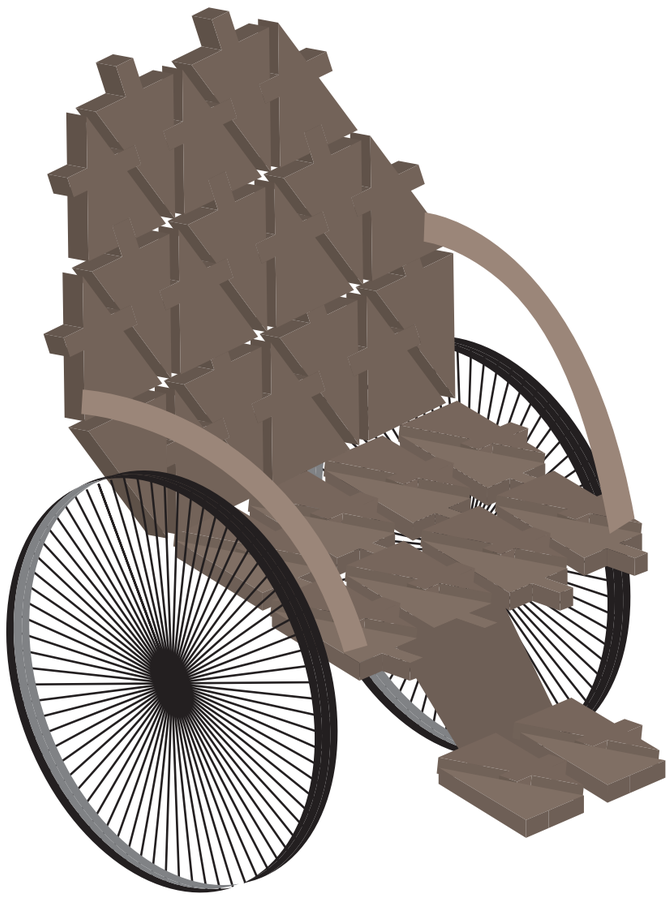
CONCEPT NO. 1

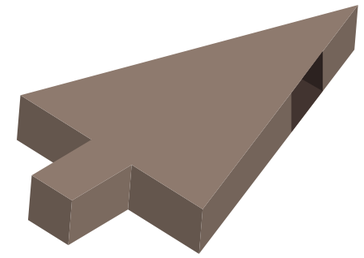


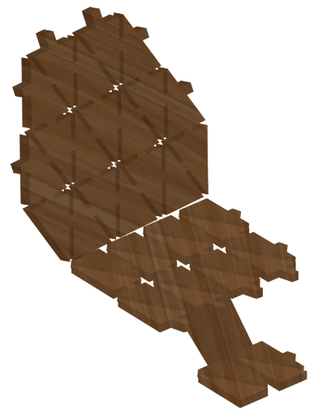


RESEARCH OF DESIGN MODULAR PIECES IN ORDER TO CREATE A SHELL

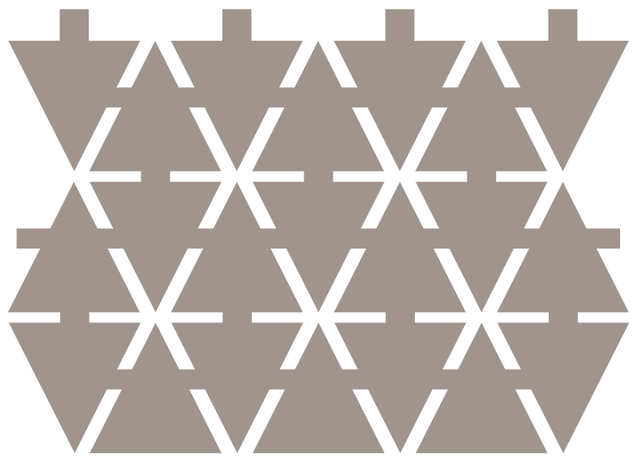




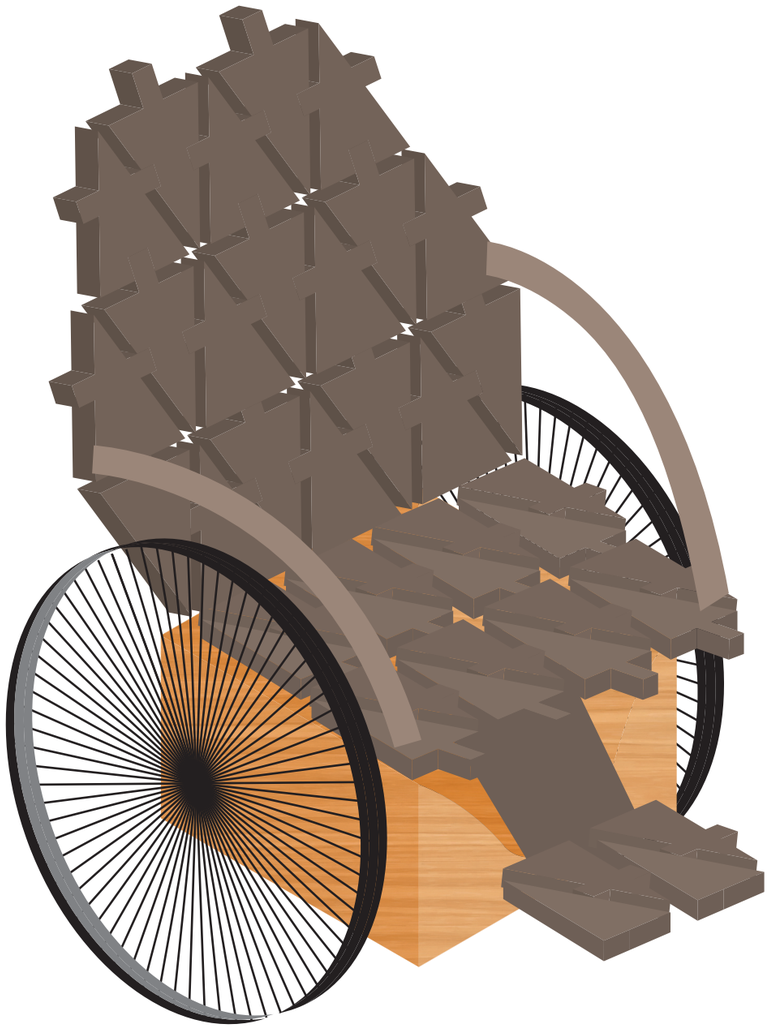




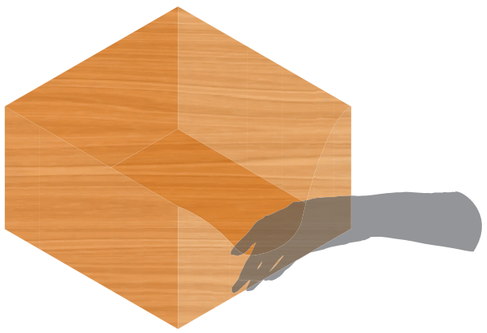
MADE IN WOOD



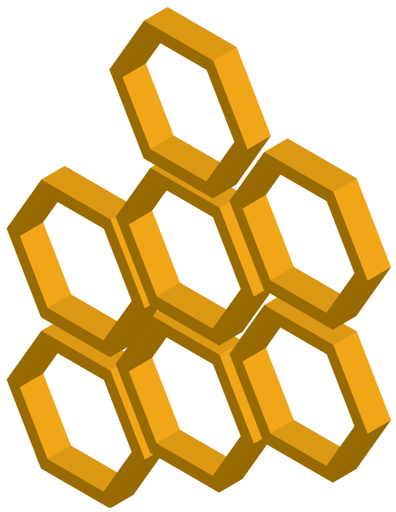
EVOLUTION OF CONCEPT NO. 1



PLACE FOR STORAGE UNDER SEAT



RESEARCH OF NEW MODULAR PIECES



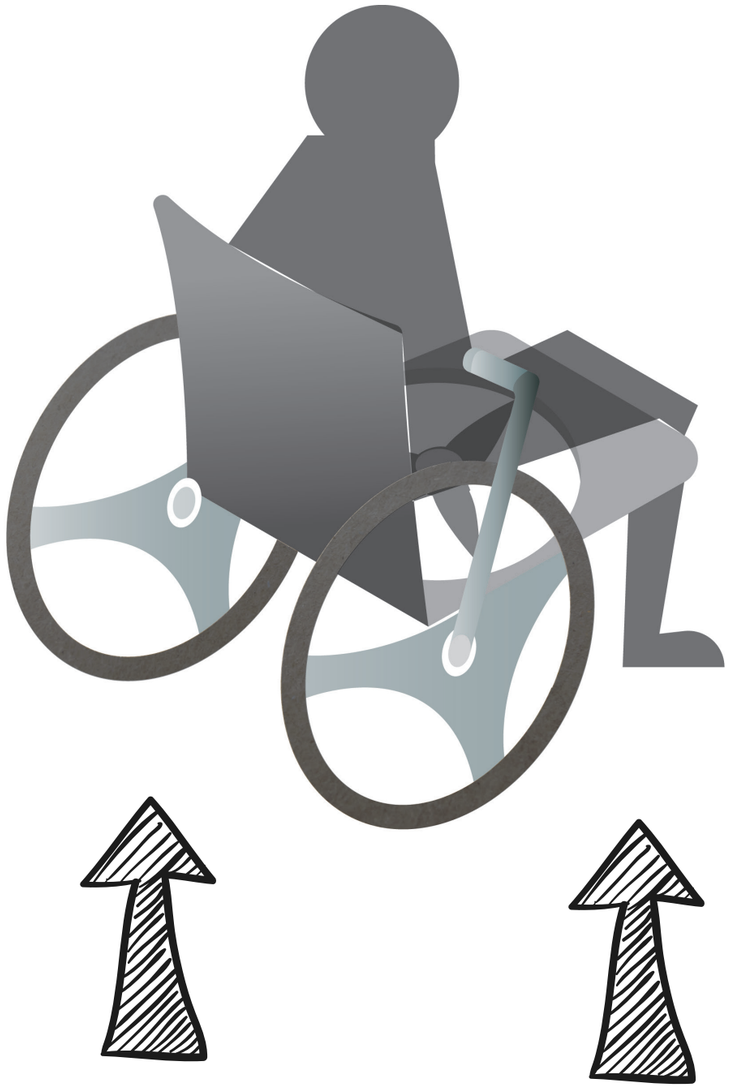
MAKE IT FOLDABLE

THINK ABOUT HYGIENE, DIRTY HANDS?

CONCEPT NO. 2

HELIX LOCATED IN THE SEAT OF THE WHEELCHAIR TO ENABLE THE POSSIBILITY OF
OVERCOMING OBSTACLES

AVAILABLE A HANDLE TO CHARGE THE BATTERY AND KEEP THE USER ACTIVE, THIS WAY IT'S LESS EXPENSIVE

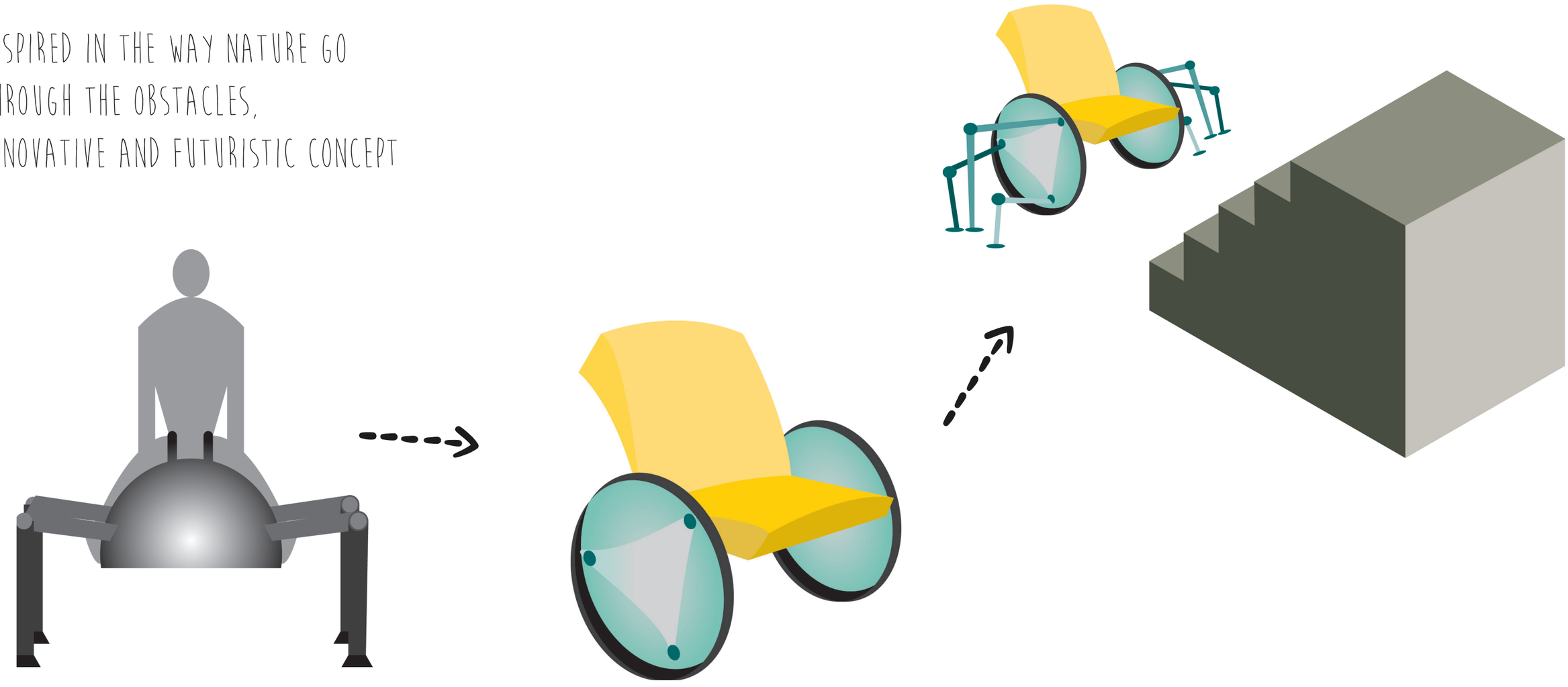


FUTURISTIC
AESTHETICS,
TECHNOLOGIC COLOURS

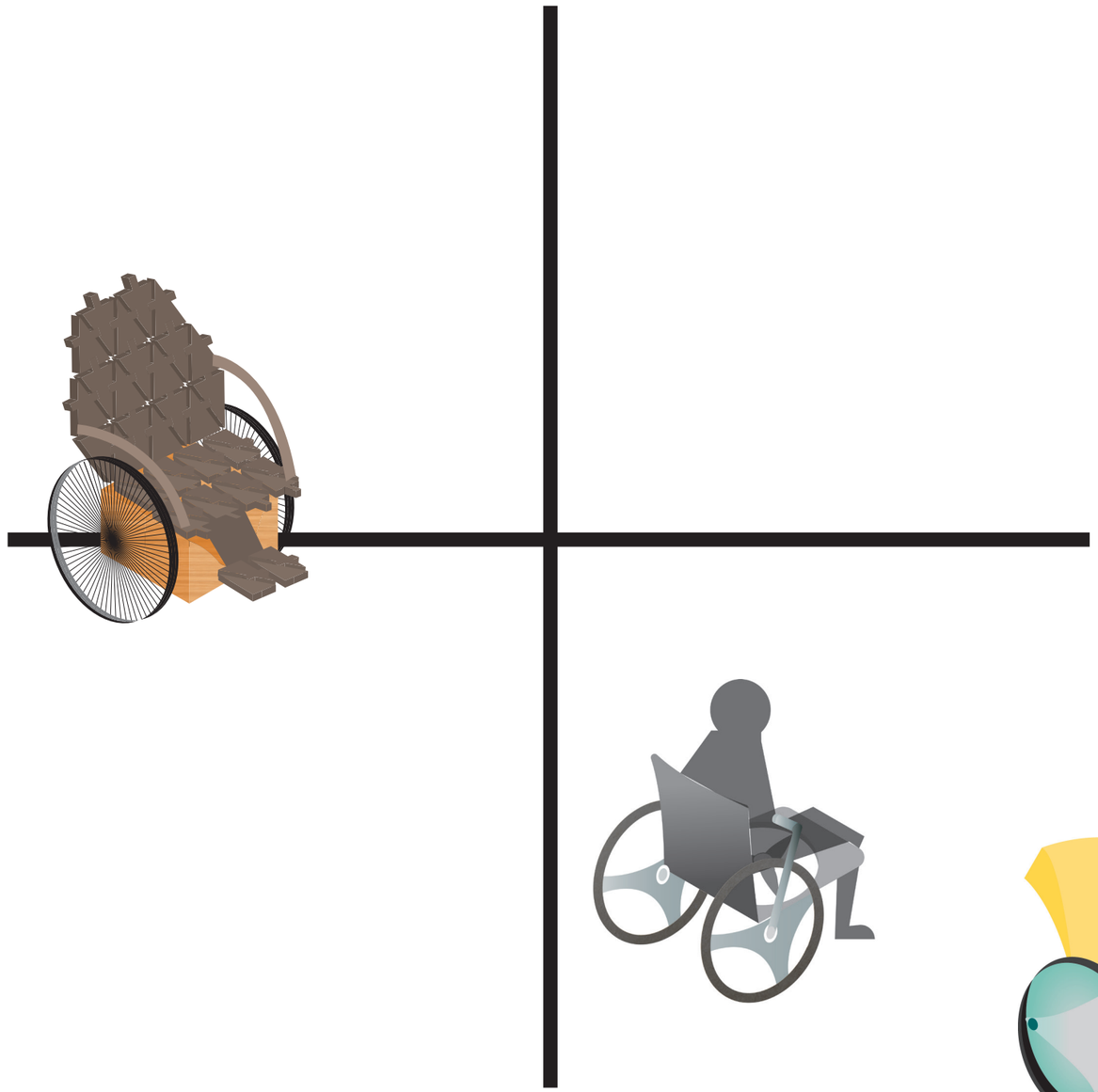
CONCEPT NO. 3

INSPIRED IN THE WAY NATURE GO
THROUGH THE OBSTACLES,
INNOVATIVE AND FUTURISTIC CONCEPT

FOCUSED ON POSTURE HEALTH AND NEW
CONCEPTION OF THE PRODUCT



CONCEPTS AND CHART



EVALUATION

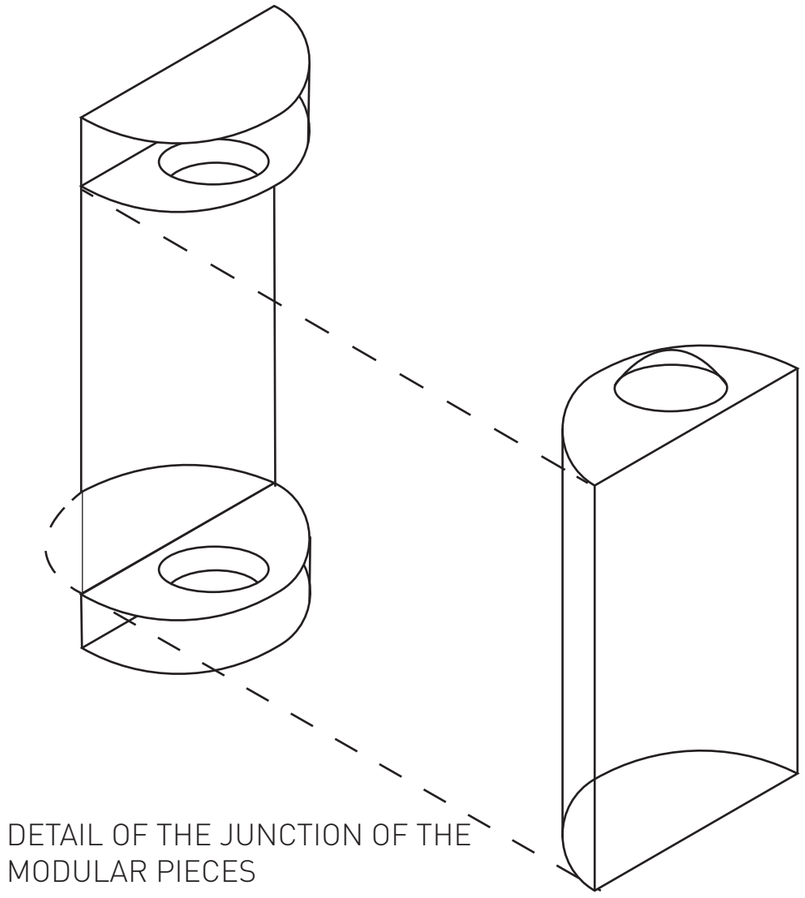
Criteria to select the concept

Criteria	Concept 1	Concept 2	Concept 3
Innovative	5	7	8
Soustanability	9	5	6
Suitable for target group	9	6	6
Low price	9	4	3
Maintenance	8	4	4
Low complexity	8	5	4
Resolution of problems	7	6	6
TOTAL	**55**	37	37

DEVELOPMENT OF CHOOSEN CONCEPT

NEXT TASKS:
-TO MAKE IT FOLDABLE
-TO PROVIDE SOME SYSTEM TO AVOID BARRIERS (TO MAKE IT CLOSER FROM THE OTHER CONCEPTS)

MAIN FEATURES:
-CHEAP
-EASY MAINTENANCE
-MODULAR AND SIMPLE PIECES
-SOUSTANAIBLE MATERIAL (ECOLOGIC PRODUCT)
-STORAGE & MULTI-USE TABLE (INCREASE INDEPENDANCE TO EAT, COOK, STUDY)



DETAIL OF THE JUNCTION OF THE MODULAR PIECES

3

THIRD PHASE

Conceptualisation

3.1 DEVELOPMENT

Realisation of a 3D model

One of the most important things at this point is to decide the dimensions of the product.

For that, it is needed to specify the size of our user and the correct dimensions of a normal wheelchair.

It is also impertant to pay attention to antropometric details which can have the target user.

For instance, the average of a southamerican adult is 1'67 m and their weight is about 73 kg [1].

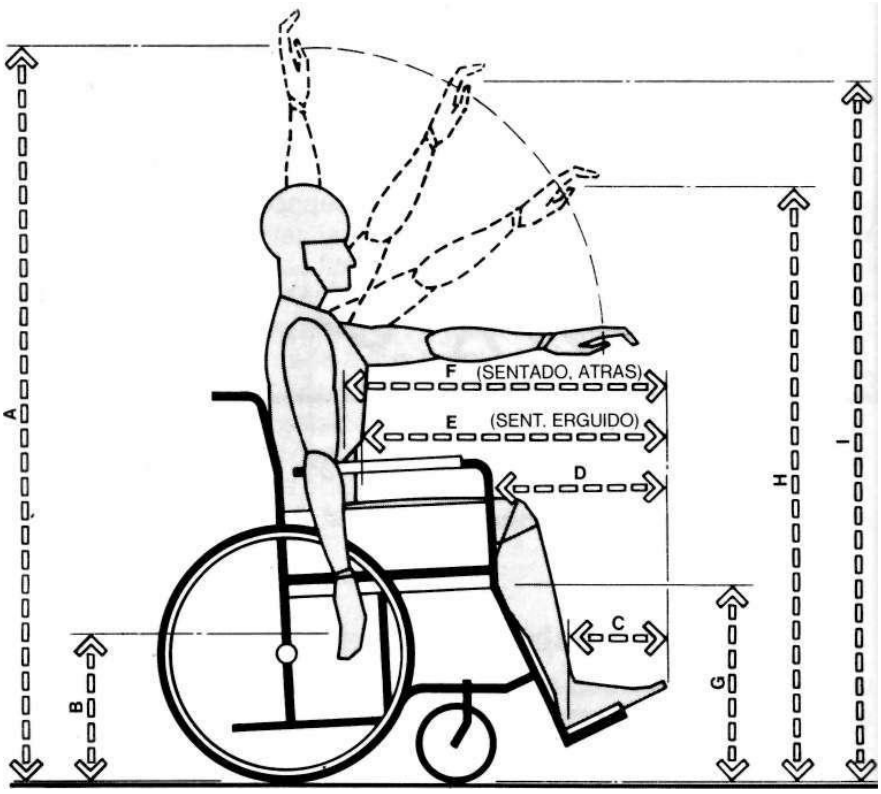
As the goal is to to reach the most people as possible the approach will be based on this data.

But, it is still missing the dimensions for a confortable wheelchair and all the essentials to prove its safety.

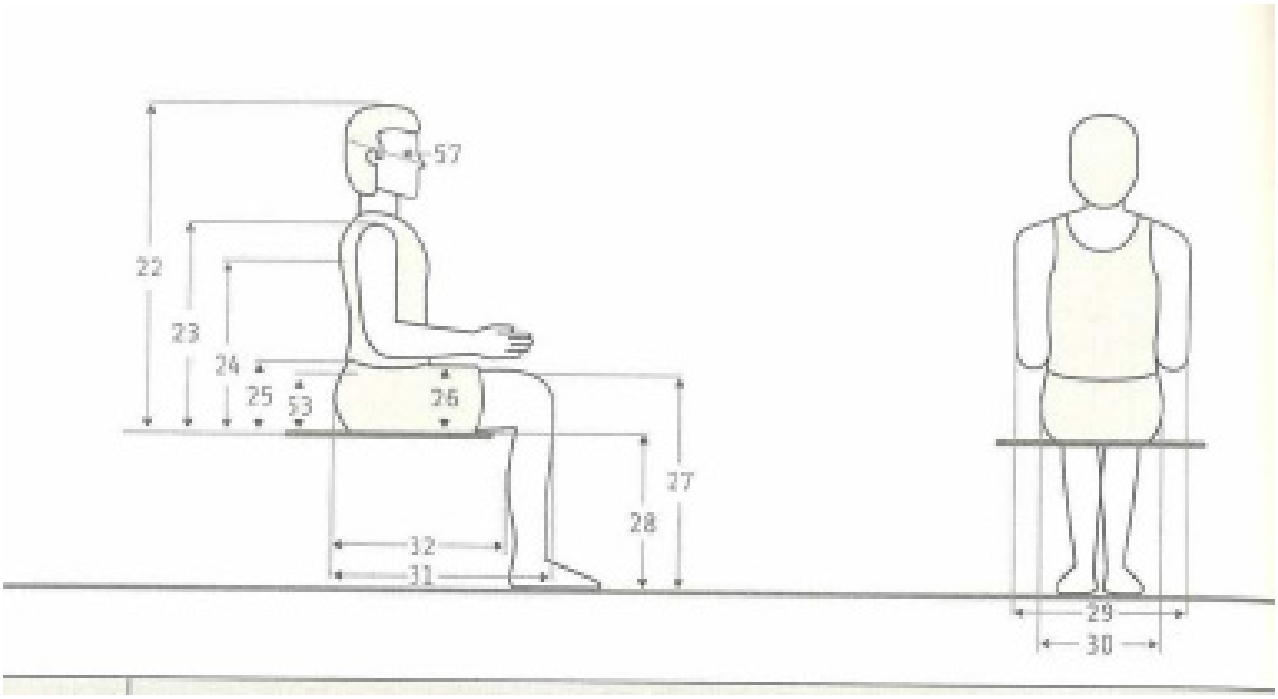
Our main goal is to focus in price, ergonomics and resolve problems.

To ensure ergonomy in the product the antropometric tables will be focused on the Male population of South America and also proper dimensions for a confortable wheelchair.

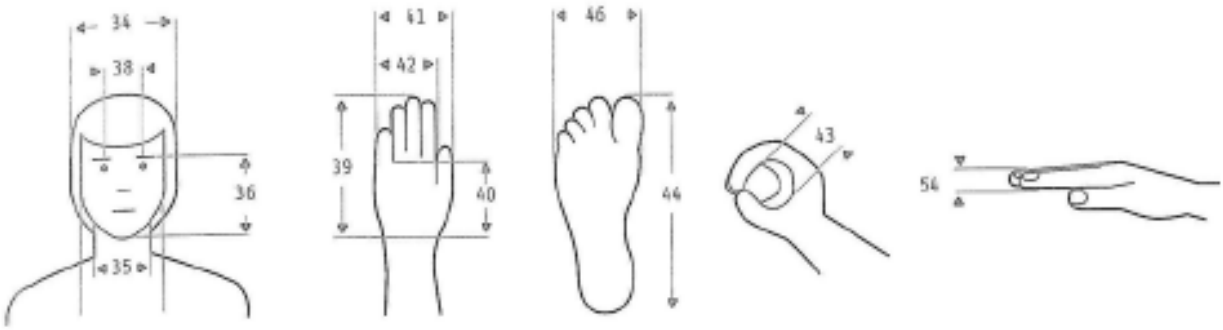
Antropometric tables



	HOMBRE		MUJER	
	pulgada	cm	pulgada	cm
A	62.25	158,1	56.75	144,1
B	16.25	41,3	17.5	44,5
C	8.75	22,2	7.0	17,8
D	18.5	47,0	16.5	41,9
E	25.75	65,4	23.0	58,4
F	28.75	73,0	26.0	66,0
G	19.0	48,3	19.0	48,3
H	51.5	130,8	47.0	119,4
I	58.25	148,0	53.24	135,2



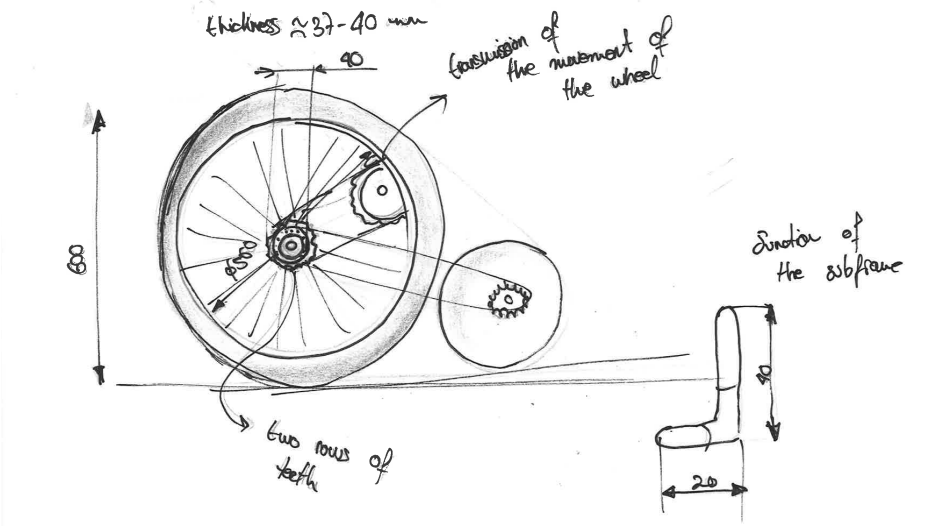
Dimensiones		18 - 65 años (n=395)				
				Percentiles		
		$\bar{x}$	D.E.	5	50	95
22	Altura normal sentado	876	31.17	825	877	927
23	Altura hombro sentado	581	27.63	535	582	638
24	Altura omoplato	442	27.66	396	443	486
25	Altura codo sentado	246	28.36	201	245	290
53	Altura cresta ilíaca	195	19.19	158	198	223
26	Altura máx. muslo	152	18.09	127	150	178
27	Altura rodilla	513	25.79	473	512	556
28	Altura poplítea	412	25.65	374	412	453
29	Anchura codos	531	54.90	443	529	620
30	Anchura cadera sentado	374	31.26	328	372	423
31	Longitud nalga-rodilla	583	33.41	537	582	640
32	Longitud nalga-popliteo	476	28.92	432	475	526
57	Diámetro a-p cara	222	8.27	207	222	235

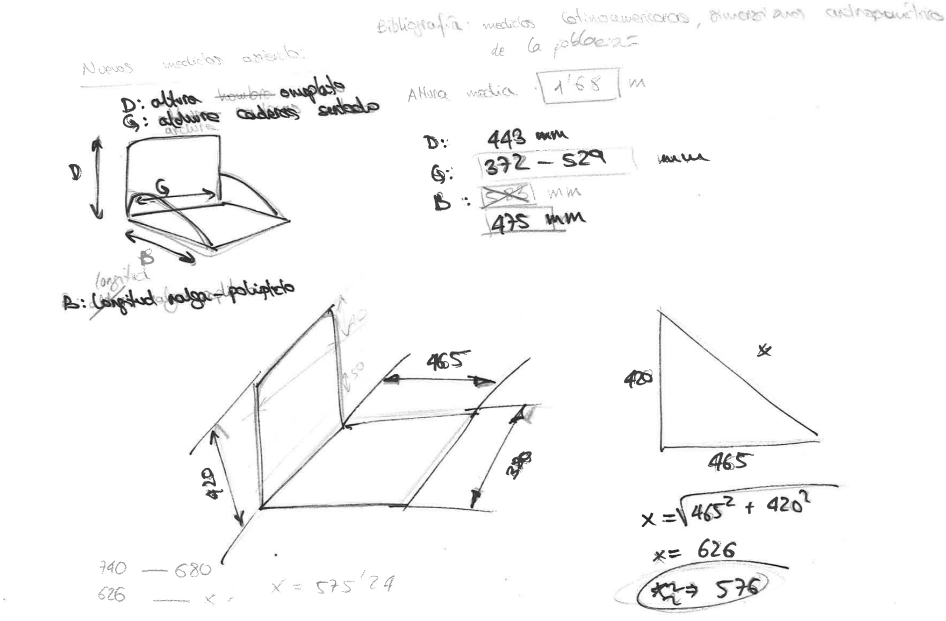


Dimensiones		18 - 65 años (n=396)				
				Percentiles		
		$\bar{x}$	D.E.	5	50	95
34	Anchura cabeza	150	8.54	134	151	165
35	Anchura cuello	110	7.94	97	109	122
36	Altura cara	127	7.55	114	128	138
37	Anchura cara	124	9.69	106	124	139
38	Diámetro interpupilar	57	4.94	49	57	65
39	Longitud mano	171	8.28	158	170	185
40	Longitud palma mano	97	4.77	90	97	105
41	Anchura mano	93	6.83	83	92	103
42	Anchura palma mano	76	3.56	71	76	82
43	Diámetro empuñadura	44	3.63	39	45	50
44	Longitud pie	232	10.13	217	232	250
46	Anchura pie	90	4.92	83	90	99
54	Espesor mano	29	3.17	24	30	35

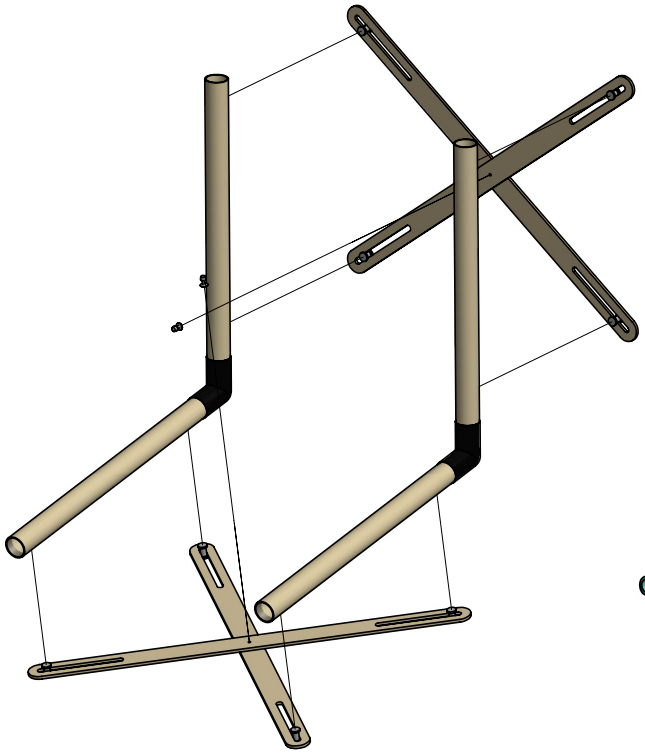
Male South America Population 18-65 years old 2007

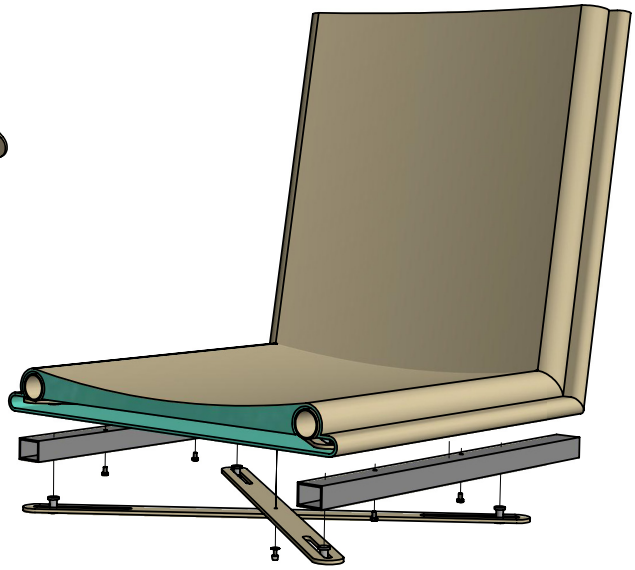
Sketches for the final concept and dimensions

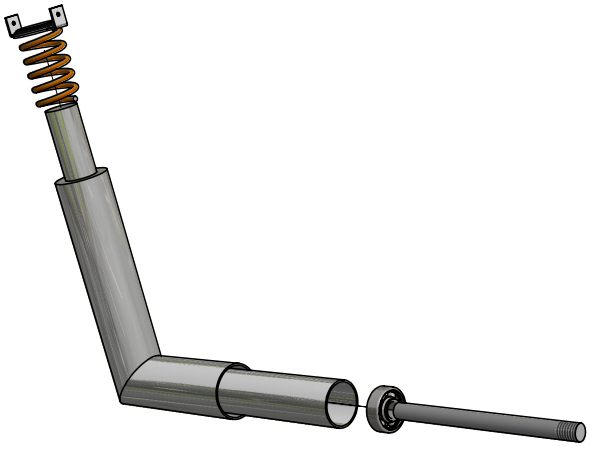




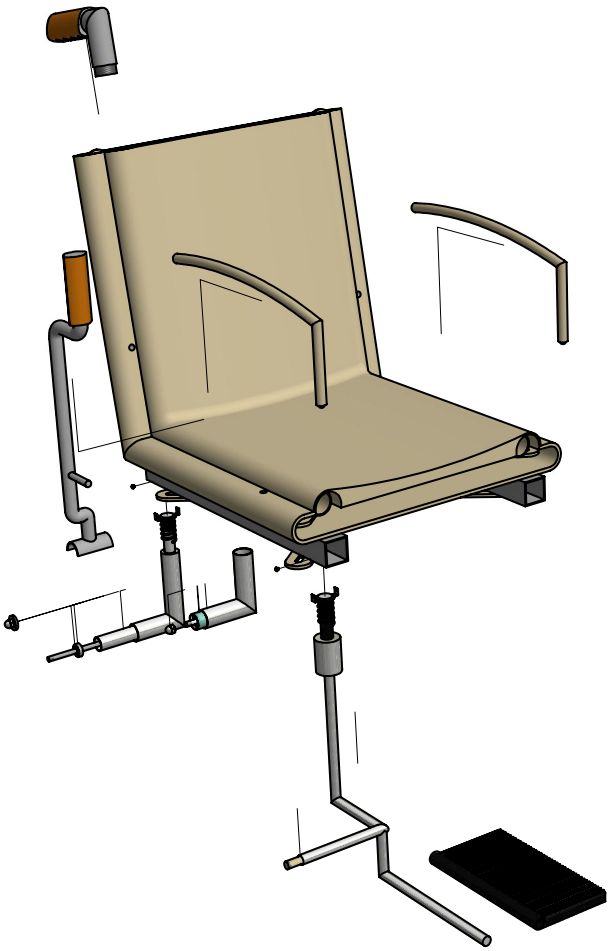
How to assembly







1.The first step is to build the foldable system. The joints of both structures are already inside to ease the mounting of the user and to avoid losses.
2. Once the internal structure is built, it's time to put the seat (foam and cover) and screw it to the square tubes.
3. The last picture shows the performance of the bearing and the spile in order to produce motion (the sproke needs to be free, otherwise when the user goes back, it will move him back).

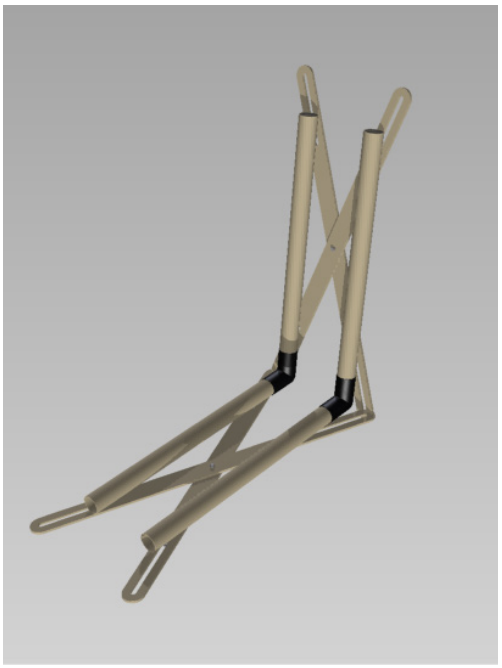


4. Then, the last parts need to be jointed but it is quite intuitive. The handgrip is screwed and the handle is located in the axes of the little sproke of the big wheel. The foot rest can twist when the user needs to fold the chair. Besides, the safety bars provides more confidence to the user and be more tight to the chair.

Later on, the user must screw the different axes to the seat carefully.

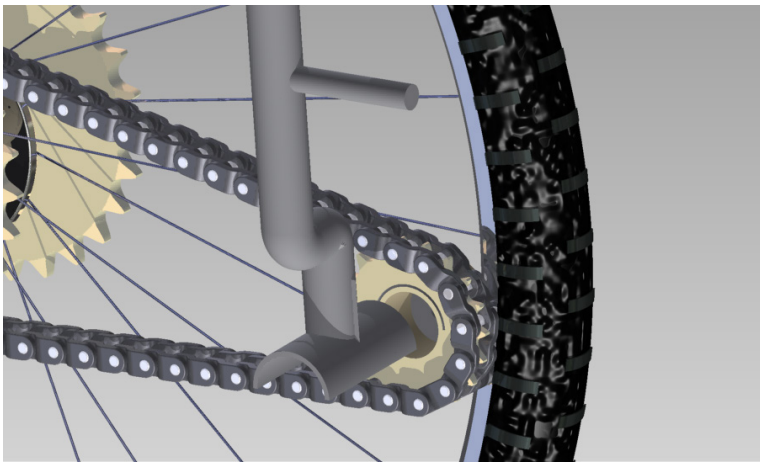
5. The most tricky part it is for the end. The user needs to put the chains on the rail and pay attention to the position of the bearings.

Some details

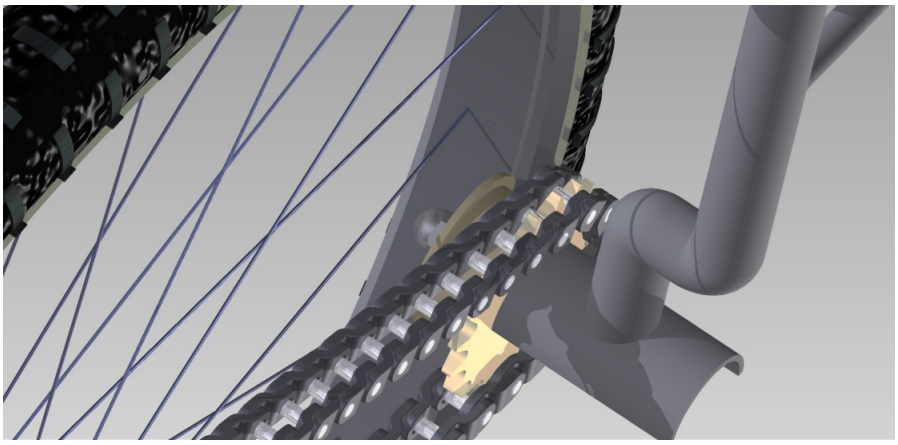


Foldability is an essential function due to the wheelchairs need to be stored when travelling by car or to save espace at home.

This design enables to reduce the space almost 2/3 of the total width.



Picture 1



Picture 2

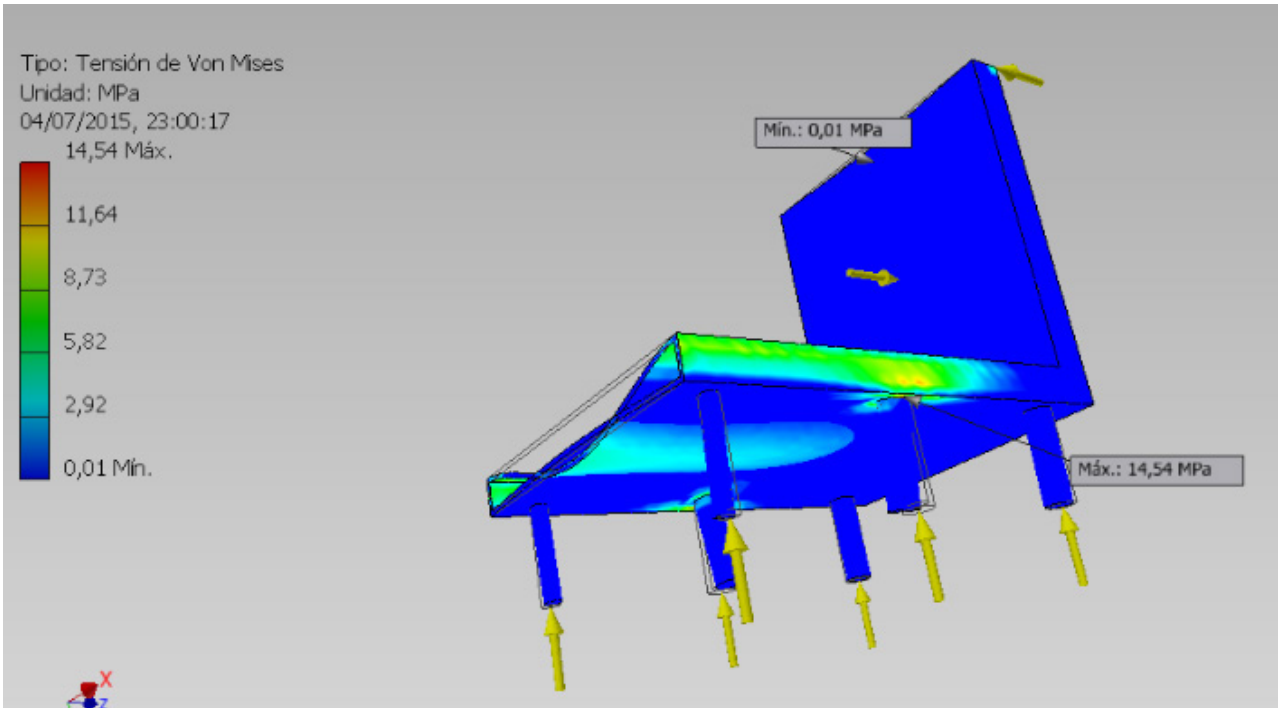
How the handle works?

The handle is located in the little sproke of the big wheel and it is inlaid in the groove which have the same dimensions than the tube of the handle.
This is one of the most important pieces of our design because it causes a big torque which enables motion with less effort (compared to normal wheelchairs). So, the user can increase his speed and his confortability.

But other big advantage is that the brakes are located in the handle, so less pieces to manufacture, hence to build. The user can twist 90º thehandle and the brakes will turn and stop the wheel. (See picture 1).

It is also important to know that the little sproke is located in the rain tangent to the rim of the wheel (Picture 2).

3.2 STRESS ANALYSIS



Calculated with Autodesk Inventor

As the weight average of the user is 70 kg, the calculations are madefor 80 kg to have a safe margin.

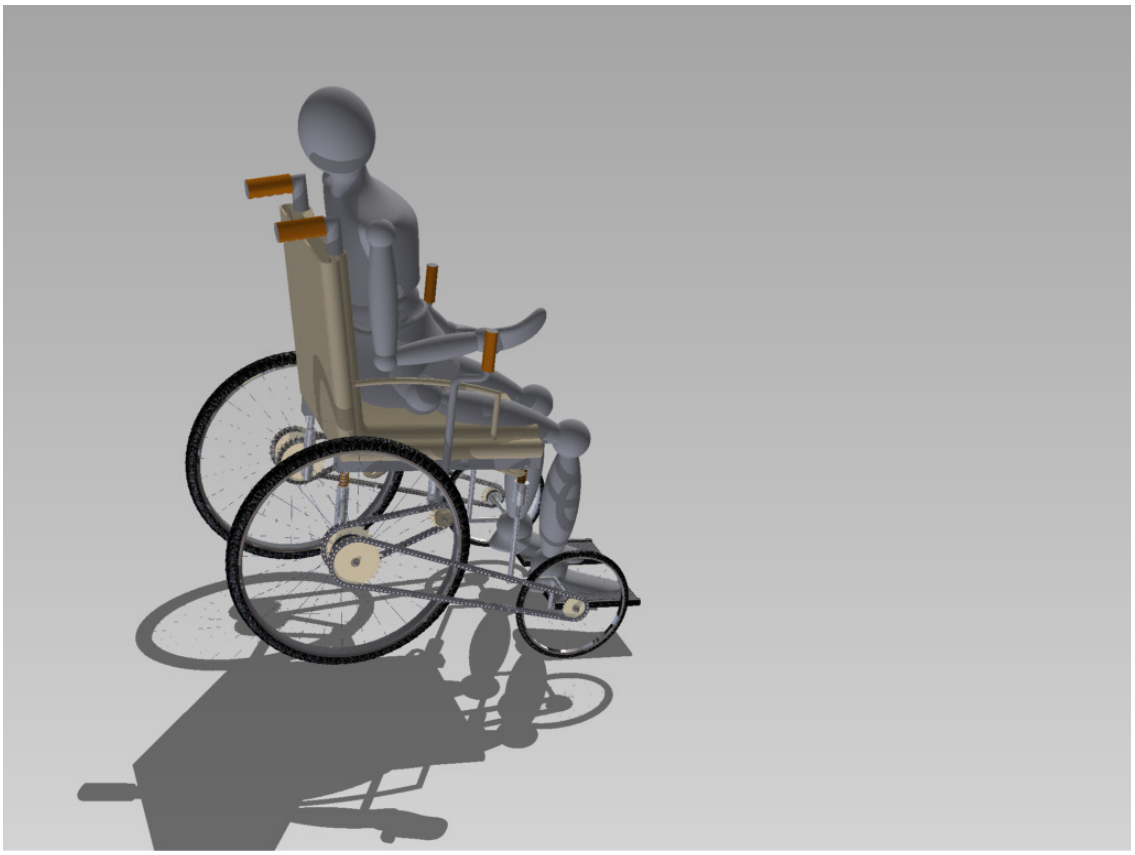
The structure of the seat has been extrapolated and the material assigned is steel.

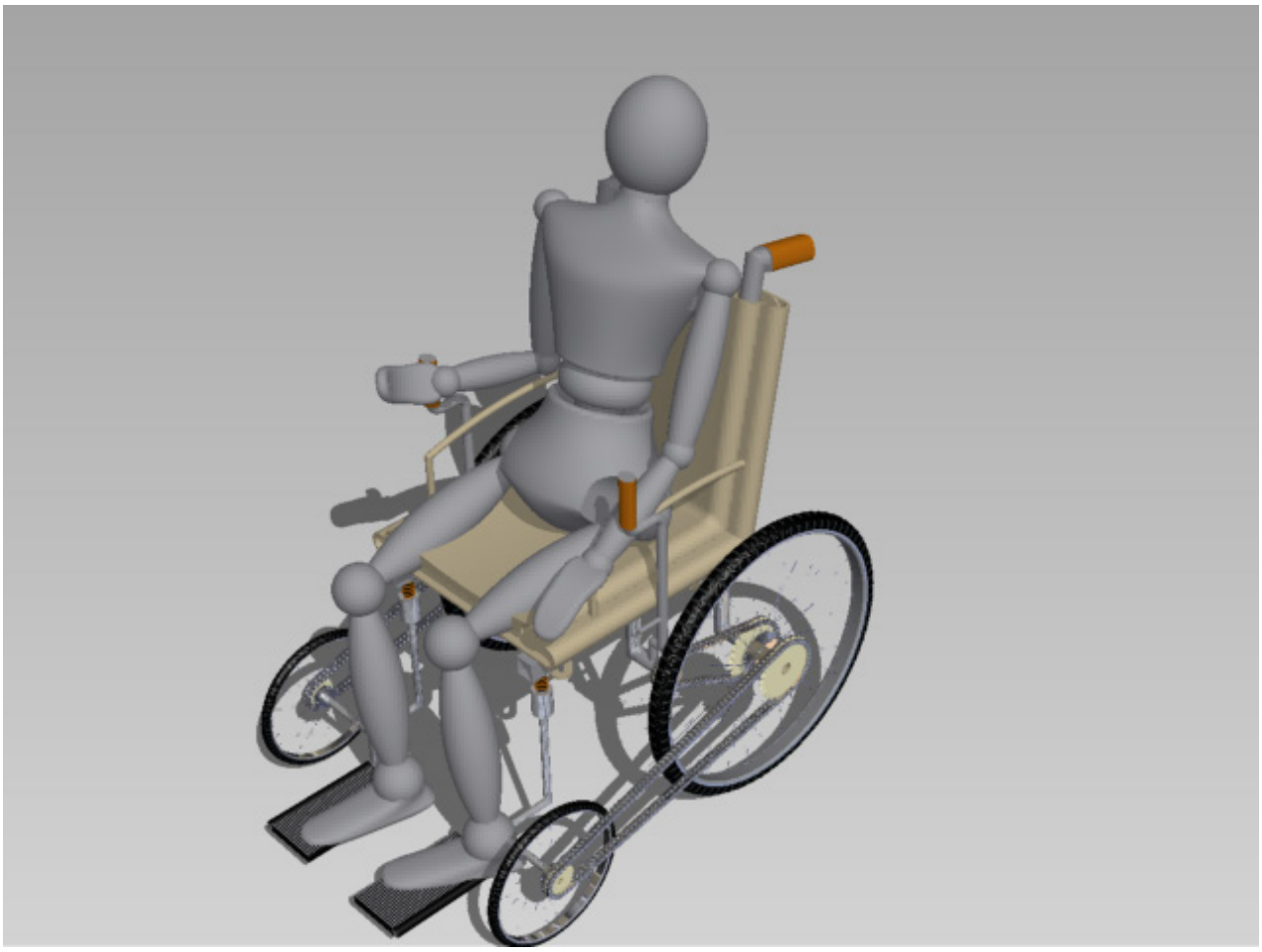
So, the forces will be:
F1=784 N (80 kg*9,8)

F2 is the force applied in the back which is estimated is 20% of F1 so, F2=156'8 N
F3 is the force from the big wheel, which has to support the weight of the chair against the floor, (12 kg weights the chair, so 117,6 N. As the little wheel is 1:2 respecting the big F5=58 N. For the last one it is estimated the user will push with a force of 490 N (50 kg).

3.3 ERGONOMICS

Verification via ergonomic puppet





Done by Inventor. Dummy dimensions: 1650 mm

3.3 MANUFACTURE

Definition of materials and manufacturing processes

The materials and manufacturing processes will respect ecologically the environment.

For the future, we are thinking about making the tubes in bamboo (due to its soustanaibility, aesthetics and resistance). There are other projects like bamboo bikes which are betting for this option.

It has been used in architectural projects since always and has many applications. But due to it's not a material from South America, it will be rare to find it there, so it means it will increase the price. But we keep it in mind for later or for a posterior redesign. [2] [3]

Hence, the tubes will be made out of steel because we have to ensure safety, quality and a long product life. Materials regarding different parts:

-**Structure:** steel. The tubes will be processed by wrought. We also will need to drill it in order to empty it (in case the raw material is massif).

-**Seat:** polyurethane foam due to its properties and price. It's used in many seats, it's flexible and easy to manufacture. It also has a high durability and high resistance (against fire and chemical agents). The seat will have a cover made out of linen to protect the foam and in order to keep it clean.
It's cheap and fresh (it is needed to consider high temperatures in theses

countries). The process will be by extrusion.
The user will be able to take it off thanks to a zipper sewed to the cover.

-Handgrips: will be made out of rubber because is non-skid (for the back and for the handles). Due to the nature of the material the best manufacture process is injection.

-**Sprokes:** alloy steel because of its resistance and good relation quality/ price. This piece is crucial because otherwise the motion is not possible in the wheelchair.
The process to manufacture a sproke is via milling and drilling (to make the axis hole).

-**Safety bars:** can be made out of aluminium because of the weight and it's cheaper than the steel. The process will be by wrought.

-Foot rest: will be extruded in Polyesthirene because of its price ant properties.

3.4 ECONOMIC

Economic feasibility

Our business model is based on a internet network.

The company will need to rent a store where they are going to mount the product.

The product is conceived as a DIY product, it means that the employes will need to prepare the packaging with all the necesary pieces in order to enable the user to build the wheelchair at home with easy and handy tools.

The store will have some basic tools as welding and sewing machine (to unit the tubes and to sew the zipper to the seat).

The company will not have a located shop, that is what is meant by internet. The orders will be done through the website. The reason is that it is easy, confortable and cheap for the company and the user. Another valuable reason is that we are able to reach more countries.

So, the economic strategy is first to determine our cost per unit and then the fixed cost. This way we can calculate the break even point and know for how many sold units the company will have benefits.

All the pieces will be ordered to a supplier because as the company is new in the market we need to know first how the people react.

Cost per unit

It would be a huge risk to invest in expensive machinery, but we could reconsider this question after the Product Launch.

For the moment, it's enough to order the pieces to a manufacturer and start our contact network.

We will ask a budget for 1,000 products.

Production costs					
Product	**Units**	**Price**	Big chain	2	3
Big wheel	2	10	Handle grip	2	3
Little wheel	2	10	Zipper seat	1	0,6
Big sproke	2	5	Handle structure	2	2,3
Little sproke	2	5	**Standard parts**		
Tube feet	2	1,8	Safety caps	4	1
Foot rest	2	2	Screws		1,5
Shock absorber	4	4,8	Bearings	6	9,24
Tube handle	2	1,5	**Packaging**		
Tube big wheel	2	1,8	Primary box	1	0,35
Square structure bar	2	1	Bubble wrap		0,15
L tube	2	1	Screw plastic bag	1	0,15
Foam seat	1	0,8	Foam separation	8	1,6
Cover seat	1	0,45	**Production process**		
Tube handgrip	2	3	Mounting (30 min)		5
Handgrip	2	3	**Distribution**		
Safety bars	2	1,1	Ship costs		6
Joints of foldable sheets	6	1,2			
Little chain	2	3	**TOTAL COST/unit**		90,08 €

Fixed costs

Machinery	Investment (€)
Tools	200
Computers	1,000
Furniture	4,000
Rental	1,000
Vehicule	10,000
TOTAL	16,200

Break even point

B.E.P= Fixed costs/(Price per unit-Cost per unit)

B.E.P.=16,200/(120-90,08)=541'4

So, basically we need to sell more than 542 wheelchairs to start having benefits.

Conclusion

The average of the minimum wage in South America is around 330$ which in euros is 296 €. [1] http://www.americaeconomia.com/economia-mercados/finanzas/conozca-los-montos-de-los-salarios-minimos-de-la-region

On the other hand, the normal price for a manual wheelchair (with no extra functionalities) is around 300€.

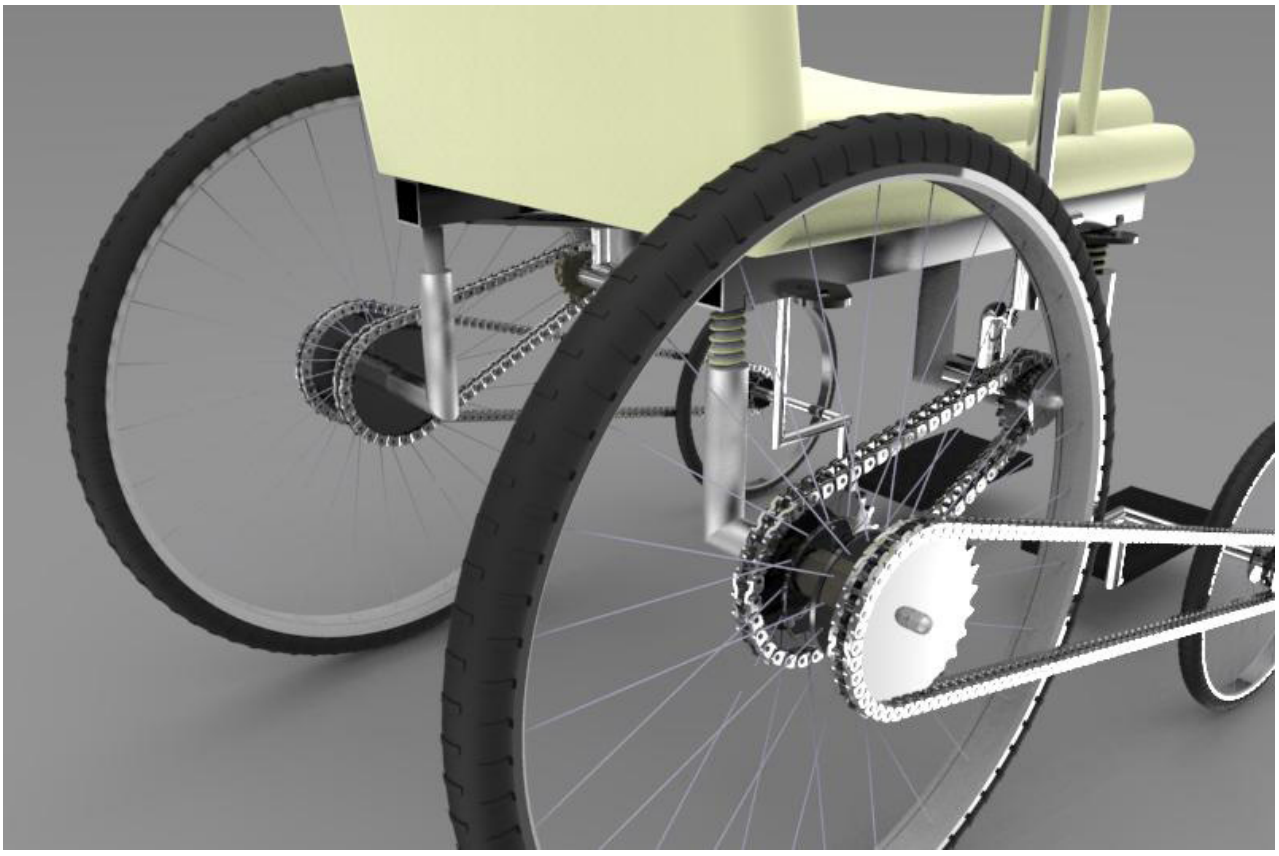
The implement of this project enables them to afford a wheelchair which is suitable for its environment and increases their independency and self-steem.

4

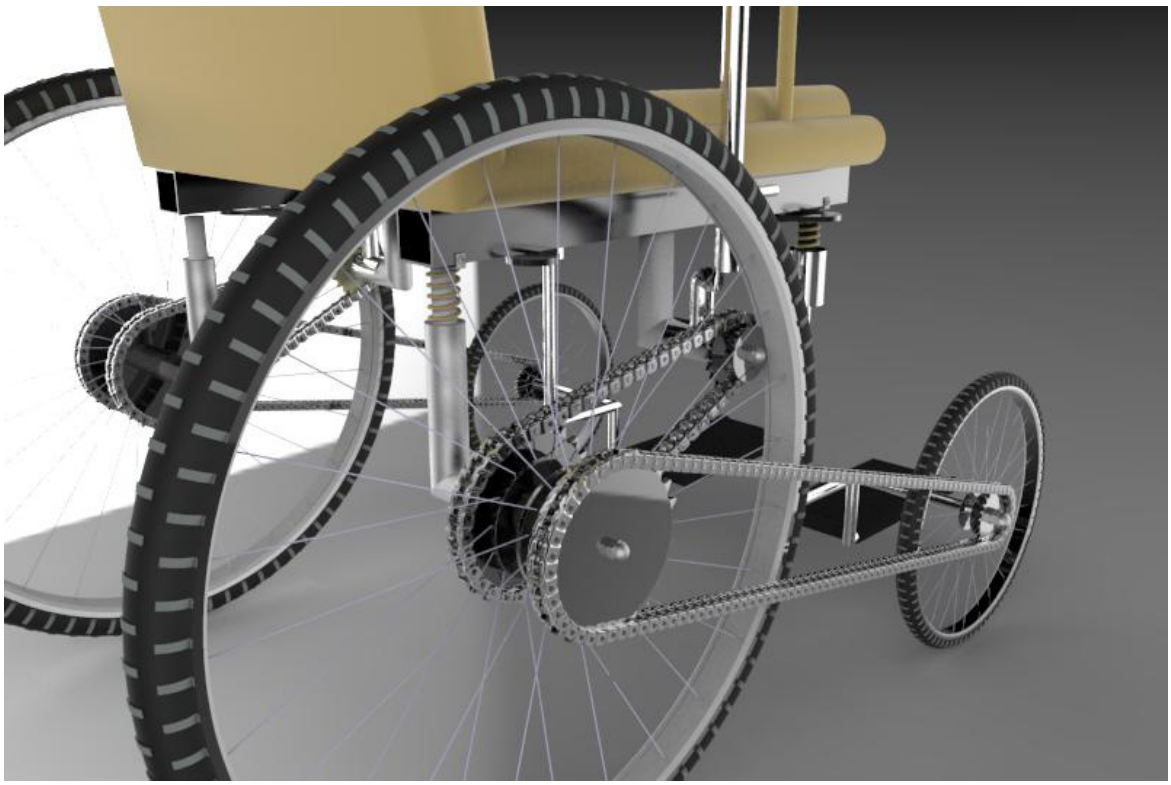
FOURTH PHASE

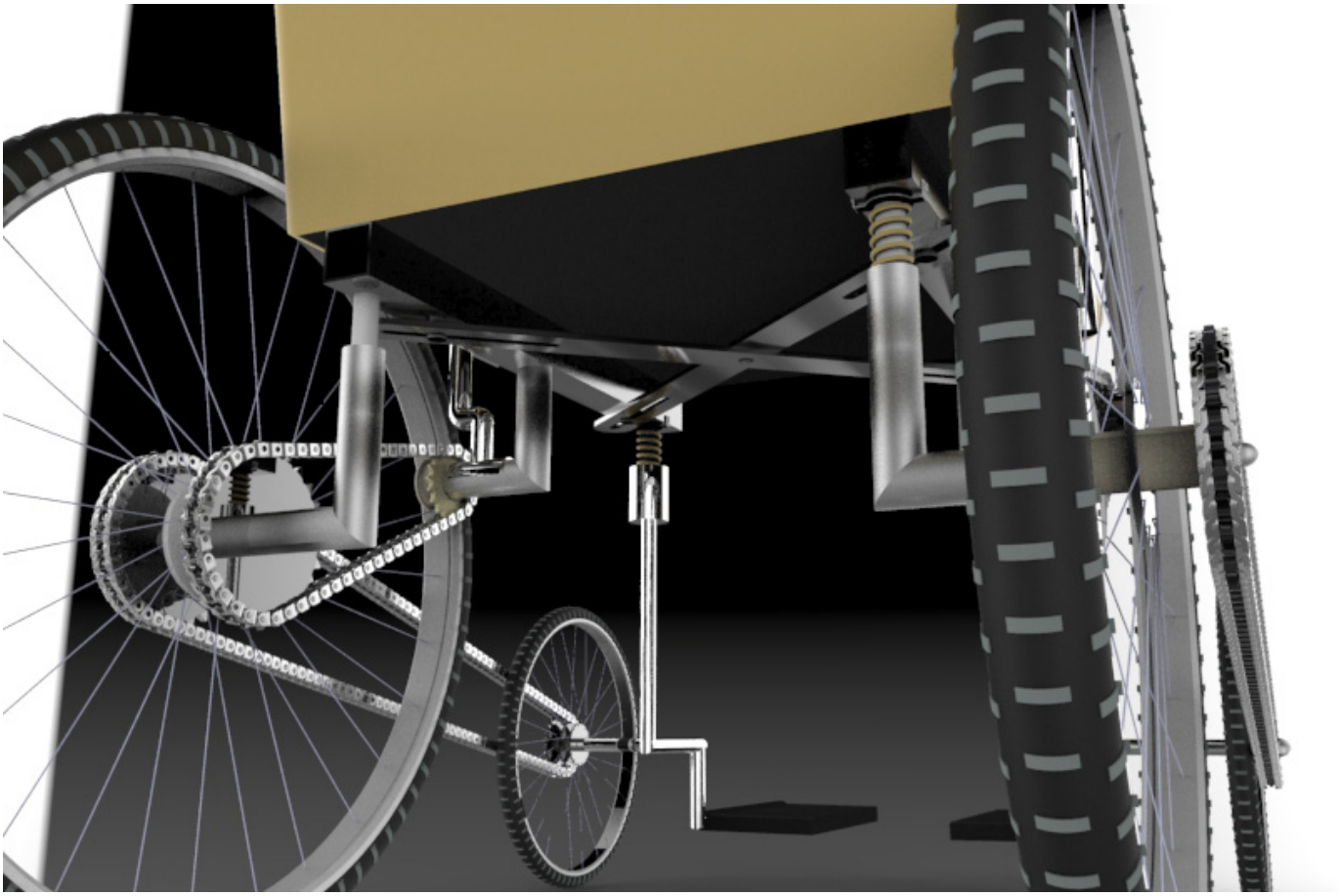
Development

4.1 RENDERINGS

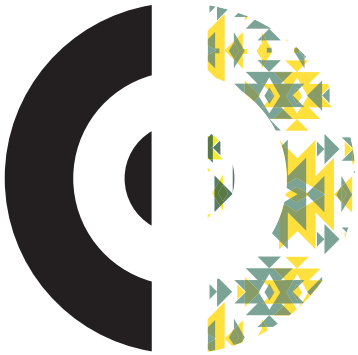


Software used: Inventor Autodesk and Keyshot





4.2 BRANDING

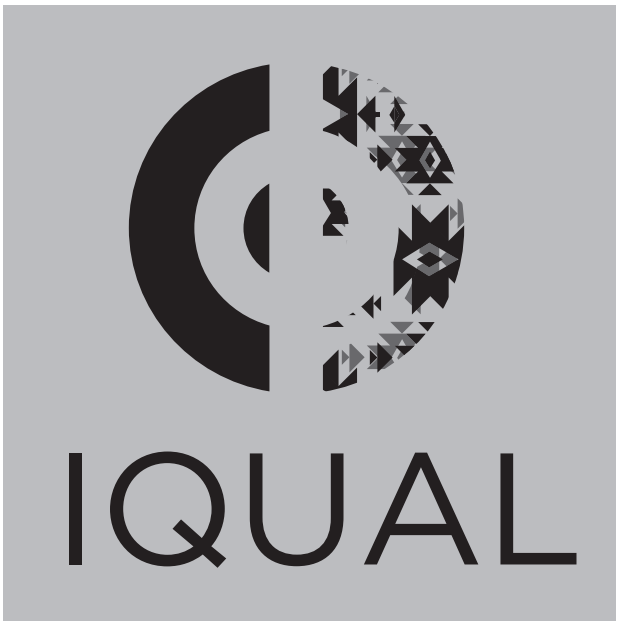


IQUAL

PANTONE 803 U

PANTONE 7726 U

PROCESS BLACK



RESERVE AREA

TIPOGRAPHY
GOTHAM BOOK

ABCDEFGHIJKL
MNÑOPQRSTU
VWXYZ 123456
7890 !"#$%&'()*
+,-./:;<=>?@\]^[
_‘{|}~¡¢£/¥ƒ§€′“

In the logo appear the two wheels of the product which is one of the main features of the wheelchair because it enables to overcome the obstacles and increase the stability and confidence of the user.

On the other hand is a balanced logo which inspires equilibrium, equity which is the most important aim of this social project.

4.3 PACKAGING

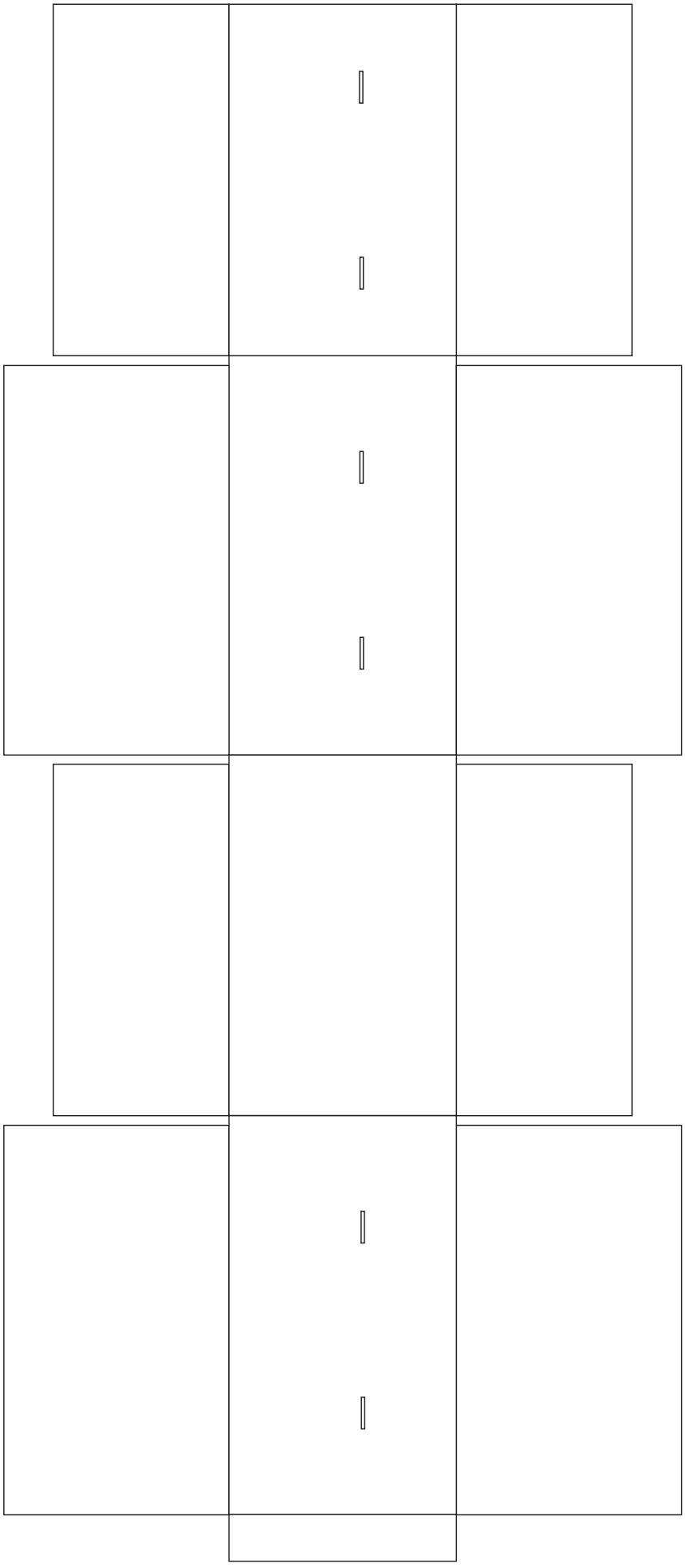
Development of the box

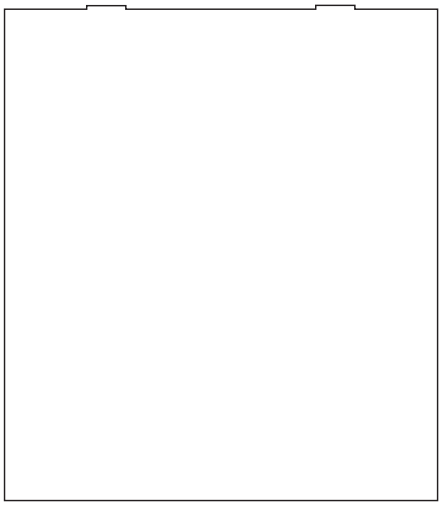
The packaging will consist on a big box, but the dimensions will be optimise as much as possible. The final dimensions of the box are:
-Base:790x695 mm
-Height: 341 mm

This dimensions cover all the dissassembly of the different pieces.

In order to keep our pieces in a good status the wheels will be divided by a sheet of carton.

Besides, every wheel will have a piece which will consist in a profile of a polymer extruded to protect the wheels between them.



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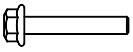
INSTRUCCIONES DE MONTAJE
ASSEMBLY MANUAL

1. Construya la “X” con cuidado uniendo las piezas a lo largo del eje central, después preste atención uniendo las barras en “L” enroscandolas en la “X”.
Build the “X” carefully uniting the sheets along the central axis. Then, pay attention uninting the “L” bars threading with the “X”.

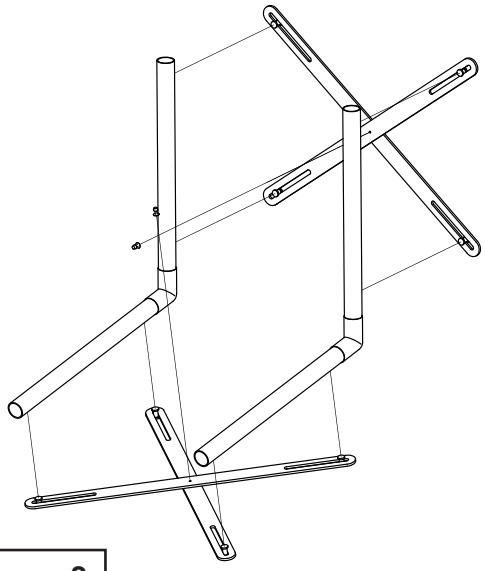
2. Atornille el asiento a las barras cuadradas y con la segundo " X " como hecho antes.
Screw the seat to the square bars and with the second “X” as done before.

3. Primero una los ejes de las ruedas prestando atención a colocar los rodamientos y las tapas en el lugar correcto. Luego, se une con los tubos y más tarde con el asiento.
First assembly the wheelaxis paying attention to correct place of the bearings and the caps. Then, join it with the tubes and later on with the seat structure.

4. Une los piñones con la estructura de la silla de ruedas respetando los amortiguadores. Fíjalo bien con las herramientas correctas y las tapas de seguridad.
Join the sprokes with the structure of the wheelchair respecting the shock absorbers. Fixit safetely with the correct tools and the safety caps.

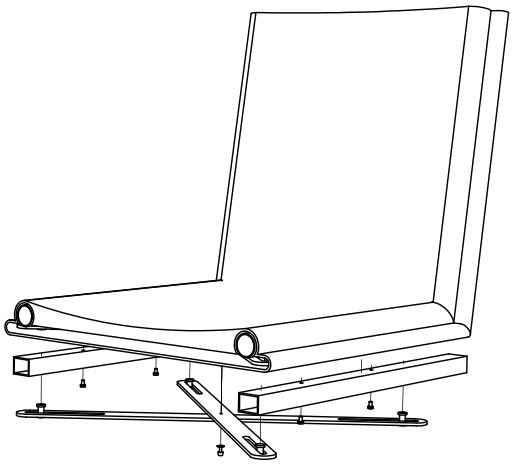
 x3  x12  x4  x8  x4  x2

1



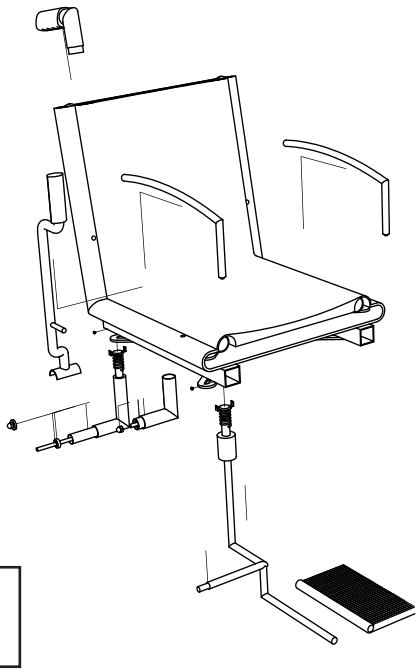
 x2
 x8

2



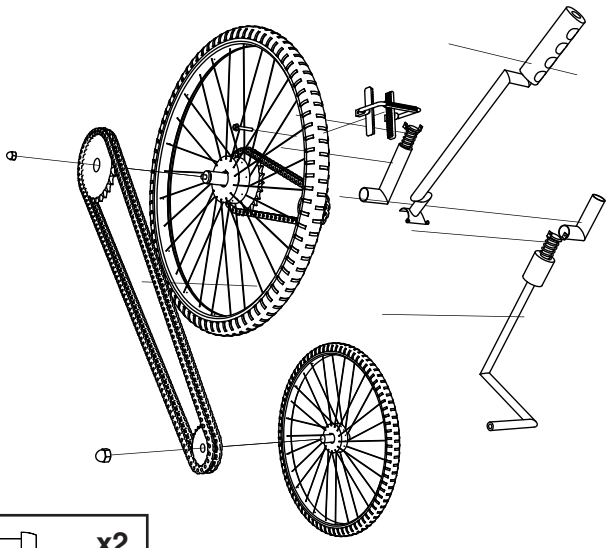
 x1
 x4
 x4

3



 x4
 x8

4



 x2
 x8

4.4 FINAL SET UP

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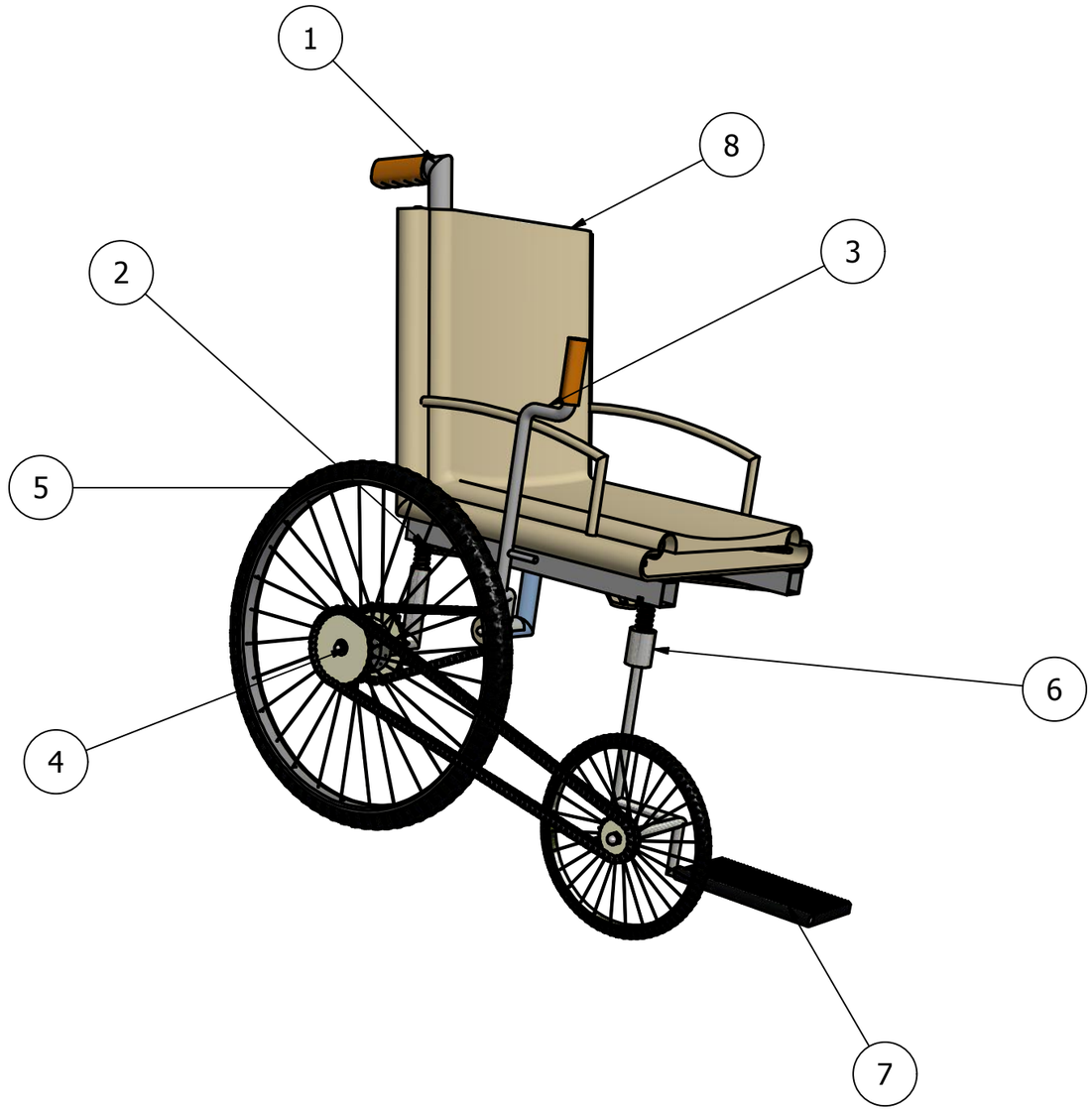
“The simplest motion
for everyone”
IQUAL

ANNEXES

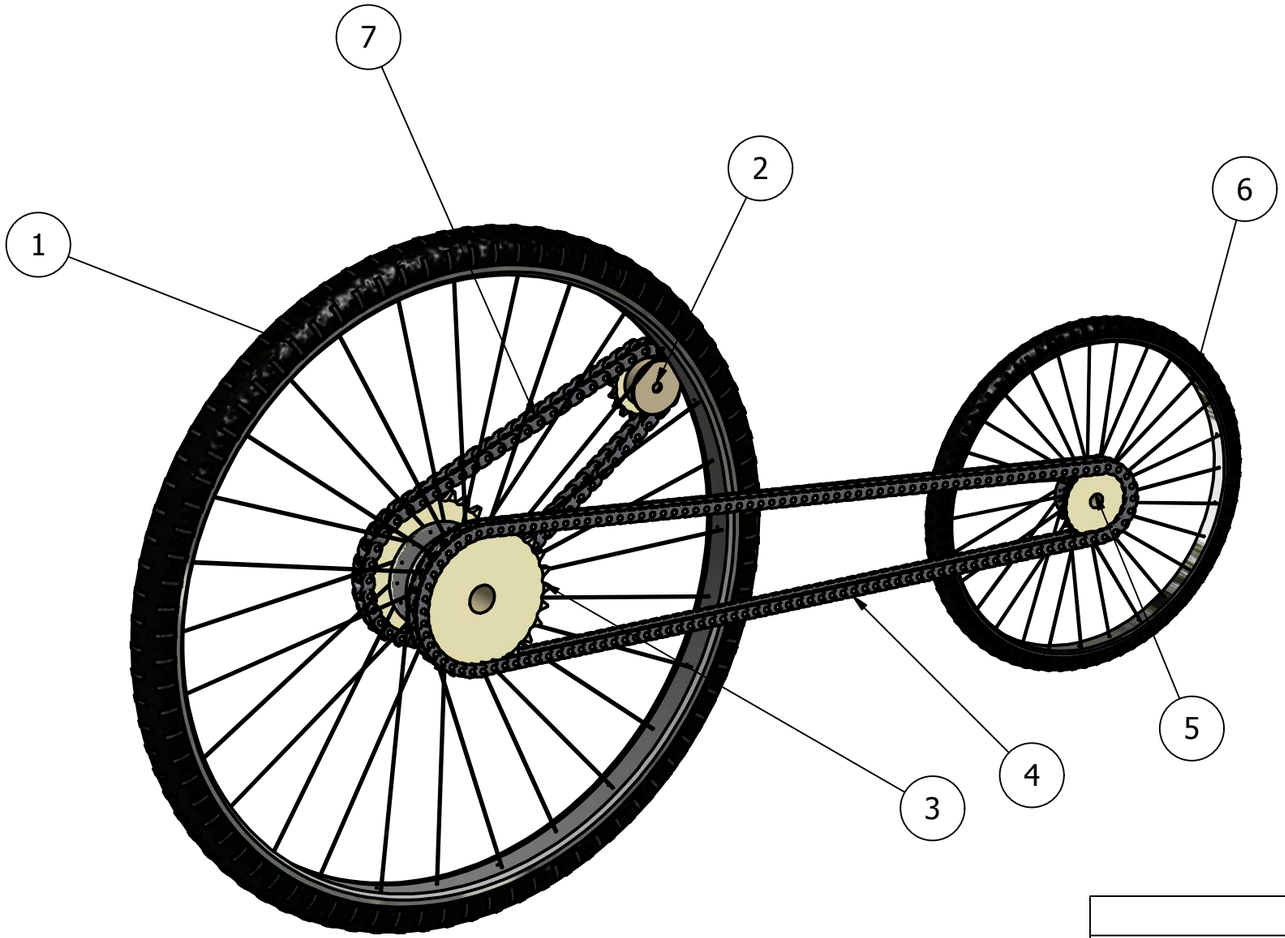
TECHNICAL DRAWINGS



PIECES LIST			
ELEMENTO	CTDAD	Nº DE PIEZA	DESCRIPCIÓN
1	1	Handgrip	Rubber and Aluminium
2	4	Shock absorber	Aluminium
3	1	Handle	Alloy steel
4	2	ANSI B 18.2.2 - 5/16-18	Low crown
5	2	Subassembly wheels	-
6	1	Tube little wheel	Steel
7	1	Foot rest	Polystyrene
8	1	Subassembly seat	-

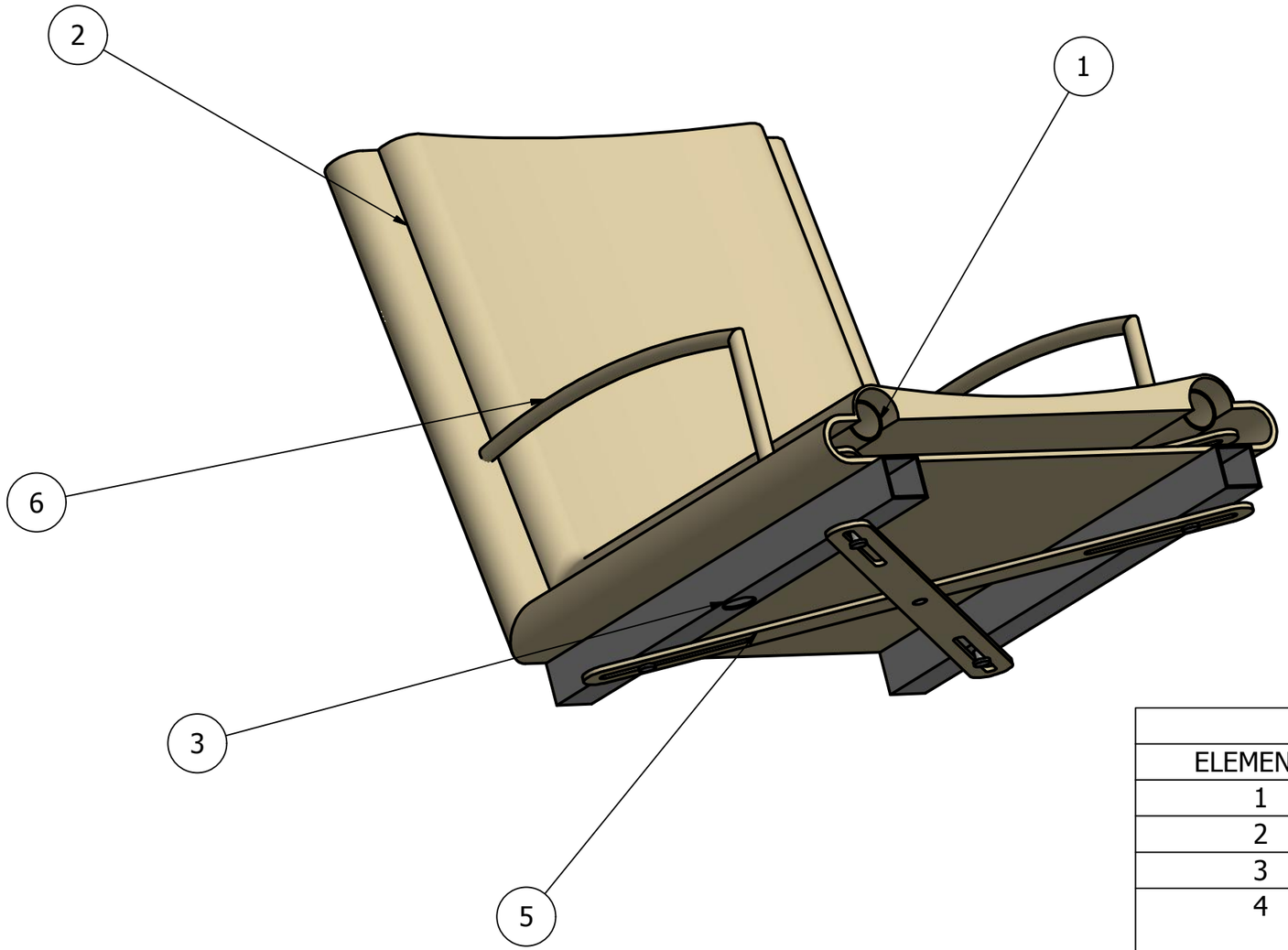
	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		ÖBERÖSTERREICH
Checked				
Scale 1:10	Title: Main assembly			Nº Student S1400444001
				Year 2014-2015
				Page nº 1

A3



LISTA DE PIEZAS			
ELEMENTO	CTDAD	Nº DE PIEZA	DESCRIPCIÓN
1	1	Big wheel	Rubber and aluminium
2	1	Sproke handle	Alloy steel
3	2	Big sproke	Alloy steel
4	1	Little chain	Alloy steel
5	1	Little sproke	Alloy steel
6	1	Little wheel	Rubber and aluminium
7	1	Big chain	Alloy steel

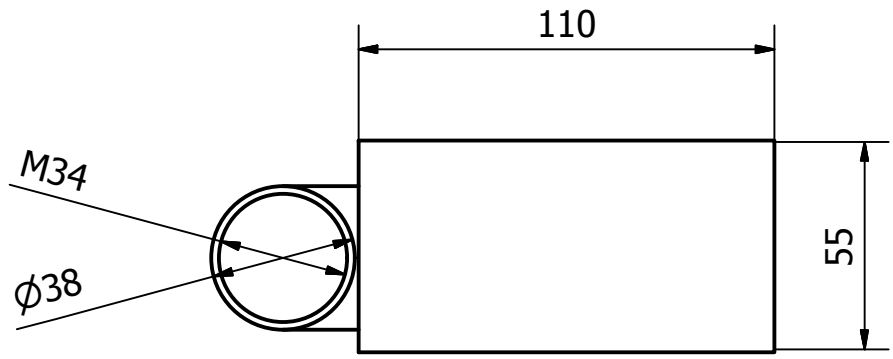
	Date	Name	Signature:	
Drawn:	1/07/15	Muniz Paula		FH OBERÖSTERREICH
Checked				
Scale 1:5	Title: Subassembly wheels			Nº Student S1400444001
				Year 2014-2015
				Page nº 2

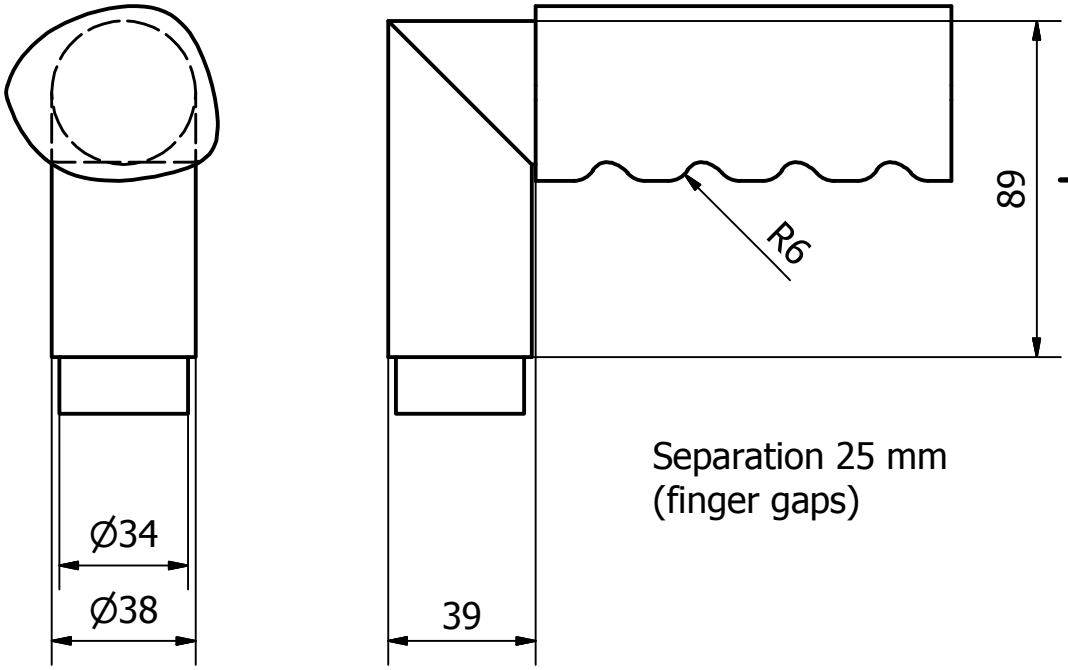


LISTA DE PIEZAS			
ELEMENTO	CTDAD	Nº DE PIEZA	DESCRIPCIÓN
1	2	L tube	Steel
2	1	Seat	Polyurethane
3	2	Square tube	Steel
4	4	ANSI B18.2.3.2M - M5x0,8 x 8	Tornillo de forma hexagonal métrico - Tornillo de forma hex - Métrico (1)
5	6	Sheet fold	Steel
6	2	Safety bar	Aluminium

	Date	Name	Signature:	
Drawn:	1/07/15	Muniz Paula		FH OBERÖSTERREICH
Checked				
Scale 1:5	Title: Subassembly seat			Nº Student S1400444001
				Year 2014-2015
				Page nº 3

A3





Separation 25 mm
(finger gaps)

	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:2	Title: Handgrip			Nº Student S1400444001
				Year 2014-2015
				Page nº 1.1

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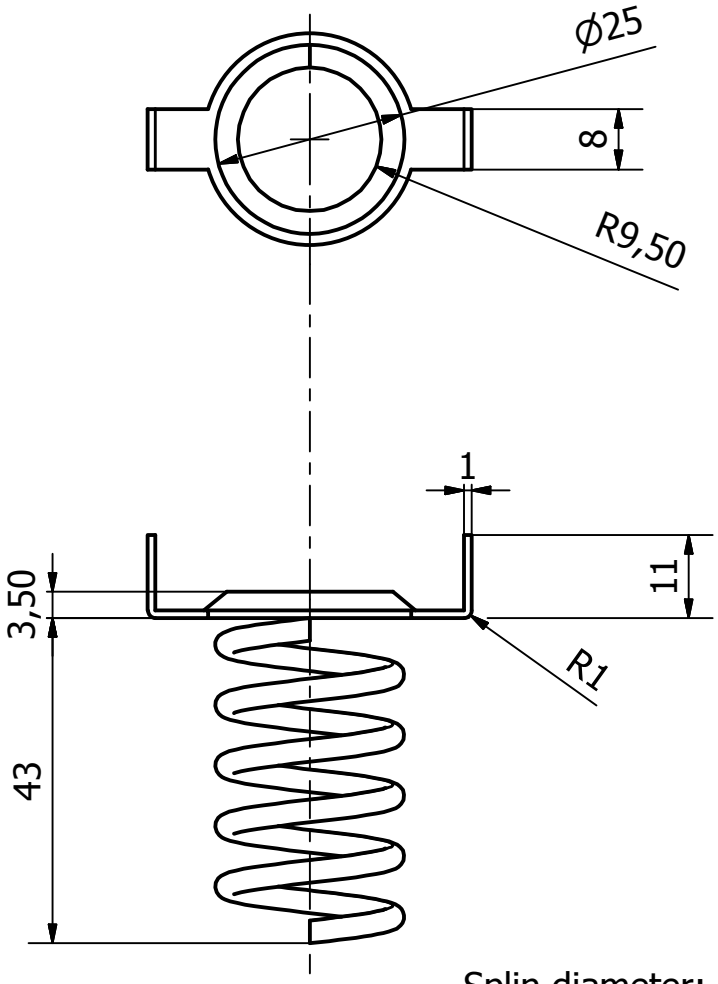
A4



Splin diameter: 22 mm

	Date	Name	Signature:	
Drawn:	01/07/2015	Muniz Paula		
Checked				
Scale 1:1	Title: Shock Absorber			Nº Student S1400444001
				Year 2014-2015
				Page nº 1.2

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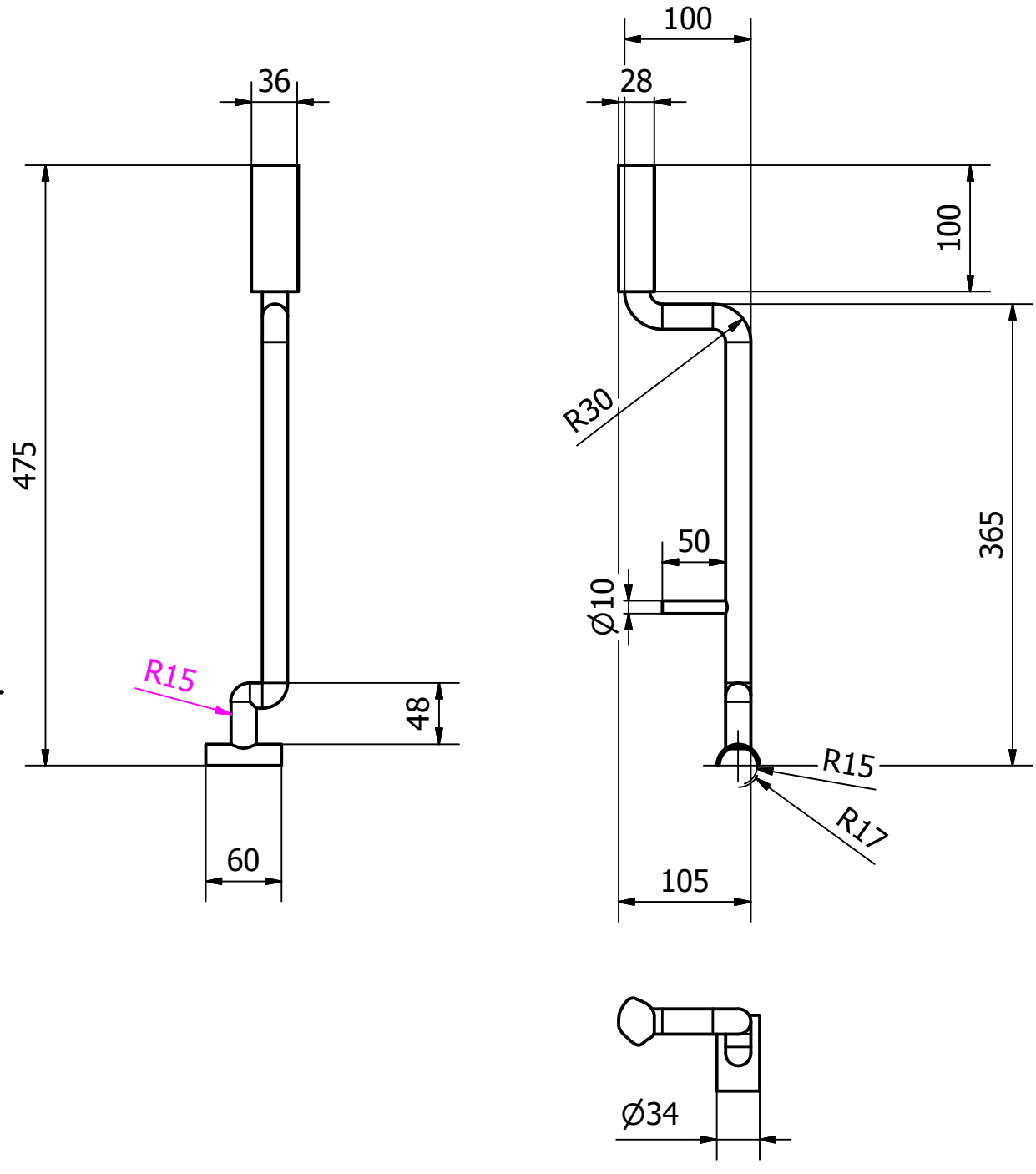
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:5	Title: Handle			Nº Student S1400444001
				Year 2014-2015
				Page nº 1.3

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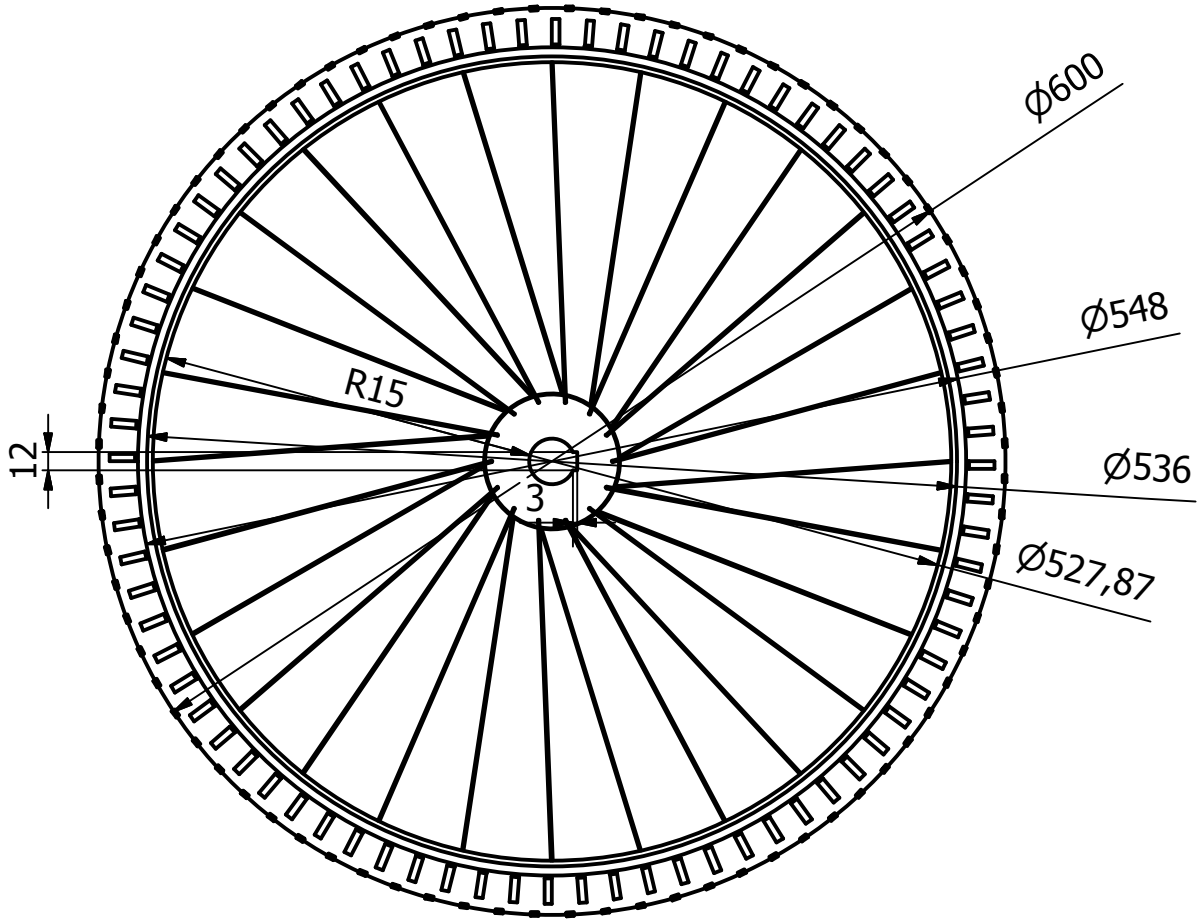
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
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Scale 1:5	Title: Big wheel			Nº Student S1400444001
				Year 2014-2015
				Page nº 2.1

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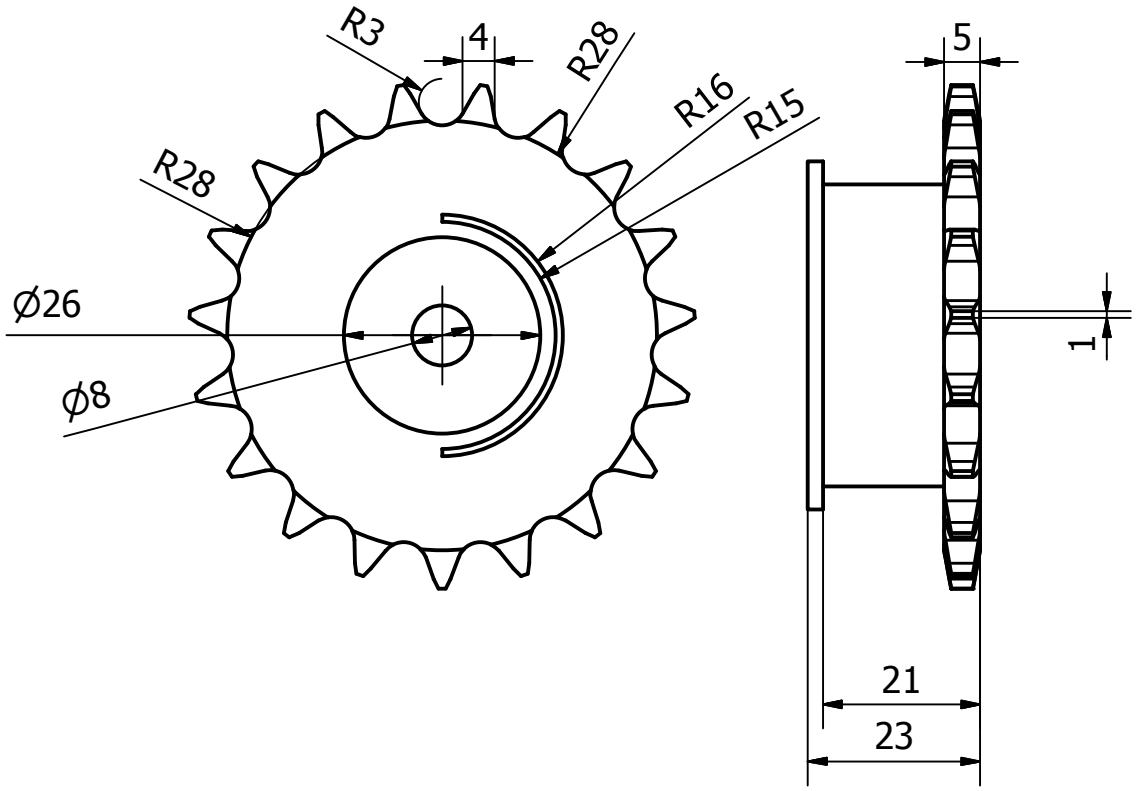

	Date	Name	Signature:	
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Checked				
Scale 1:1	Title: Handle sproke			Nº Student S1400444001
				Year 2014-2015
				Page nº 2.2

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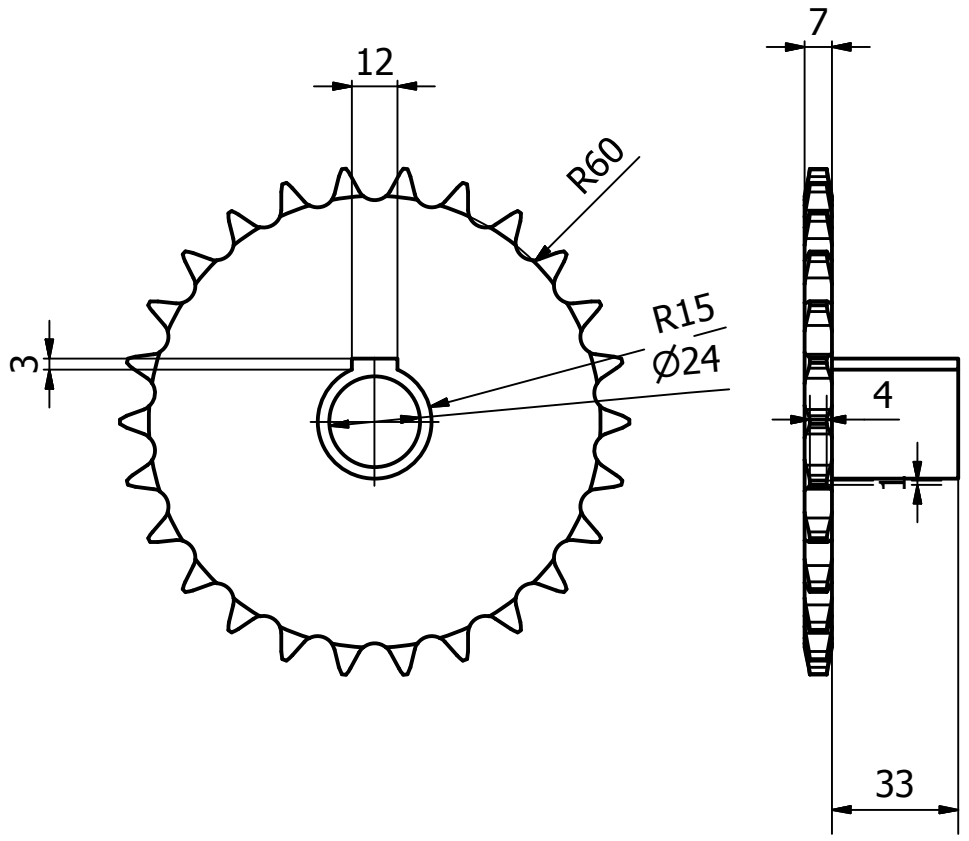
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:2	Title: Big sproke			Nº Student S1400444001
				Year 2014-2015
				Page nº 2.3

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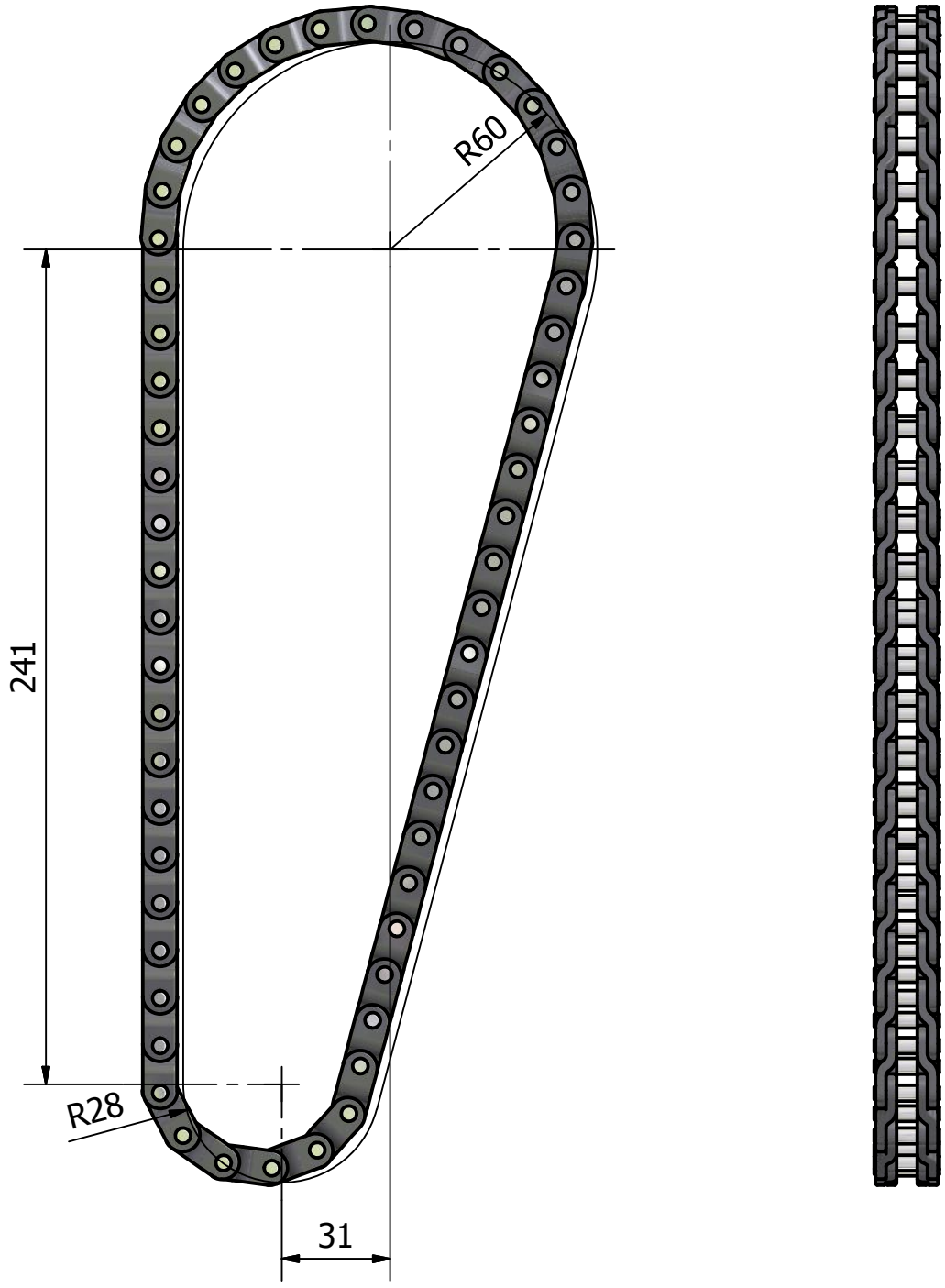

	Date	Name	Signature:	
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Checked				
Scale 1:2	Title: Little chain			Nº Student S1400444001
				Year 2014-2015
				Page nº 2.4

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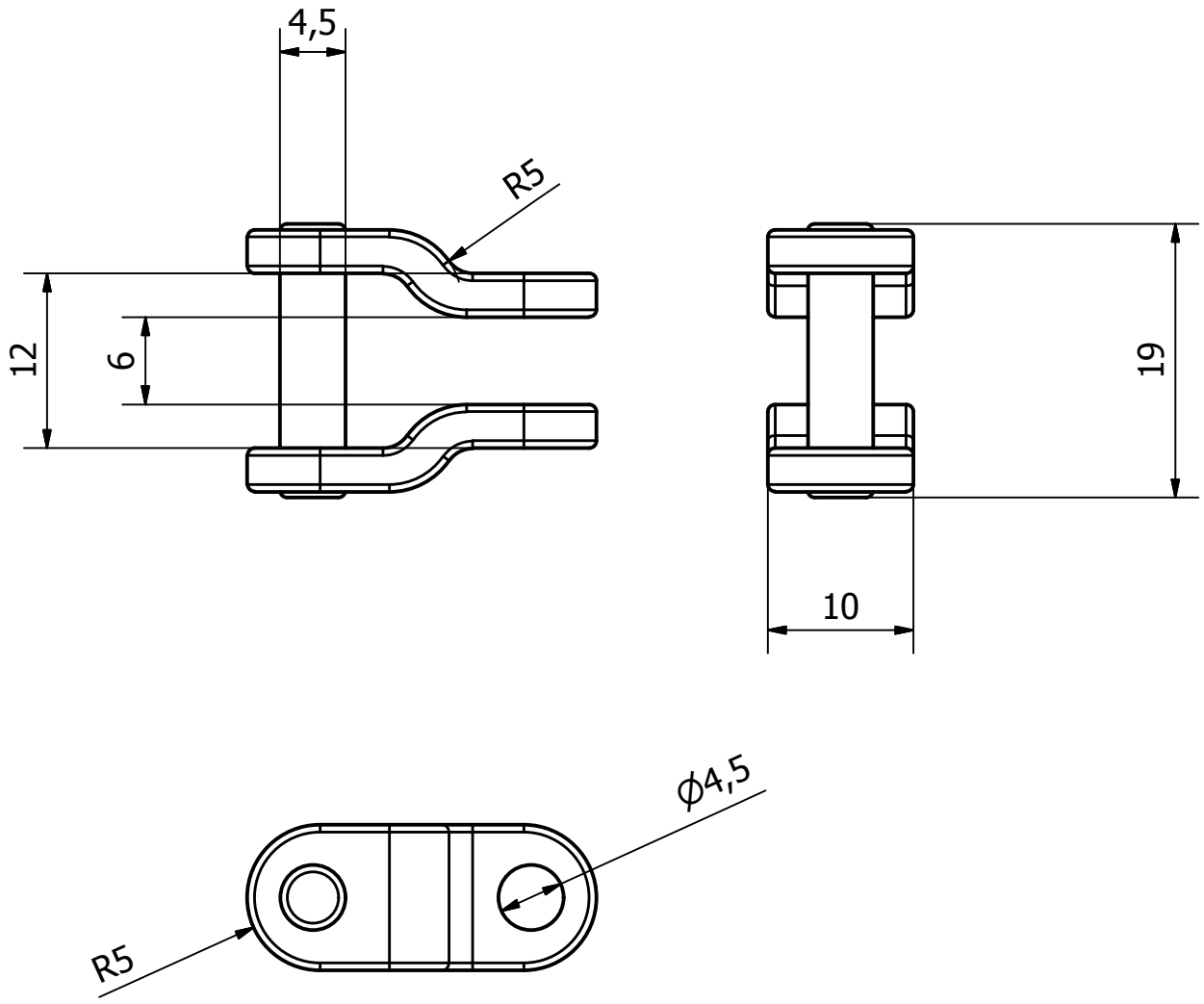
A4



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Scale 2:1	Title: Chain link			Nº Student S1400444001
				Year 2014-2015
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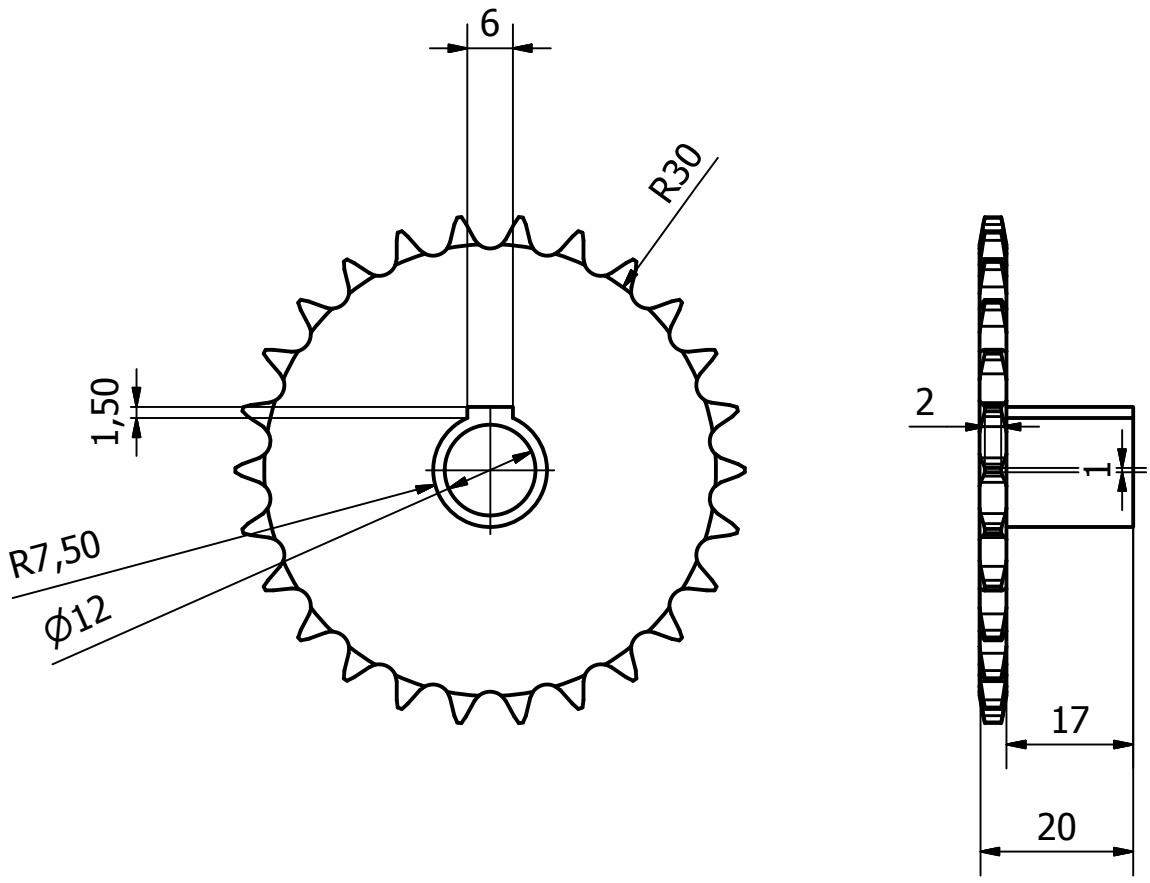

	Date	Name	Signature:	
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				Year 2014-2015
				Page nº 2.6

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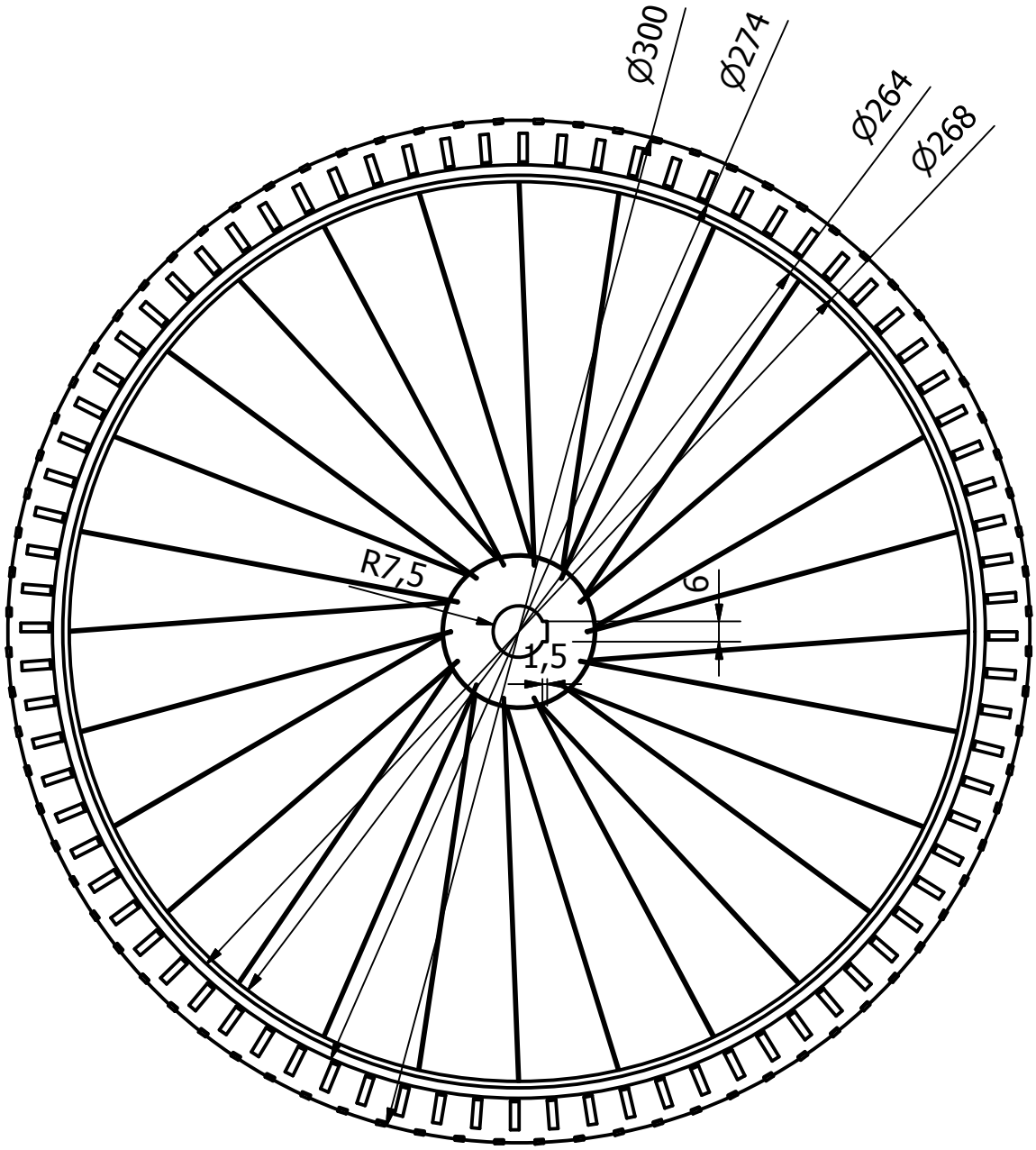
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:2	Title: Little wheel			Nº Student S1400444001
				Year 2014-2015
				Page nº 2.7

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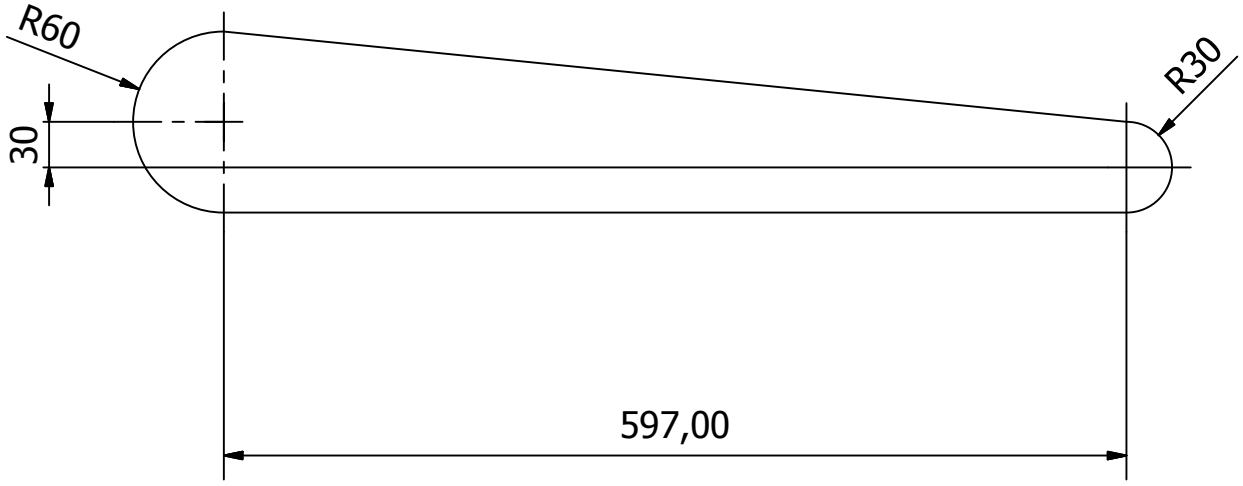
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:5	Title: Dimensions big chain			Nº Student S1400444001
				Year 2014-2015
				Page nº 2.8

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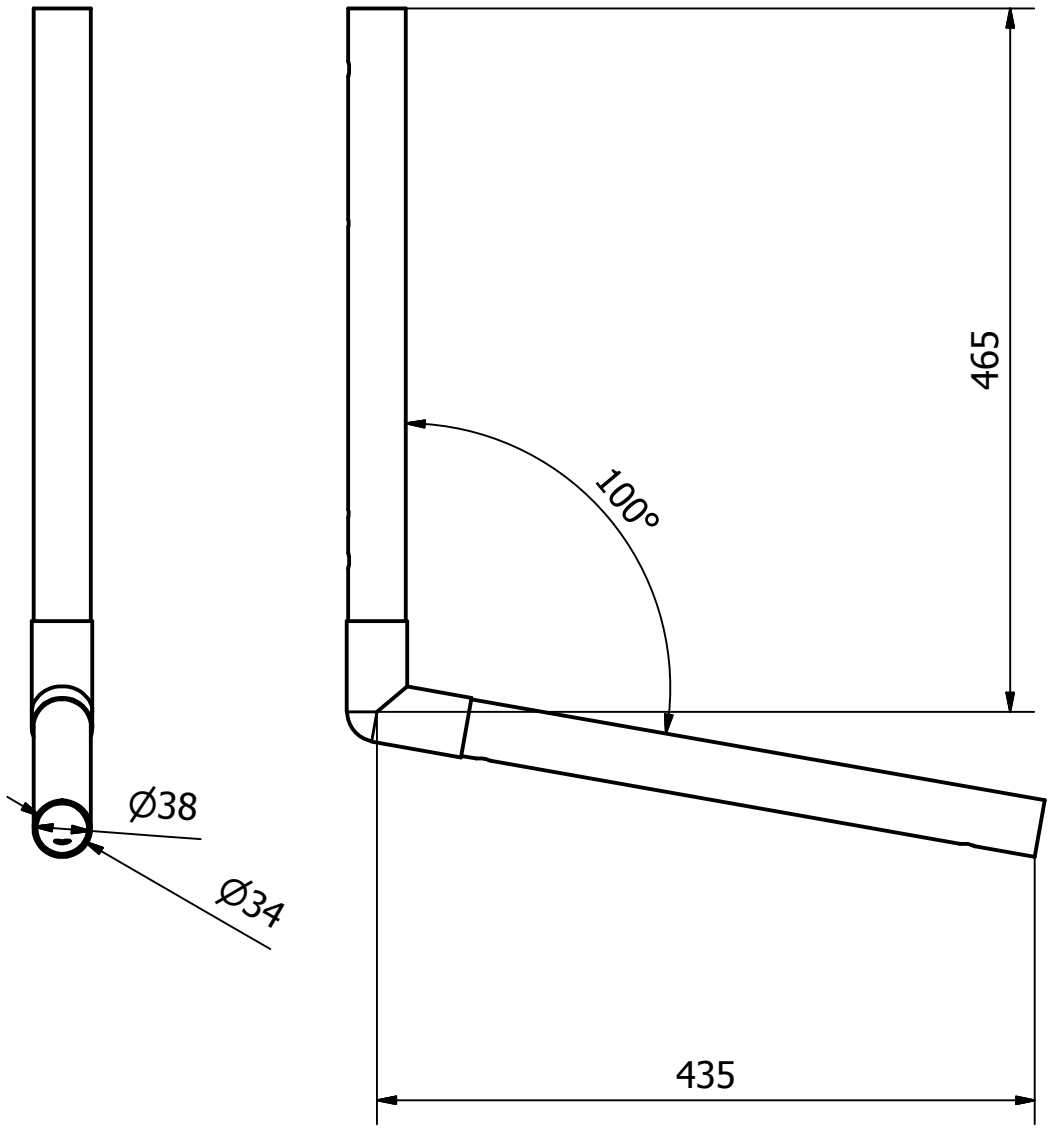
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:5	Title: L tube 1			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.1

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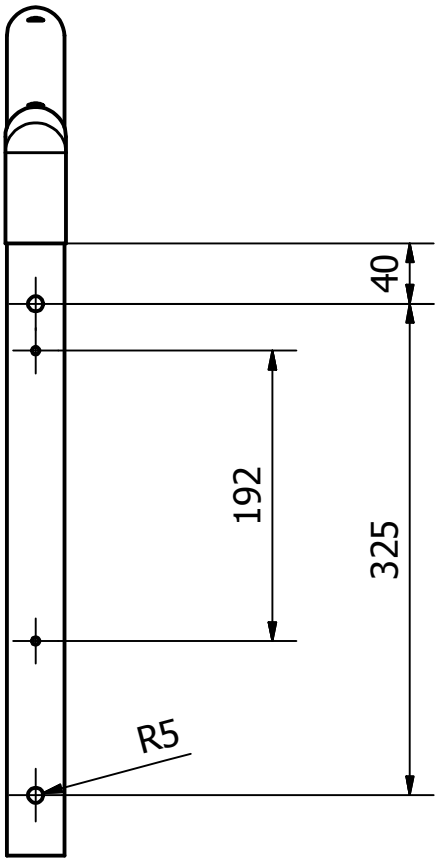
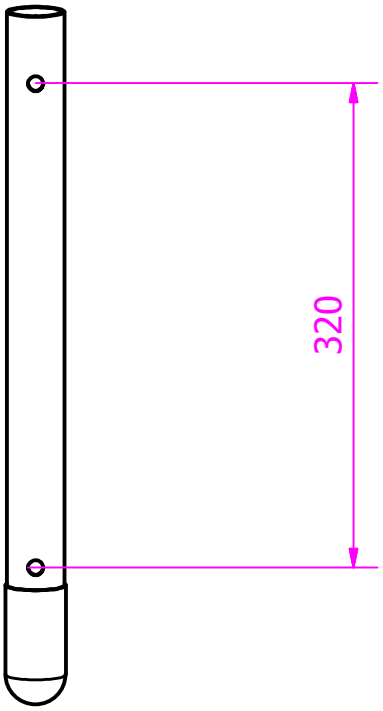
A4





	Date	Name	Signature:	
Drawn:	07/07/2015	Muniz Paula		
Checked				
Scale 1:5	Title: L tube 2			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.2

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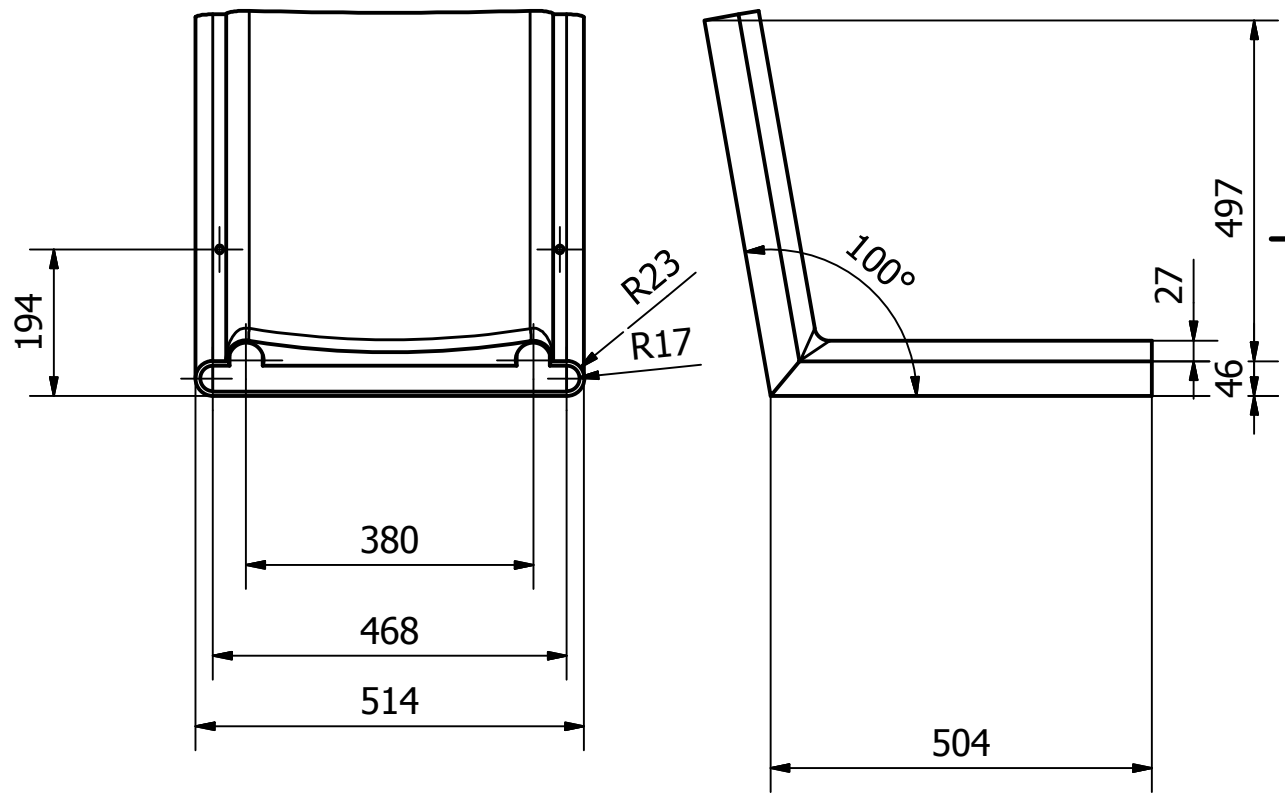

	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:10	Title: Seat			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.3

OBERÖSTERREICH

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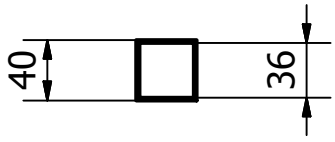
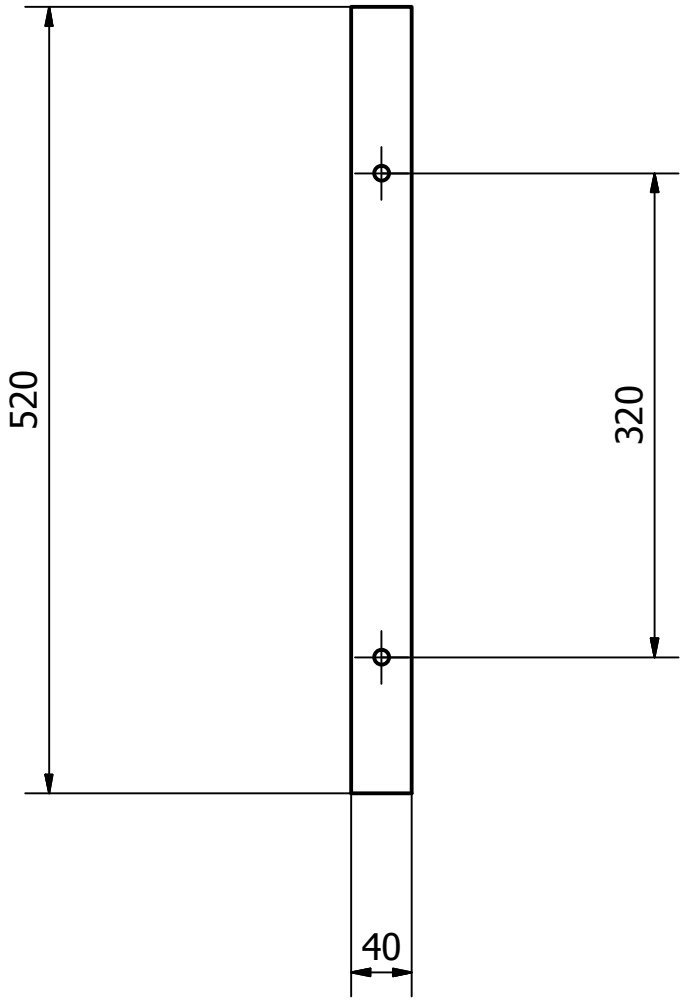
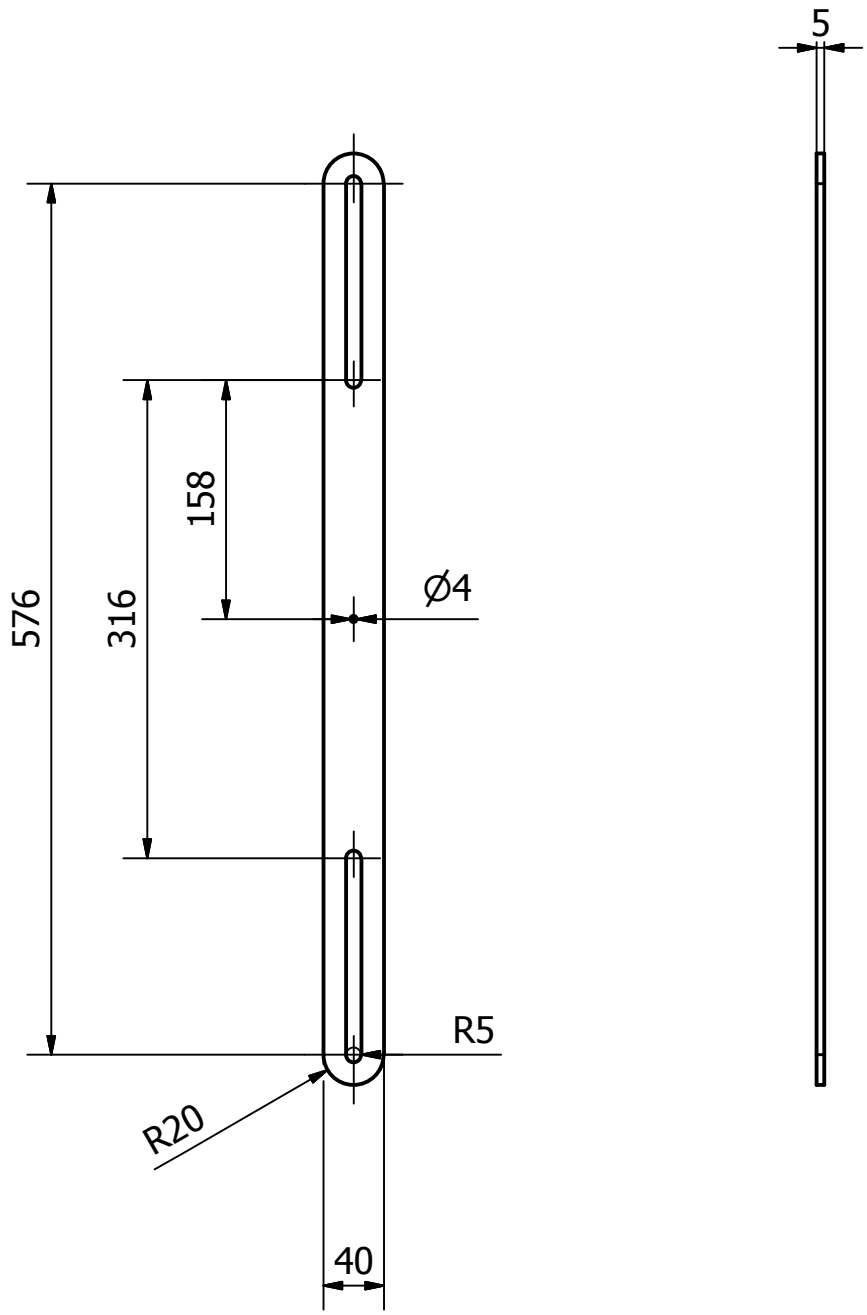




	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:5	Title: Square tube			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.4

OBERÖSTERREICH

A4



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Scale 1:5	Title: Foldable sheets			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.6

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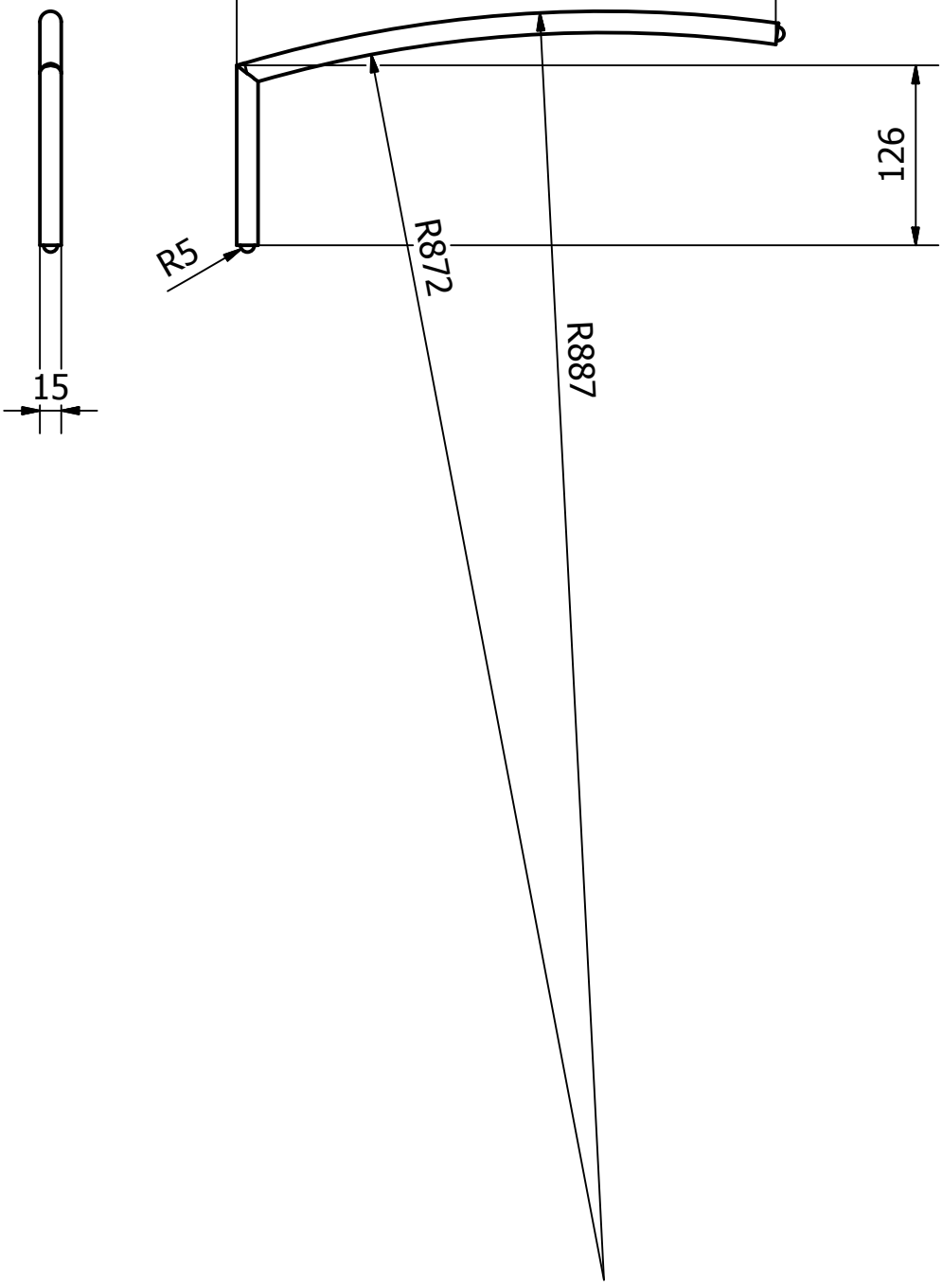
A4



	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 1:5	Title: Safety bar			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.7

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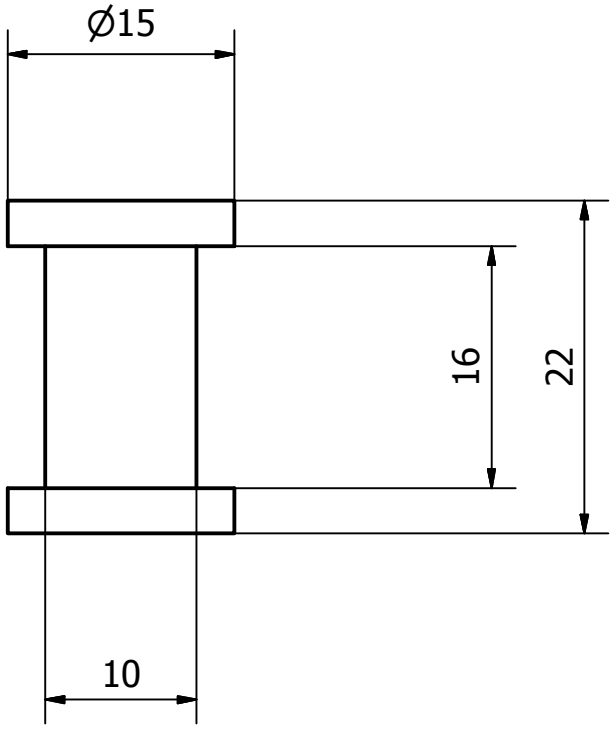
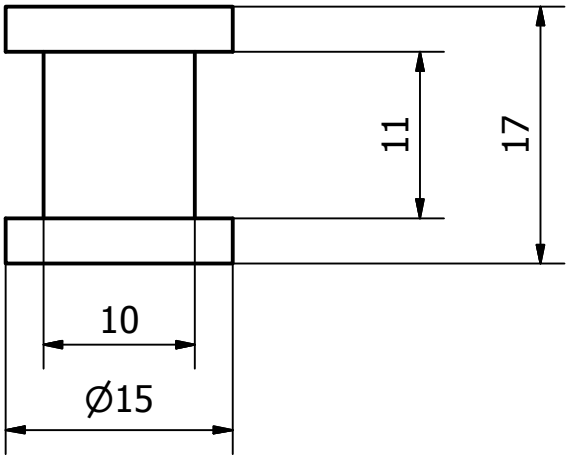
A4





6 pieces needed each joint

	Date	Name	Signature:	
Drawn:	07/01/2015	Muniz Paula		
Checked				
Scale 2:1	Title: Joint sheets			Nº Student S1400444001
				Year 2014-2015
				Page nº 3.7

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A4