

ACCESSORIES AND ADAPTATIONS FOR THE ACCESS OF PEOPLE WITH DISABILITIES TO NATIONAL PARKS AND PROTECTED AREAS

Earth Council

Project for a Protocol of Accessibility to National Parks and other Protected Areas

EARTH COUNCIL
PROJECT ON ACCESSIBILITY OF PERSONS WITH DISABILITIES TO NATIONAL PARKS AND PROTECTED
AREAS

1-DISABILITY 2-ACCESORIES 3-ADAPTATIONS 4-ACCESSIBILITY 5-NATIONAL PARKS 6- PROTECTED AREAS

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- The personnel of the National Council of Rehabilitation and Special Education, and of the Ministry of Environment and Energy of Costa Rica, whose resolute support has directed the success of the protocol for accessibility to protected areas for people with disabilities.
- The technical support of the Technological Institute of Costa Rica, the Citizens Defense Council, the Justice and Gender Foundation, and the National Insurance Institute.
- The Costa Rica-Holland Agreement which, through Fundecooperación, has believed in the importance of the enjoyment of protected areas by people with disabilities.
- The valuable cooperation of several groups of volunteers who offered their service during the diagnosis workshops, in the work of accessibility for adults, children and adolescents with disabilities.
- And, specially, the people with disabilities who joined their efforts and knowledge in order to achieve many of the contributions published in this document.

PRESENTATION

The Project of Accessibility to Protected Areas for People with Disabilities of the Earth Council, and the State of Costa Rica through the following institutions: National Council of Rehabilitation and Special Education, the Ministry of Environment and Energy, the Citizens Defense Council, and the Technological Institute of Costa Rica, have joined their efforts in order to design the first protocol in the world on accessibility for people with disabilities to protected areas.

Its objective is to provide a series of instruments directed towards guiding, recommending and facilitating the access of people with disabilities to protected areas.

The protocol is divided into ten handbooks that may be used jointly or separately, according to the reader's interest. The subjects developed are the following:

- 1- GUIDE FOR MAKING AN ACCESSIBILITY DIAGNOSIS
- 2- GUIDE FOR CARRYING OUT AN ACCESSIBILITY PLAN
- 3- GUIDE FOR THE INTERPRETATION OF PROTECTED AREAS FOR PEOPLE WITH DISABILITIES
- 4- GUIDE FOR THE ACCESS TO PHYSICAL SPACE (design and materials)
- 5- GUIDE FOR SIGNALING, INFORMATION AND COMMUNICATION FOR ACCESS OF PEOPLE WITH DISABILITIES TO PROTECTED AREAS
- 6- GUIDE FOR PREVENTION AND SAFETY FOR PEOPLE WITH DISABILITIES IN PROTECTED AREAS
- 7- GUIDE FOR CHILDREN AND ADOLESCENTS: ACCESS AND ENJOYMENT OF PROTECTED AREAS, A MULTI-SENSORY POINT OF VIEW OF OUR NATURAL SURROUNDINGS

8- OPENING THE DOORS TO PROTECTED AREAS

9- ACCESSORIES FOR TECHNICAL AIDS FOR ACCESS OF PEOPLE WITH DISABILITIES TO PROTECTED AREAS

10- SUSTAINABLE DEVELOPMENT AND HUMAN RIGHTS OF PEOPLE WITH DISABILITIES

The Guide of Accessories for Technical Aids for the Access of People with Disabilities to Protected Areas is part of the general objective of the project, which seeks to ensure equality of opportunities for people with disabilities through the elimination of barriers in the access to national parks and protected areas.

This component seeks to provide options for accessories and adaptations directed towards people with disabilities, so that they have access to the value, knowledge and importance of natural resources in national parks and other protected areas.

We hope that this effort helps open the doors to protected areas.

Ilonka González Chacón
Industrial Design Consultant

Rodrigo Jiménez
Project Coordinator

INTRODUCTION

In Costa Rica, 10% of the total population presents some kind of disability.

Recently, more attention has been granted to the possibilities that these people have of developing and adapting to the conditions of an environment generally not designed for people who do not fulfill certain requirements.

Several efforts have been carried out so that these people can enjoy equal opportunities as to social, cultural, physical, recreational, or any other kind of aspects.

The Protocol of Accessibility for People with Disabilities in National Parks and Protected Areas is one of the results of these efforts. The goal of this project is for people with disabilities to comfortably and safely enjoy the natural beauty at their disposal. This project has a team in charge of the research and development of elements in the area of industrial design. The task of this team is to recommend and develop a series of elements to facilitate and improve movement and safety conditions for people during their interaction with nature.

This project includes three major areas, which are the following: communication and signaling, technical aids, and access to physical space.

DESIGN OF ADAPTATIONS FOR TECHNICAL AIDS

Basic Concepts

- **Technical aids:**

A technical aid is a permanent element used by people with disabilities, which allows them to carry out different activities that would otherwise be difficult for them.

- **Support:**

It is a provisional aid given at the moment that it is required.

Objectives

General Objective

To facilitate the access of people with any kind of disability to national parks and protected areas, by designing a series of adaptations to the technical aids selected.

Specific Objective

To design a series of adaptations to the technical aids selected, by applying functional, ergonomic, safety, economic and aesthetic criteria.

Work Team

Coordinators:

I.D. Ilonka González Chacón

I.D. Sergio Rivas Porras

I.D. Olga Sánchez Brenes

Other members:

Students in the course of Design IV of the School of Industrial Design of the Costa Rica Technological Institute.

Technical Aids Selected

- Stroller
- Support canes
- Axillary crutches
- Canadian crutches
- Wheelchairs
- Technical aid for entering the water

Ground Conditions

- Sandy ground (beach)
- All grounds (irregular grounds)

Populations

- Children
- Adults

PRESENTATION OF THE PROJECTS

AQUATIC FLOTATION SYSTEM

Designed by: Fernando Rodríguez

This project presents a technical aid that facilitates interaction and movement within aquatic environments for people with disabilities. Currently, there are not many of these devices in the market, which is why this will be a product creation task more than an adaptation one.

Environment

Water is the environment where the device will be used. As we know, there are different kinds of aquatic environments, among which we find natural ones (rivers, seas, lagoons) and the ones created by man, such as swimming pools. In the case of natural environments, the constant waves, the currents, and the changing temperature are all determinant factors. Swimming pools possess characteristics such as depth and capacity. When choosing the materials, one must take into account that the different kinds of water (salty, sweet, chlorinated, etc.) may weaken them, alter their properties, or demand from them a higher resistance. The different water densities may also alter the flotation capacity.

Population

The population is constituted by children with motor impairment in their lower limbs (paraplegic), between 6 and 13 years old. When designing a technical aid for children, the approach given to the device is different. It becomes a device for recreational activities, and thus its simplicity and safety must be greater than if it were a design for an adult market.

Functions of the Product

The product must fulfill the following basic functions:

Practical

It must allow for movement within an aquatic environment, keep the user above water, give him safety and resistance, and provide children with an enjoyable and entertaining experience.

Aesthetic

It must be a discreet technical aid, which is identifiable within the market and colorful, so that it is not lost from sight.

Constructive

It must have a simple operation, be easy to move, provide stability and resistance, and comfortably adjust to the user.

Requirements

Once the environment and basic functions of the product are defined, we must establish the necessary requirements to fulfill what is stated above.

- It must have simple mechanisms.
- It must have flotation devices.
- It must be light.
- It must be easy to carry (collapsible).
- It must be stable and resistant

- It must not be too big.
- It must have a marketing graphic.
- It must be safe for the user and his or her companions.

Objectives of the Project

The project comprises the development of a device destined for children, which allows them to float and move within an aquatic environment (sea or swimming pool). This will provide them with an entertaining activity in national parks conditioned for the access of people with disabilities. It may also be useful for rehabilitation purposes.

Once the functions and requirements of the device are established, the criteria that will guide the design process are as follows:

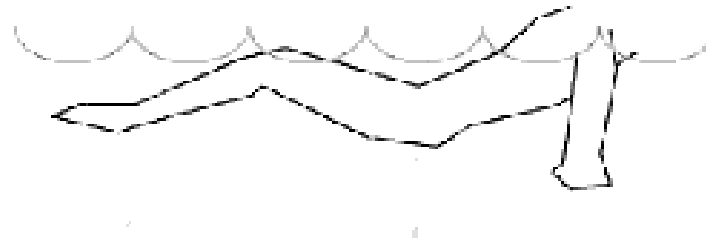
- The material used must have a low density, since this allows for better flotation.
- It must also have a low absorbency.
- The juncture systems must present good attachment, but they must be easily removable.
- The structure must be simple, so as to facilitate movement and flotation.
- It must have an adequate shape that does not concentrate material in the space of movement of the arms (as is the case of ring-shaped floats), so as not to obstruct the use of the upper limbs.
- Since it is destined for a children's market, primary colors or bright combinations may be used.
- Aside from it being simple and formed by several parts, a device to facilitate its packing and transportation must be designed (such as a backpack).

Flotation (therapeutic and for swimming)

For an adequate movement and a stable flotation in the water, the person's body must remain as a single unit. The right posture is specially important for paraplegic children, both the ones that lack movement in their legs and the ones who suffer from bifid spine, who can move their legs but not in a coordinated manner.

Thus the device may be concentrated in two main areas, in order to maintain an adequate floating position.

- AREA 1: It comprises the person's trunk, supports most of the weight, and is the one that grants stability. If the device is placed too low (almost at the waist), most of the trunk would be free, and the point where the force exercised by the water on the device is felt would be at a very risky place. Thus, the flotation device must be placed slightly below the chest, a level where the arms are at an adequate position for free movement, and where the force of the water is exercised on the upper back, which helps the person to improve their posture.
- AREA 2: People's legs may pull down the body, which is not very good for moving. Thus, the second part of the device must be placed between the legs, so that they float and the person stays in an horizontal position when moving. Since the person has no control over his or her legs, it is important to attach them and keep them as close as possible, so that the body behaves as one single unit, and stays in the proper position during movement.

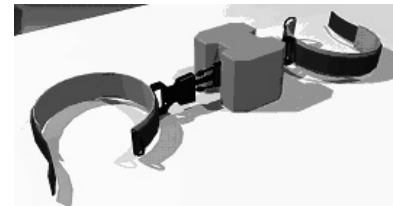
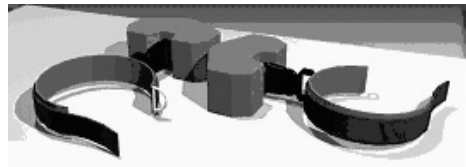
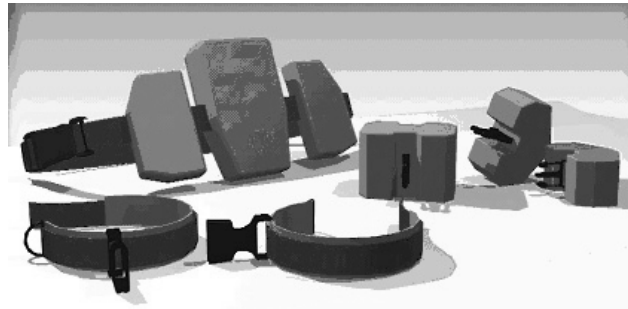


Final Proposal

Thus the final proposal is established as of the analysis and testing of the device.

Characteristics

- It is composed of simple elements (unions, straps, etc.)
- It is fast and easy to attach and adjust.
- It has a proper color combination for the children's market.
- It allows the user to propel himself and move.
- It may also be used in rehabilitation therapies, both for children and adults.
- A second system of individual floats for the feet may be adapted.
- It is made of an adequate material (resistant and light).
- It uses mechanisms familiar to users and easily accessible (clasps, belt adjusters).
- It allows for help from a second person.
- It has a low price due to its simple production system.



How to Use



Materials

- Floats: polyfoam (polystyrene foam)
- Belt: nylon
- Ankle wraps: foam strips (polyurethane foam) and Velcro
- Plastic safety clasps

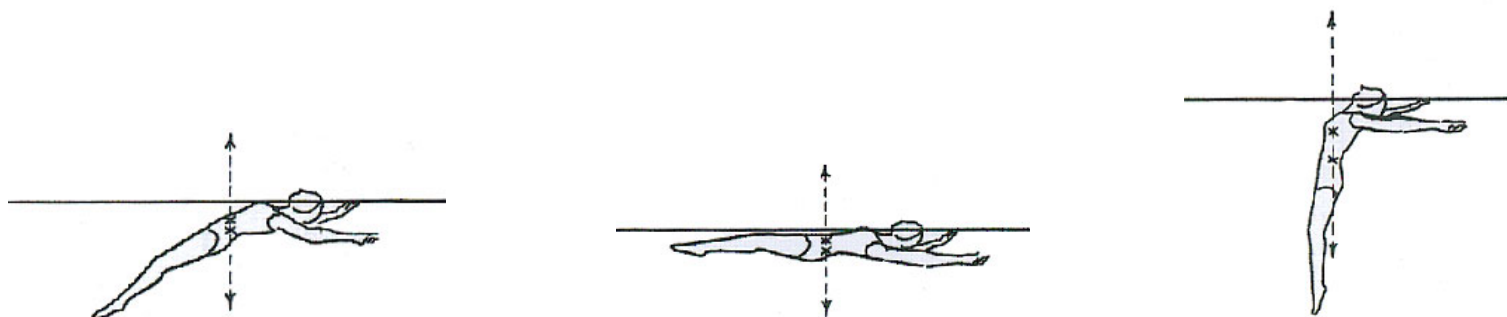
AQUATIC FLOTATION SYSTEM

Designed by: Itzel Murillo Rojas

The former design shows the mechanism for people with disabilities to interact in an aquatic environment. The following is a proposal made for these same environmental conditions, but destined for the population of paraplegic adults.

As was formerly mentioned, the environment considered is the water of rivers, seas, lagoons, swimming pools or other aquatic environments in which the proposal may be applied.

Kind of Flotation



Design Criteria

- Safety
- Accessibility
- Technical feasibility

Parts

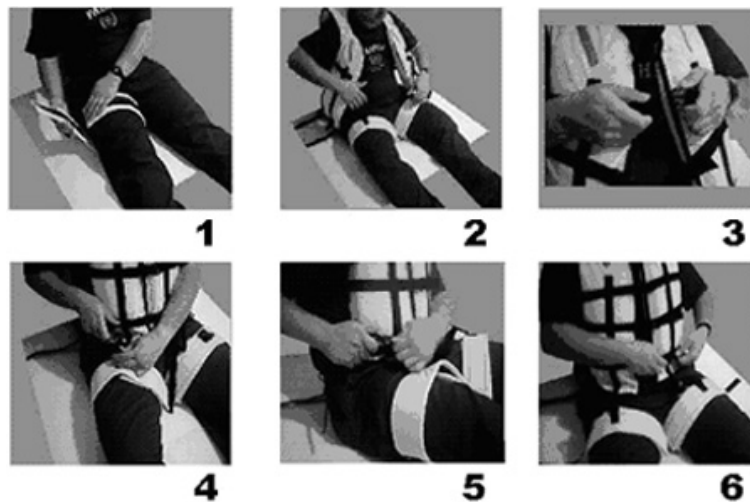
- Floating pieces (front and back)
- Support straps for legs
- Attachment straps (torso and legs)

Materials

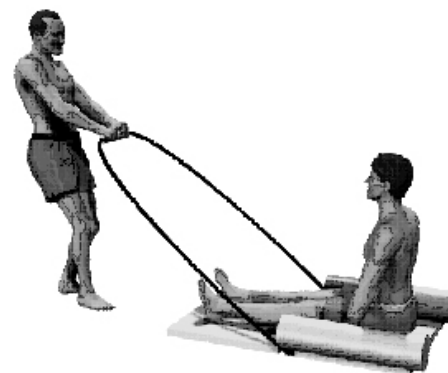
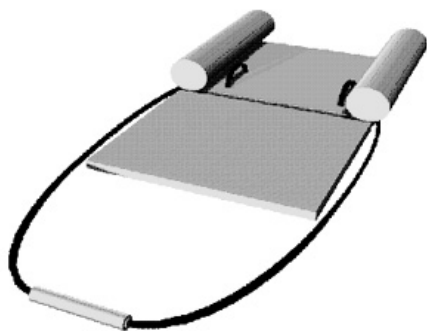
- Vest
- Impermeable nylon fabric in yellow
- Straps, seams, and seam reinforcements in black
- Click-type PVC buckles
- Polyethylene foam (or polyfoam) bubble-type filling in white, approximately 5 mm thick



How to Use



Accessory



Functionality Test



{Safety elements

- Water level
- Fastening systems
- Easy to use (one single adjustment)

Close Interaction with Other People

- Mobility
- Independence
- Integration



Conclusions

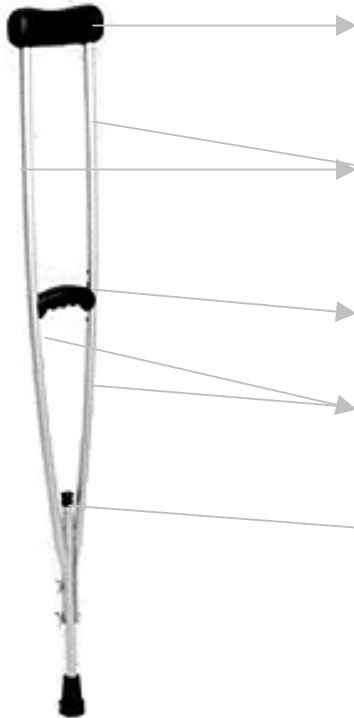
- It may be used in the sea or in a pool.
- It does not flaunt the disability.
- It allows for different activities.
- It permits recreation even for those who do not know how to swim.
- It does not pose any danger for the user and the people around him.

Recommendations

- Use under supervision of an expert.
- Learn previous concepts about swimming.
- Study the possibility of using the vest for sports.
- Consider the accessory as an additional element.
- Do not use the accessory as the only flotation device.

TECHNICAL AID

Axillaries Crutch



The **axillary support** stabilizes the trunk of the user. Ideally, it must be held between the inner side of the arm and the lateral frontal side of the thorax. Carrying heavy weights on it must be avoided, so as to avoid disorders in the axillary area.

The **arm** joins the support to the handle. It is usually formed by two bars that are in contact with both ends of the handle. In some models, its length is adjustable.

The **handle** must allow for a comfortable and safe grip. The shape of the handle may be straight or anatomical. In some models, the support, the arm and the handle are one single piece.

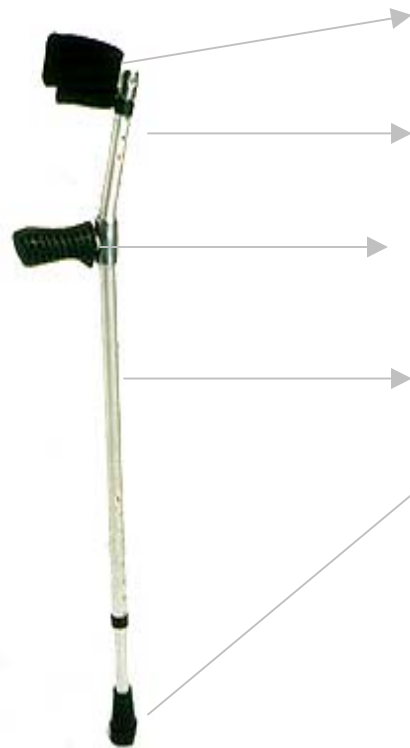
The **shaft** transmits the load to the ground. It is usually made of metal and its length adjustable, which allows the crutch to adjust to the user's height.

The **ferrule** softens the impact of the crutch on the ground, and also serves as a non-skid system. It is usually made of rubber. It is very important to check its wear in order to replace it. It is one of the most important elements for the safe use of this technical aid.

Axillary crutches require an adequate muscular capacity and a wide range of movement in the upper limbs, as well as a good grip capacity in the hands. It has a support at the upper part of the trunk that grants it great stability. An improper use of this kind of crutch may result in neurological and vascular disorders in the axillary area.

Elbow Crutches

The elbow crutch is also known under other names: English cane, Canadian crutch or Lofstrand crutch. The main parts of this kind of crutch are:



The **brace** aids propulsion, provides stability, and contributes to supporting the user. In some models it is collapsible.

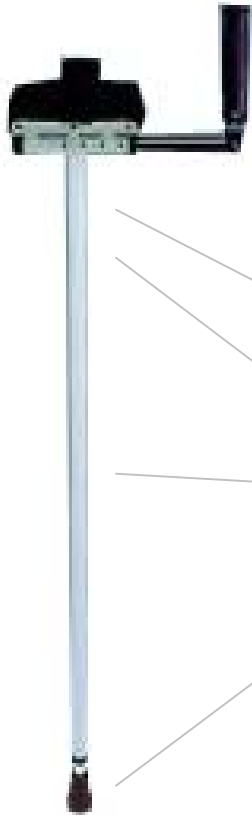
The **arm** joins the brace to the handle. It is inclined with respect to the shaft. In some models its length is adjustable.

The **handle** must allow for a comfortable and safe grip. The shape of the handle may be straight or anatomical. In some models, the brace, the arm and the handle are one single piece.

The **shaft** transmits the load to the ground. It is usually made of metal and its length adjustable, which allows the crutch to adjust to the user's height.

The **ferrule** softens the impact of the crutch on the ground, and also serves as a non-skid system. It is usually made of rubber. It is very important to check its wear in order to replace it.

Forearm Crutches



It requires an adequate muscular capacity and a wide range of movement in the upper arms, a good grip capacity in the hands, and an adequate equilibrium of the trunk, in order to achieve a save displacement. It results in high efforts at shoulder level.

The **handle** must allow for a comfortable and safe grip. The shape of the handle may be straight or anatomical. In some models, the brace, the arm and the handle are one single piece .

The **arm** joins the brace to the handle. It is usually perpendicular with respect to the shaft. In some models its length is adjustable.

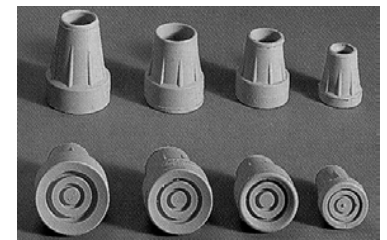
The **brace** aids propulsion, provides stability, and contributes to supporting the user. It usually has a strap to attach the forearm.

The **shaft** transmits the load to the ground. It is usually made of metal and its length adjustable, which allows the crutch to adjust to the user's height.

The **ferrule** softens the impact of the crutch on the ground, and also serves as a non-skid system.

The ferrules are one of the most important parts of a crutch. Whatever their kind, they have an essential role in stability. They can be found in different materials: rubber, granulated rubber and plastic. They are always made using a mold, whatever the material.

They can be found in several sizes, defined by the diameter of the shaft. Their height varies from 3 cm to 6 cm, and they are available in all diameters, generally from 2 to 3 cm.

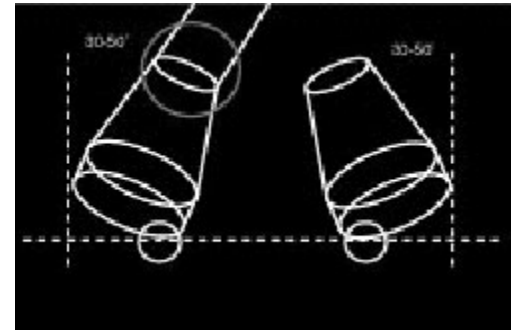
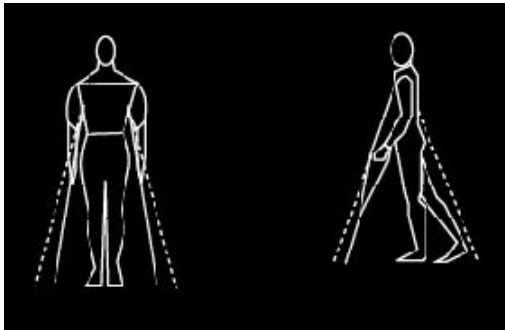


ADAPTATIONS TO CRUTCHES

Designed by: Sofia Protti

The link between the crutch and the ferrule takes place at the interface with the aluminum tube. Thus, it is a system that has a minimum direct relationship with the rest of the crutch.

However, the movement of the user in crutches is an important aspect, since it shows the movement that the crutch performs, and the strategic support points of the ferrule.



The Problem of Design

The problem arises with the need of a special ferrule for irregular ground, to provide access for people with disabilities to national parks.

The problem with the existing ferrules is that they do not adapt to this kind of ground, and they make for inefficient displacement along it.

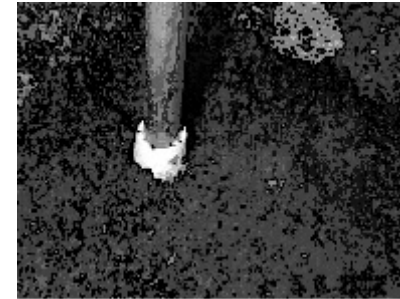


Problems of the Current Ferrule

It is unstable because it does not have a grip on the surface.



It gets stuck in the mud due to accumulation of material.



It accumulates material on the contact surface.



The contact surface is parallel to the ground.



Secondary Problems

The Environment

- Irregular grounds in national parks, with rainy weather conditions
- Influence of factors such as humidity and temperature
- Elements typical to the ground, such as stones, trunks, moss, mud, water, etc.

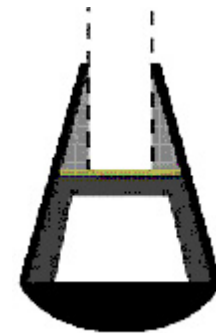


Design Requirements

- Adaptable to the surroundings
- Stable
- It must not get stuck
- Adaptable for different crutches
- Light
- Easy to clean
- Resistant
- Easy to install
- Low-priced
- Simple

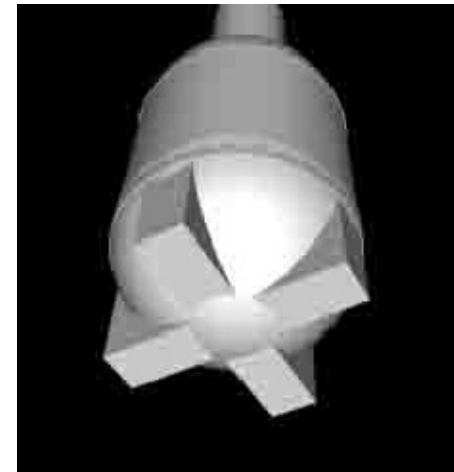
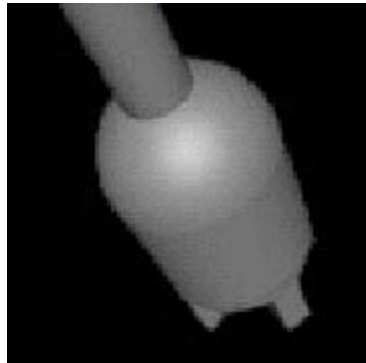
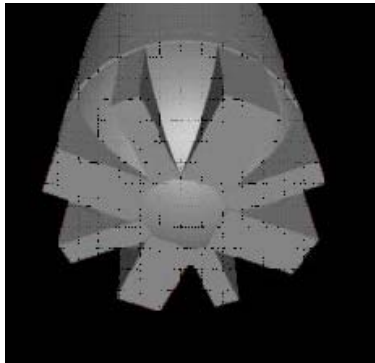
The evaluation of multiple alternatives gives rise to ideas and concepts that present possible solutions to the design problem.

- Increase the surface of contact with the ground.
- Eliminate the perpendicularity of the current ferrule with respect to the ground, and generate approach angles (entrance and exit) for pendulum movement.
- Increase the grip on the contact surface (ground).
- Eliminate angles on the ferrule body, so as to avoid accumulation of material.



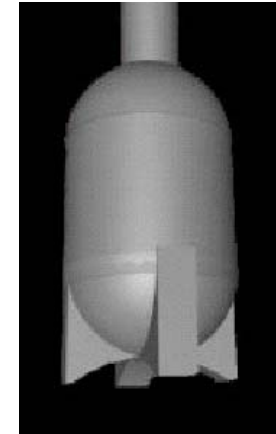
In the design proposed:

- Lateral angles are eliminated.
- Grip elements are incorporated.
- The object's symmetry gives versatility to its use (it has no front or back).
- The number of heels on the spherical surface increases.
- The contact surface is greater.
- There is more material.
- The weight is greater.
- The relief spaces are smaller, and thus it accumulates material.
- It has a good grip.

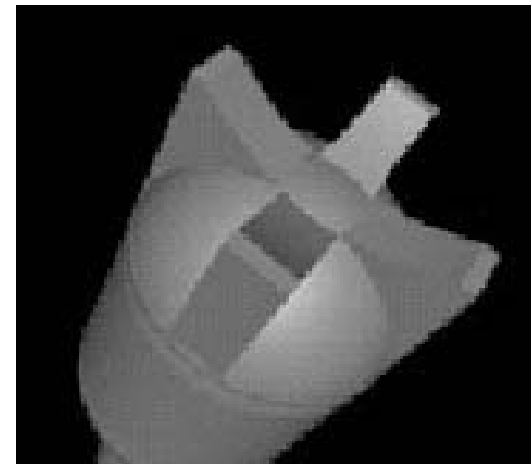


Proposal

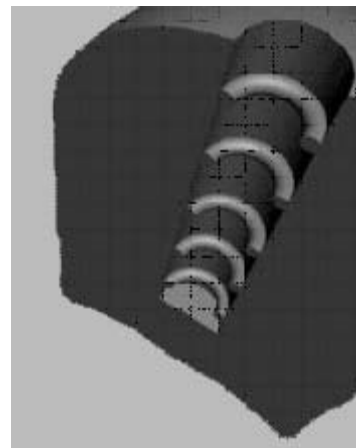
A hemisphere at the end of the ferrule, to relieve materials, and avoid its sinking. A symmetry that grants the product simplicity and manufacturing advantages is sought.



The heels are placed at angles of 90° , so that the area of the sphere displaces the material outwards. The ends of the heels have extensions for a better grip. The evacuation area is maximized and the grip improved. The heels are anchored to the surface.



Rubber rings with a hardness of approximately 50 shore A.



The attachment of the crutch to the ferrule is achieved by pressure. The rubber rings along the inside of the ferrule increase the friction of the tube against the material.



Field performance of the ferrule

It presents advantages, especially for displacement of materials and grip of the heels on the surface, aside from being flexible on rough surfaces.



On low-level water, the ferrule manages to anchor its heels on the surface.



Material

The ferrule will be made of natural rubber, due to its flexibility, its resistance to moisture, and its mechanical resistance.

The elasticity of the material will vary throughout the system, ensuring the concentration of material on strategic spots such as the heels. The interface with the crutch will have an average hardness of 35-40 shore A, to allow its adaptation to crutches with different diameters.

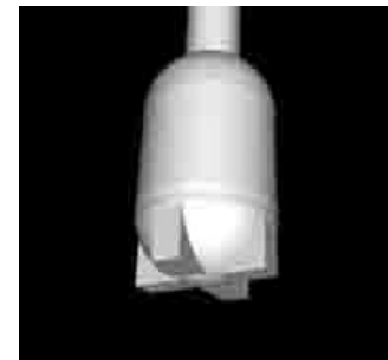
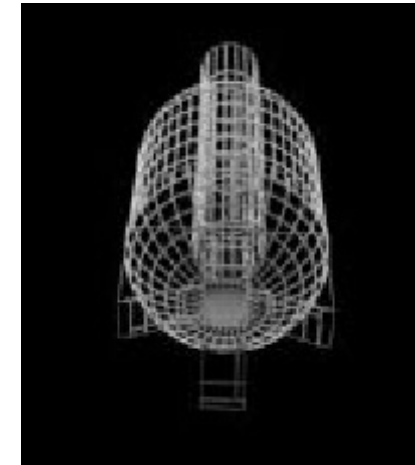
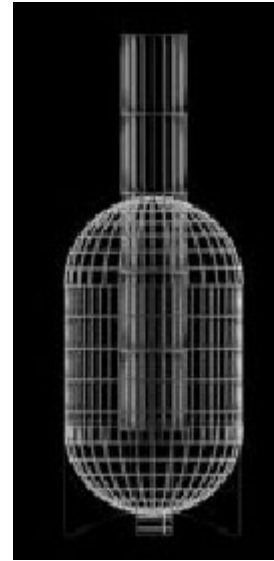
The formula includes antioxidant softeners, and charges such as sulfur. Its weight is approximately 100 grams.

Color

The color of the ferrule must be light. We propose light gray to avoid absorption of sunlight, which deteriorates the material.

Manufacturing Process

It is manufactured by compression, in a 10-20 steel mold. Its vulcanizing rate is approximately 8 minutes.



It has been proved that the design proposal for the new ferrule complies with the following conditions:

- It adapts to the ground, and to crutches with different diameters.
- It has a good grip on the ground.
- It evacuates materials.
- It minimizes the risk of sinking into soft grounds.
- It is easy to use and clean.
- It is simple.
- It has a low cost and an easy manufacturing process.
- It is light.

Conclusions and recommendations

- We recommend the exclusive use of this ferrule on grounds that have the specified conditions.
- The ferrule must be used preferably on axillary or Canadian crutches.
- National parks and rainforest areas are always hazardous for the displacement of any individual.
- We recommend caution when using the ferrule.

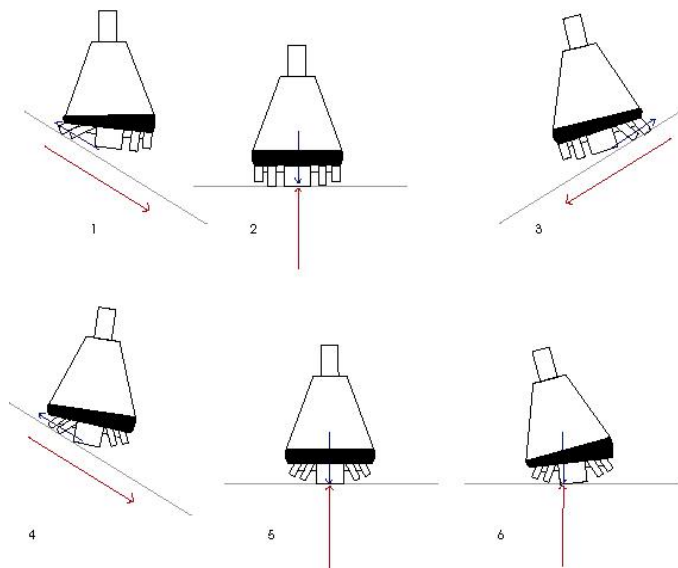
FERRULE FOR CRUTCHES

Designed by: Juan Pablo Calvo

The main problem encountered was the interaction of the crutch with the ground. Thus, the device to be designed solves this problem and provides higher physical and psychological stability to the user, thus facilitating accessibility.

This proposal is composed of three pieces: the cone, the polybutadiene sole with a hardness of 70, since this material has good flexibility and a great resistance to wear, and a closed-cell polystyrene layer in the middle.

- The small heels are placed in such a way that they react to obstacles and common walking situations, as shown in all the figures.
- The angle of the heels was eliminated, making for a more versatile adaptation to the ground. The entry and exit angle is achieved by a reduction of the outer heels.
- The number of heels was reduced, thus making movement more efficient. Also, since the heels are more flexible, they evacuate any object stuck between them, be it mud or pebbles.
- The front part is the same as the back, which makes using the crutch easier.
- The polystyrene layer was added in order to provide better adaptability and higher equilibrium control since, when the person supports his or her weight in order to achieve equilibrium, he o or she compresses the layer and it adapts the sole to the direction in which the force is applied (Figures 1, 3 and 4). This adaptability and compression solves the problem of the person not being able to use the crutches at full 90° (Figure 6). Thus the system is useful when walking forward.
- The incorporation of this layer also creates a curve that softens the transition between sole and cone, making it easier to pull out in case it sinks in the mud.



Grip System

The proposed grip system is an aluminum tube attached to the plug with two nuts and bolts. This tube will have four perforations: two in the middle, where the bolts will attach it to the plug, and two more threaded perforations on the upper part to place the attaching devices. These attaching devices will be two wing nuts that will adjust to the crutch tube by compression. The wing nuts will push in two steel flats with a rubber coating at the end. These last provide grip of the piece to the crutch.

The diameter of the tube is based on the maximum diameter of crutches that exist in the market, plus the mobilization space for the attachment flats.

The bolts that attach the tube to the plug must have countersunk heads, so that they are not left exposed in the tube's interior and do not hinder the system's performance.

The wing nuts must be middle-sized, so that the person may easily adjust them.

This system works better than the former one, since the common plug works only by friction and by a slight compression that decreases as the material yields with constant use. On the other hand, this new system works by friction of the rubber on the steel flats with the crutch tube, and also by their compression. This compression does not decrease, since it only takes a slight adjustment of the wing nuts.

Materials

Aluminum was chosen for the tube, since it is light and does not hinder walking. It does not rust either, which prolongs the useful life of the device, which will be exposed to moisture.

Steel was chosen for the flats due to its mechanical resistance, since the flats will be subject to a constant compression effort.

These will be coated with rubber to provoke friction with the tube, so that the system works.

Conclusions

- In order to facilitate access to certain paths, a system that provides a better grip and counteracts the forces present during walking is needed.
- It is necessary for this device to have a great adaptability to the different topographical conditions and the obstacles present on the paths.
- It is very important for the user to be sure that he will be able to maintain equilibrium with this system.
- It is also very important that the user may enter certain paths with his or her own crutches.

Recommendations

- We recommend the use of small rubber heels (polybutadiene with a hardness of 70) arranged in such a way that they counteract the forces in question and provide a better grip.
- We recommend the use of flexible materials such as closed-cell polystyrene and polybutadiene with a hardness of 70, since they provide an adequate flexibility and resistance to wear.
- We recommend that the surface of the whole plug be increased, in order to manipulate grip elements and provide a greater support area with every move.
- We recommend the use of a system that adapts to the crutches that exist in the market.

FERRULE FOR CRUTCHES

Designed by: Jimmy Navarro Navarro

Problem

The problem consists of designing an accessory for crutches that grants the users physical access to national parks and protected areas with loose, muddy or slippery ground conditions and slight slopes.

Functions

Main function

- Provide stability for moving

Secondary functions

- Provide safety
- Provide support
- Provide equilibrium

General Objective

Facilitate the access of people in crutches to national parks and protected areas through the design of an accessory to allow them to enter, exit and move along inaccessible grounds.

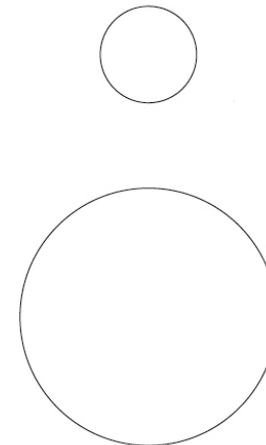
Specific Objectives

- Design an accessory that can be used with standard crutches, by means of the morphological and structural comparison of these last.
- Facilitate movement with crutches along inaccessible grounds, by maximizing the user's stability.
- Minimize the cost of the accessory by the evaluation of materials and manufacturing processes.

Product Requirements

The product must have the following characteristics:

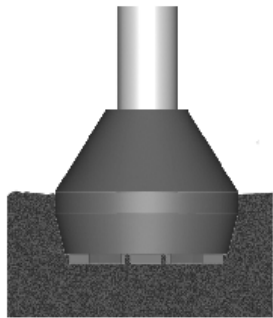
- Easy to install.
- Has a simple shape (coherent with the crutch).
- Light.
- Resists efforts and the effects of the environment.
- National production.
- Easy to use (not hinder walking).
- Increases the user's stability.
- Easy to clean.
- Easy to unclog (pull out of the mud).
- Non-skid.



This design proposal increases the transversal section area to 50,26 cm², which is seven times the normal surface. This is achieved by increasing the radius of the ferrule from 1,5 cm to 4 cm.

Ratio of surfaces

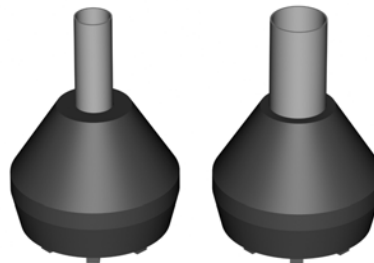
The design of this accessory must not be very different from the one of traditional ferrules, since there is a direct relationship of the user with these shapes and their manner of use; that is, this design maintains configuration features from the traditional ferrule. It is important to point out that the shape does not predetermine support, nor does it possess many entries or diverse points that make the user unsure about walking or about the way they must prop up the ferrule.



The shape of the new accessory can be subject to sinking up to 3 cm in the ground without risk of getting stuck, since up to this point it presents no resistance to exit. Also, the shape opens a space in the ground, slowly increasing the diameter and achieving displacement of the muddy material.

It is very common for traditional ferrules to become dislodged from the shaft and remain stuck to the ground. This is due to the fact that there is not enough pressure between ferrule and shaft. The diameter of the tubes varies so much that, in some cases, the ferrule fits loosely because there is not enough pressure on the shaft.

This design efficiently solves the problem of diameter, since the ferrule can be made in a variety of diameters through a machine process. This makes it possible to generate more pressure on the shaft, since the hole of the ferrule may be controlled by adjusting it to any diameter.

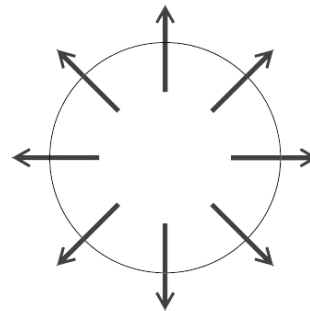


perforation for smaller diameter



In order to avoid sliding, grip elements in the shape of small heels are included. Their function is to penetrate the ground and provide firmness. These elements have a small transversal section area, which allows them to sink easily and provide grip.

These small heels are arranged in such a way that they do not oppose the pressure exercised by weight, but they do oppose any possible sliding due to ground instability.

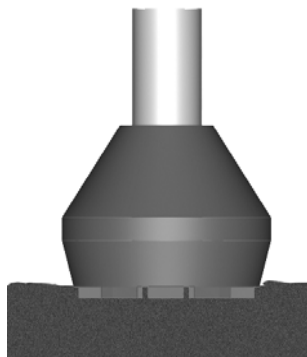


*possible movement directions
due to ground instability*

The ferrule must remain perpendicular to the ground. However, the crutch is used in such a way that it makes the ferrule stand in an oblique position regarding the ground. Thus, flexible materials are sought in order to allow the ferrule to flex and maintain its perpendicularity.

The manufacturing process of the new ferrule will take place through press molding, which has a relatively low cost. The mold will cost ¢250 000, and six pieces may be molded simultaneously.

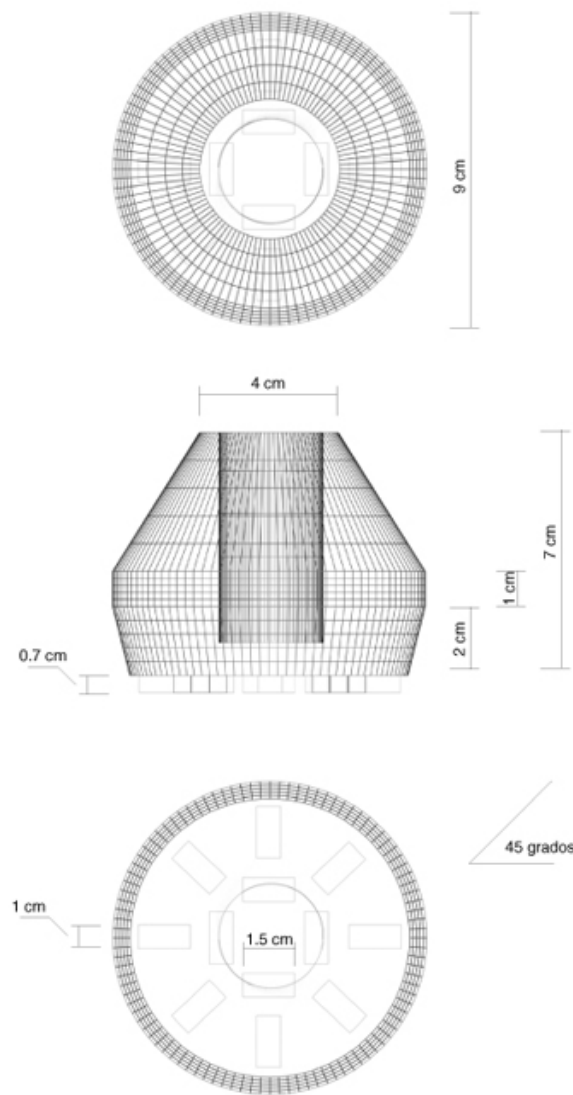
Traditionally, ferrules have been made with natural rubber. However, this material possesses a low resistance to atmospheric agents and, in the conditions that characterize national parks, it would become damaged too rapidly.



grip of the heels on the ground

The material chosen for manufacturing is polyurethane, which is well known for its great mechanical properties, its excellent resistance to abrasion, compression, cutting, impact due to deformations, corrosive agents, crystallization at low temperatures, and for its great tolerance to high load pressures. This material presents many advantages in comparison to other elastomers.

Construction drawings



Conclusions

- The machine process through which the different diameters are achieved reduces production costs and generates more pressure on the shaft.
- Users are not willing to change the kind of crutches they use, which is why they must be provided with an accessory for the crutch they use daily.
- Introducing grip elements provides more stability to the user.
- National manufacturing of the accessory is feasible.
- Increasing the ferrule surface decreases the pressure exercised on it, thus minimizing its sinking into the ground.
- Polyurethane provides better characteristics than natural rubber.

Recommendations

- We do not recommend that the contact surface be increased to more than 9 cm in diameter, since this would hinder the movement of the user.

FERRULE FOR CANES

Designed by: Randall Marín

Functions

The basic main function of the cane is to provide a stable support point that helps the user to move.

As secondary functions, we may include softening impact, decreasing muscular effort, minimizing the risk of injuries, and offering versatility for different activities.

The main function of the ferrule (or plug) is to maintain the position of the support point (grip) as long as the user needs it; that is, avoiding slipping, sinking, or getting stuck. Some secondary functions of the ferrule are softening impact and providing an entry or initial contact angle with the surface.

The main starting points for the design are grip, stability and weight distribution, being grip the most relevant one.

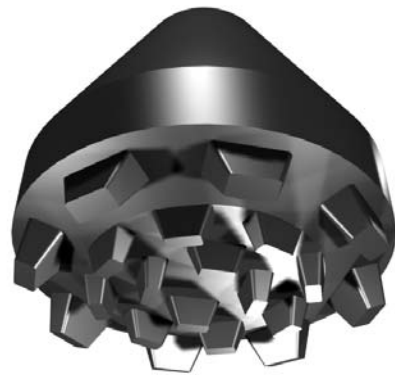
Details of the Proposal

- Accessory
- Natural ground
- Rubber
- Radial symmetry
- Diameter slightly lower than 10 cm
- Initial contact area and support area at 90°
- Conical
- Anchor elements
- Diameters: 1 1/2", 1", 1/2", 3/4", 7/8"
- Weight lower than 400g
- Supports a weight of 120 Kg. (250 lb.)
- Metal butt end
- Less than €1000
- Injection

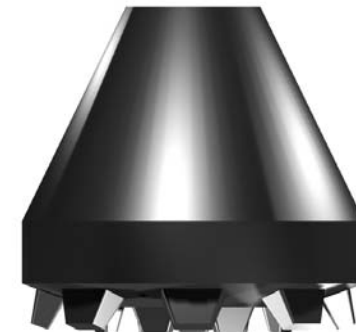
Design Proposal

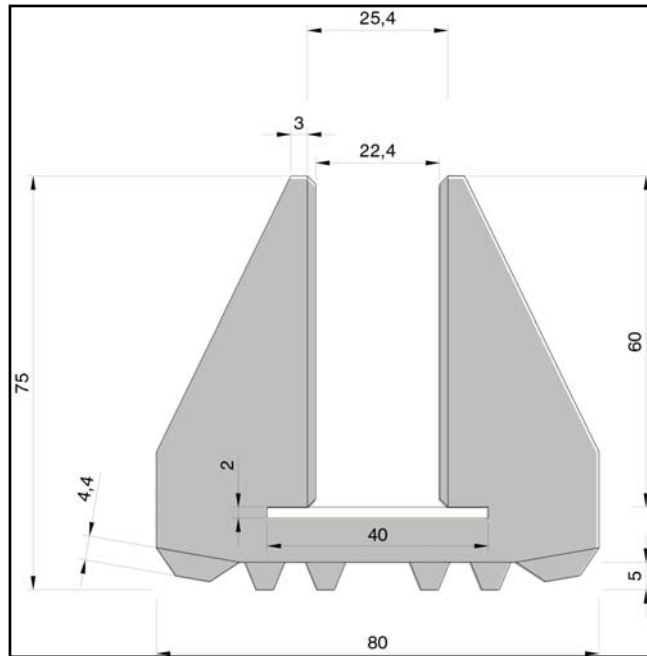
Proposal E has been chosen as the final proposal, and it summarizes the best characteristics of the former models. The reason for this choice is that this is the proposal that complies with all the requirements. It is the one that best possesses all the characteristics required.

On restating the problem of when the ferrule gets stuck, the possibility of improving the attachment system between ferrule and cane, instead of using ventilation channels, was studied. The problem does not pertain to the possibility or ease of removing the device, but to the effectiveness of the system when staying in one piece. The ventilation system would only help diminish the strength needed to remove the device, but it does not help keep the system together. On the other hand, when the perforation where the cane is entered is lengthened, the contact area between both parts increases, and coupling improves.



Some longitudinal filaments or striations along the contact walls improve the grip, since the space they leave between them is less than the tube's diameter, thus increasing the pressure along it.





The material selected is polybutadiene rubber with a hardness of 80 chore A. Experts in the subject of rubbers have recommended this material for several reasons:

- Its standardized world formula facilitates its production in any part of the world, which is very important for this project, which has an international scope.
- It has a high resistance to humidity.
- Its elastic properties and its hardness allow for a slight compression of the material and maintain the shape (the hardness of the existing ferrules studied is 70; our proposal requires something harder, in order for the heels to really become anchored and avoid movement).
- It is resistant to traction, and to tearing and breaking.
- It facilitates the protection of ozone (antioxidants).
- It is easy to model by injection.

Due to production and cost reasons, one single kind of polymer has been chosen. Aside from rubber, the system has a metal plate whose main function is to avoid direct friction of the tube edges with the ferrule, thus avoiding the wear of the material.

Distribution of Heels



WHEELCHAIR

Designed by: Diego Escalante

A wheelchair is a technical aid for those people who are not capable of using their legs due to an illness or injury. It is basically a seat that has four wheels attached to it: two in the front and two in the back. It works by the impulse the user gives it by means of the back wheels.

Users

The market towards which the product is directed are national parks. They would be interested in buying the chair in order to satisfy the demand for an adequate technical aid that allows the access to the area of people who suffer from paraplegia.

Characterization of the User

The users considered when proposing a solution will be those people who suffer from paraplegia, with an age between 18 and 45 years old, who perform some kind of regular physical activity, and who belong within the average range as to anthropometrical measures.

Performance

In this case, the performance of a traditional wheelchair in Prusia and Tapantí National Parks in Costa Rica was studied.

It was uncomfortable to watch the hindrances that disabled people face in order to move independently.

In most cases, the wheelchair changed from a technical aid to an obstacle, due to the fact that its current configuration does not allow for adequate movement on this kind of ground.



In many cases, great help was need from other people in order for the disabled person to overcome the obstacles encountered along the path.

There were occasions in which the help of up to four people was needed in order for the users to continue.



General Objective

Improve the movement of paraplegic persons on non-traditional grounds, by means of redesigning a system (wheelchair), in order to allow them access to national parks.

Specific Objectives

- Establish the reasons for which a traditional wheelchair has a low performance, by gathering information during an on-site test.
- Design a wheelchair capable of moving safely and effectively on non-traditional grounds based on the information gathered during the research process.
- Propose its manufacturing at a national level.

Product Requirements

- It must have adequate wheels for non-traditional grounds.
- It must allow the user to brake or decrease his speed.
- It must soften the bumps on the way.
- It must provide the user with a comfortable and safe position.
- It must take into account the current legal architectural dimensions.

Alternative Systems

Since traditional wheelchairs are not apt for this given terrain, due to their configuration, research was carried out to determine what systems are available to use in this terrain. Due to the fact that the objective is to facilitate the access of the majority of persons, it was necessary to find something that could be used by persons of different sex, gender and contexture.

Once the different options were studied, the result was that there are no wheelchairs available that can adapt to this terrain.



Design Criteria

a. Traction and relationship of pinions: It seeks a more effective use of the force applied by the user.

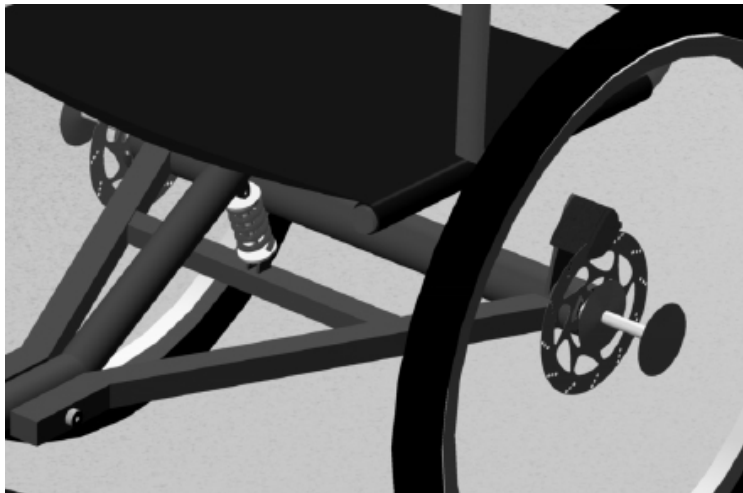
b. Control of direction: A long distance between the axes maintains a better course (this is why race chairs are long). A short distance between axes is softer and easier to manage (this is why basketball chairs tend to shorten this distance).

If the wheels have a positive angle (wider at the base) the chair will maintain a better course, it will be more stable, and the shoulder posture will improve (arms closer to the body for propulsion). The problem is that this increases the

total width of the chair, which is why this is only used in sports chairs. A neutral angle (wheels parallel to the chair) is less effective regarding rolling facility. A negative angle (narrower base) makes for a worse posture of the shoulders and a less stable chair.

c. Overcoming obstacles: Big wheels are more adequate for outdoor areas and irregular grounds. Small wheels are better for indoor use and for sports, due to their faster pivot on smooth and hard surfaces. However, the right size will be determined by the combination of the weight distribution on the chair and the surface on which it will be used. This is why a small wheel on a chair with a 50/50% weight distribution results in high friction.

A smaller back wheel requires less effort for propulsion, but it also covers a smaller distance. Wheels inferior to 600 mm (24") are usually used for people who have difficulties moving their shoulders or who have kyphotic spine. Smaller wheels are also used on children's wheelchairs, so that the propulsion ring is at a more adequate height to the length of their arms.



d. Gravity center of the chair: When moving the gravity center backwards and upwards, the weight on the back wheels is increased, thus making the wheelchair easier to manage but more unstable. If the center of gravity is moved downwards and to the front, the chair achieves stability but is harder to drive. Usually equilibrium can be reached according to the needs of the user. It may be necessary to include safety devices such as wheels that prevent overturning.

REDESIGN OF ADULT STROLLER

Designed by: Nayibe Fonseca

Problem

This consists of searching for a way to facilitate the access of an adult in a stroller to a national park.

General Objective

Facilitate the access of an adult in a stroller to a national park, by redesigning this technical aid.

Users

The design is destined towards new stroller users, or to the ones that want to change their current equipment.

Kind of User

Adults with mobility problems who need full or partial support of their weight in order to move, and who have the same strength and control in both their upper limbs.

Product Requirements

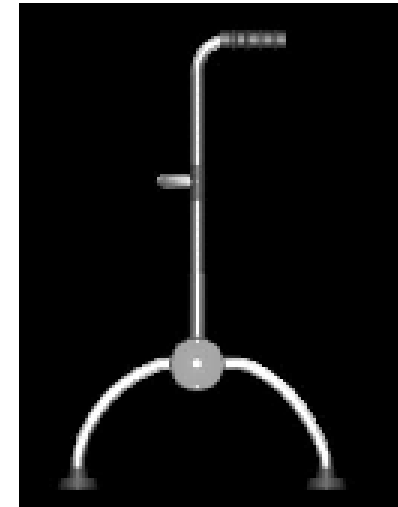
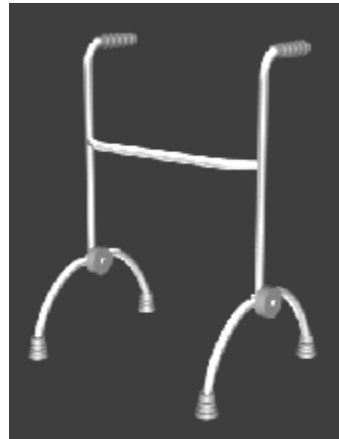
The product must:

- Provide stability.
- Provide support.

- Adapt to the kind of ground.
- Adapt to the user.
- Adapt to environmental conditions.

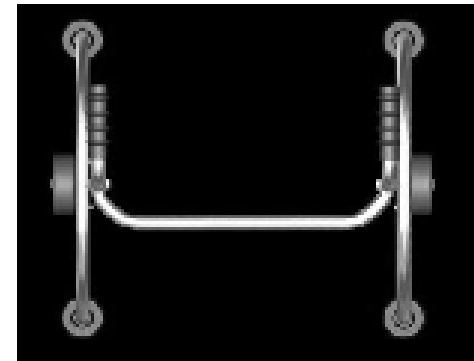
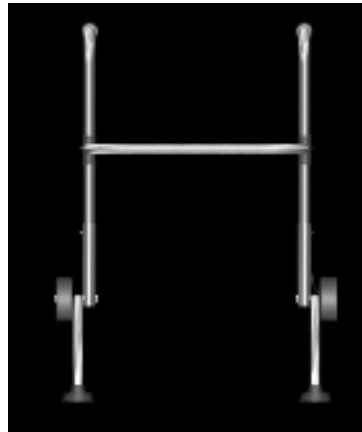
Criteria

- Resistance - durability
- Flexibility - adaptation
- Comfort
- Aesthetics
- Feasibility
- Cost



Concept

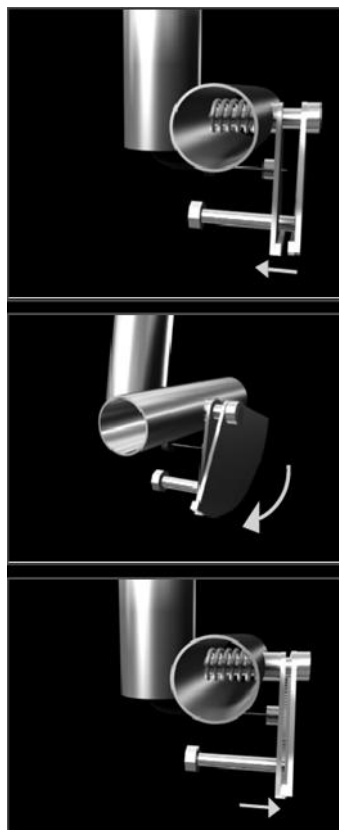
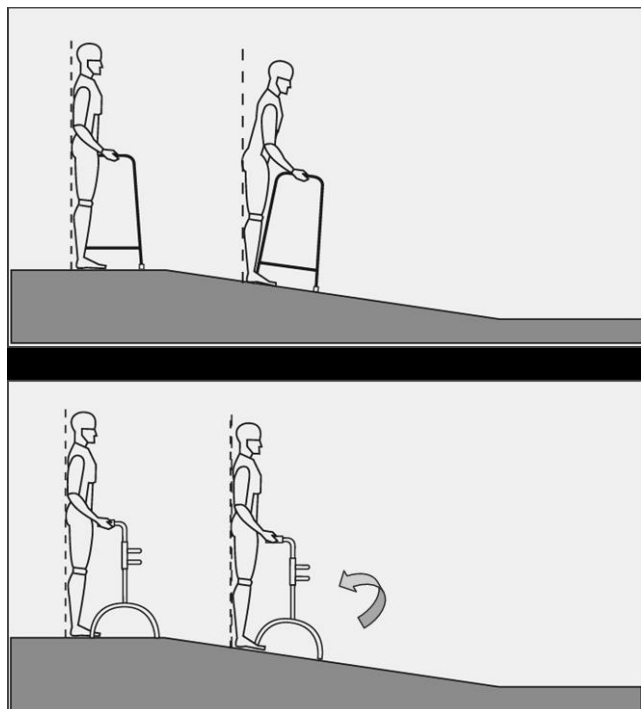
- Reclinable
- Collapsible
- With adjustable height
- With adaptable ferrule
- Minimization of structure



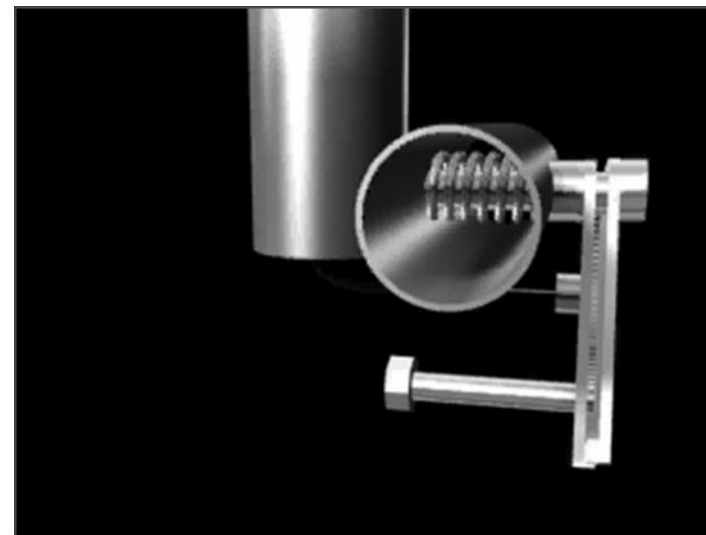
Components

Inclination Adjustment System

Mechanism for inclination system...



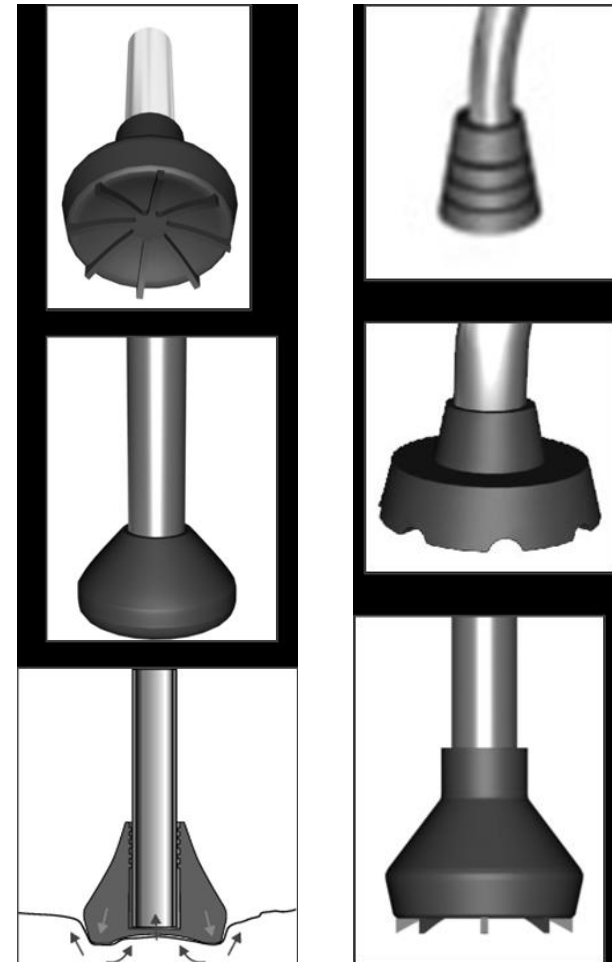
...by coupling of two indented pieces



Height adjustment system...



...through a retractile button mechanism

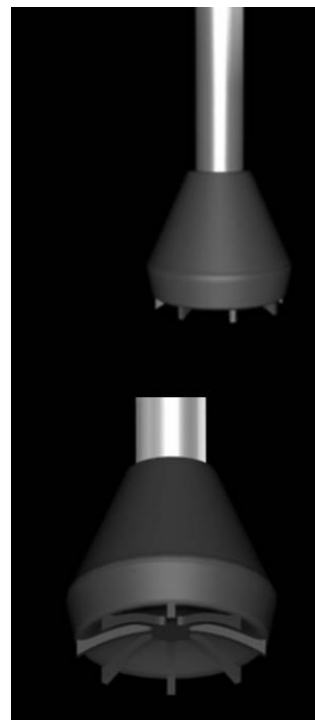


Ferrule

- Adaptation to ground
- Sticking
- Incorporation of grip elements
- Distribution and exit angle that do not allow accumulation of material
- Flexible material
- Exit angle to avoid sticking

Handle

- Dimensions and shape that allow it to adjust to the user's hand
- Water-resistant
- Soft material which provides comfort
- Non-skid



Advantages

- It is adaptable to slopes.
- It weighs up to 10% less.
- Its components are resistant to corrosion.
- It has 45 % less structural components.
- It occupies a reduced space.
- Its cost-benefit relationship is acceptable.
- It can be manufactured with national technology.

Disadvantages

- Its adaptation to the environment is limited.
- It requires additional actions during its use.
- Its grip point is at a bad location.
- It is limited to a specific group of users.

Conclusions

The proposed system is the result of a global approach to the technical aid and the multiple problems it presents.

The proposed system does not allow the user to enter any part of the park, but it provides greater facility, both in urban and mountain environments, in comparison with the regular stroller.

Its qualitative and quantitative scope is reduced, since it was necessary to find the balance between a flexible structure that adapts to the conditions of the environment and a stable one that provides a better support and balance point.

The structure proposed may be manufactured with the technology and materials available in the country.

The cost-benefit relationship is acceptable and competitive with respect to similar strollers that exist in the market.

Recommendations

It is important that the user previously consult a specialist to make sure that he or she can use the product, since it was designed for a group with specific characteristics.

If the conditions of the environment where the product will be used do not fit into the specifications provided, we recommend that the user employ another safer method for entering the place.

It is recommended that a good analysis be made before conferring the product more flexibility than the one stated in the proposal, since this could be dangerous for the user.

We recommend that a detailed study of the manufacturing process be carried out, in order to optimize the design according to the production system and infrastructure available, thus decreasing costs.

Specifications Recommended for the Environment

- Paths 1 to 1,5m wide
- Rest areas
- Absence of big obstacles
- Bridges with homogeneous surfaces and drainage system
- Steps with adequate treads and risers

DESIGNS AND RECOMMENDATIONS THAT FACILITATE ACCESS TO PHYSICAL SPACE

Designed by: Ilonka González Chacón

Picnic Tables

As to the design of picnic tables, we recommend that the seats be benches (full top). In this case, one of the seat tops must reach only up to half the length of the table, so that a person in a wheelchair can fit in the free space, and also beside his or her companions. In some of the tables, the individual seat could also have a back support at the lumbar area for those people who have hip support impediments.

Materials

So as to not alter the natural aesthetics of national parks and protected areas, it is preferable to use natural wood for manufacturing tables, and that the kinds of wood typical to each area be used as much as possible.

It is also recommended that the wood keep its natural color and that it be treated only with a sealer to counteract the effects of moisture and bug repellents, without the wood losing its natural color.



Potable Water Fountains

In the case of potable water fountains, we recommend that they have two spouts at different levels, since this facilitates their use by people with and without disabilities, especially people who move in wheelchairs. It also facilitates their use by children.

For this kind of water system we recommend the use of a pressure faucet, since it is easier to use. Aside from this, it is also important to incorporate a pedal that can be activated with the foot on the lower part of the base.

It is also recommended that the waterspout for children and people in wheelchairs be suspended, so that the user in a wheelchair can get as close as possible to the water fountain.



Rest Benches

We recommend that the rest benches possess a very simple design, so that they do not distort the natural environment in which they are located. Thus, we recommend that they be made with wooden boards, as can be observed in the image.

On the other hand, it is important that there is a possibility of making benches with kinds of wood that exist in the area where they will be placed, since this lessens the impact on the environment.

Just like the picnic tables, we recommend that the benches be treated only with a sealer to counteract the effects of moisture and bug repellents. We also recommend that they maintain their natural color, so that they become part of the environment and its aesthetics are not affected.

Accessories

It is important that accessories in installations be easy to use for all people, regardless of their condition. The following section establishes recommendations to facilitate the use of some accessories such as doorknobs, hand dryers, and faucets, among others, by all people.

As to faucets, we recommend the use of those that require one single action and which do not require turning the knob in order to turn on the water. For example, a faucet that can be operated by rising and lowering a lever can be used, as can be seen in the example.

The simplest faucet to use is called a “pressure” faucet, which is pressed in order for the water to come out and then pressed again when the hands have been washed.

We recommend the use of lever door handles, since they are simpler to use and do not require a turning movement by the user.



We recommend the use of automatic hand dryers, since it is not necessary to push buttons in order to operate them, but rather the air comes out when the hands are placed under the outlet and stops when they are removed.

As to illumination systems, we recommend the use of fluorescent light, since it is the most recommended white light for things to become adequately defined.

As to the light control system, we also recommend the use of movement sensors or laser beam sensors at the entrance, and at a height of 40 cm from the floor, with a specific switching-off rate.

We also recommend the use of a digital switch, since it is not necessary to exercise pressure on it but is rather operated by contact and easy to locate due to its luminescent spot.

Otherwise, pressure switches that light up can be used, so that they can be easily located.

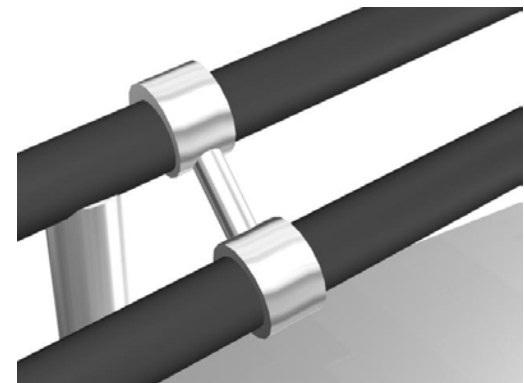
Switches must be placed at a height of 1 m above the floor, so that they can be reached by people in wheelchairs.

Railings

Railings provide support and a sensation of safety to the user.

They must be formed by a double railing with an angle of 45°, so as to provide more comfort to the different kinds of users.

The external railing is placed at a height of 85 cm with an opening of 60 cm, while the internal railing with an angle is placed at a height of 75 cm and with an opening of 45 cm. This facilitates the use of the ramp and the comfort of people with different builds is guaranteed.



DESIGNS AND RECOMMENDATIONS THAT FACILITATE ACCESS TO INFORMATION

Ilonka González Chacón

Internal Signaling

For internal signaling we recommend the use of pictograms in restrooms, first-aid equipment, lodging, cafeterias, telephones, information booths, showers, picnic areas, etc.

The material recommended for their manufacture is acrylic-coated paper, and an aluminum sheet at the lower part of the sign with the information in Braille.

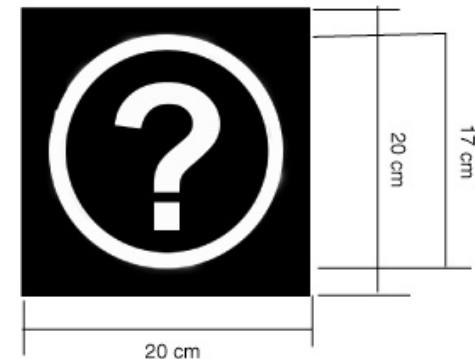
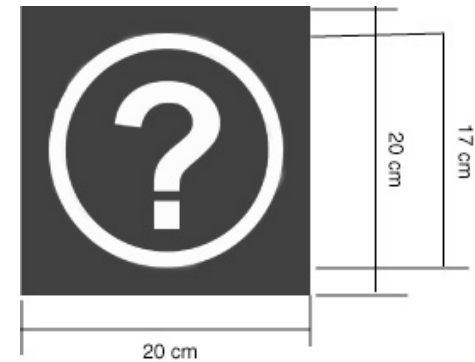
The background will be black and the pictogram white, or vice versa, since this facilitates reading due to color contrast.

We also recommend that the background color cover at least 50% of the total area of the space, so as to facilitate and improve reading.

The use of pictograms is the most recommended, since it allows for comprehension of the signal even beyond the barrier of speech.

Note:

For more information, see the Guide on Signaling, Communication and Information for the Access of People with Disabilities to Protected Areas.



External Signaling

Whenever possible, we recommend the use of pictograms for external signaling, since they allow the sign to be understood even beyond the barrier of speech. For example, they can be used in restrooms, first-aid equipment, lodging, cafeterias, telephones, information booths, showers, picnic areas, etc.

We recommend that the signs be made in wood. However, in order to select the kind of wood to be used, it is necessary to take into account the climatic conditions to which the sign will be exposed.

We recommend that the sign be painted in yellow letters over a black background, so that the color contrast facilitates reading.

We also recommend that the background color cover at least 50% of the total area of the space, so as to facilitate and improve reading.

To facilitate reading for visually impaired people, it is important for the text to be embossed. This is due to the fact that following the contour of embossed letters facilitates reading for these people.



Museums

It is important for all people without distinction to have access to museums that show the different species of flora and fauna that can be found in parks and protected areas.

Thus we propose an alternative design for species expositions.

This design uses a stand, and it has an audio area with headphones that allow the person to hear the sound emitted by the species studied, as well as its description.

On the front board there is a picture of the species and the text with its description or characterization. On the top, we find this information on a Braille slate, as well as the embossed silhouette, so that visually impaired people have access to the information.

Beside the embossed silhouette, we can find a sample of the specie's texture, be it a feather, fur, or skin, so that people can touch it. There will also be a sample of each specie's footprint.

