

DESIGN OF A FURNITURE FOR PATIENTS IN REHABILITATION STAGE. KEY STUDY OF THE DETACHABLE SECTION

Sotiria FERFYRH

University of Thessaly, Faculty of Wood Technology and Furniture Design
Laboratory of Wood Design
V. Griva 11, Karditsa Greece
E-mail: ferfyrhsot@yahoo.gr

Abstract:

Human spin is a complicate and sensitive body part. Every spine is as unique as a fingerprint. Every person has his own unique 'spine print', and that print changes as the person's posture changes. Injuries in the spine can cause serious problems in a person's daily life. Sometimes the conservative treatment that is often applied is not enough, so surgical intervention is necessary. A serious kind of spine surgery is spinal fusion, a surgical procedure to correct problems with small bones in the spine. After this stage, the patient is undergoing rehabilitation, a stage that varies from person to person and is temporary but very critical for patient's recovery. In current research, we studied the design of an auxiliary furniture, aimed to improving the quality of life of people in rehabilitation stage after a back surgery. The study and design of the wood furniture includes initially the use of creative thinking and logging of ideas such as Brain Storming, Mind Map, Story Board to define the final specifications of the furniture so to imprint them by creating original and final sketches and 3d models using 3D CAD software. More emphasis was given to the horizontally detached surface that it has and serves to facilitate other functions.

Key words: furniture design; universal design; patients; spinal fusion; rehabilitation stage.

INTRODUCTION

The main purpose of industrial design since the end of the 19th century, when it began to appear until today, is the design of furniture and other industrial products that aim to improve the everyday life of the people who use them. With the evolution of science, materials and technology, people's needs have grown dramatically. Furniture and other industrial products should be increasingly complex and sophisticated to cover a larger group of human needs (Clarkson et al. 2013). Many times these needs are not covered from a classic industrial design process but we have to adopt more efficient methods like Universal Design. According to Roger Coleman the following questions have to be answered in a new design "Who is going to use my design?" "What do they need from my design?" "How do I take any medical needs into account?" (Coleman et al. 1994).

The evolution of medical science is continuous, new methods of treatment are constantly being discovered, new wound treatment techniques are being implemented. A large number of wound treatment techniques result in surgical procedures (Outi et al. 2017). The patient after a surgical procedure should follow a rehabilitation step following specific medical instructions. Indeed, in some post-operative rehabilitation stages such as Spinal fusion, the patient should follow a long rehabilitation phase that may take several months. During that time, the patient should be in upright position (Laureen et al. 2017).

The purpose of this paper is to design interior furniture that will be able to support and facilitate the patient in the rehabilitation phase after Spinal fusion surgery. Beyond the ergonomic design of the entire skeleton of the auxiliary furniture, great importance was given to its horizontal detachable surface. This over the storage character that has a significant function is that it can be detached from the base skeleton. This surface may be placed on any horizontal surface of the surrounding area as well as on the bed surface of the person using it. The role of this surface is very important since transporting will also serve the transfer of useful objects which are directly recruited for the person in the reporting stage.

Both design and construction materials should facilitate easy disconnection from the main skeleton and the transport away from it. Ideally, the transfer could be carried out by the patient himself.

For this purpose, a survey was carried out with the distribution of questionnaires in rehabilitation centers in Central Greece, as well as the method of personal interviews from people in the process of rehabilitation or who have already completed this stage. Subsequently, based on the data collected, they were utilized using tools for the design and development of furniture and other industrial products. The methods used as design tools are Brainstorming, Story Board, Mind mapping, concept design and cad modeling.

OBJECTIVE

The main objective of the present study was to assess the needs of people in the process of surgery recover and to create auxiliary furniture for them in the home. Both the patient's needs and the functions that

arose from the research held about the needs that the furniture could cover, aimed to provide the details for its ergonomic design. The most important point was the possibility of transferring its horizontal surface according to everyday needs.

METHOD, MATERIAL, EQUIPMENT

In order to search the necessity of designing a furniture that supports the patient at the rehabilitation stage, a survey was carried out which was based on the questionnaires responded by patients undergoing rehabilitation after a surgical procedure and personal interviews of patients who completed the stage of rehabilitation. A market survey was also conducted to find similar furniture - aids that serve patients' needs. The answers given from the questionnaires, shows the need for designing a product - furniture that will serve the needs of the patients at home. Overall, the questionnaire contained 15 questions and responded to it by 73 people who are either ill themselves or have a patient in their family. Specifically, the question of how much such furniture would help the movement of the persons in their space, 38% of respondents answered "very much" while 40% responded 'much' (Fig.1). To the question of how important it is to detach the horizontal surface of the furniture from the base frame 83% answered yes and 17% answered no (Fig.2). As regards the required characteristics of the horizontal surface, the needs of the patients that are essential to be covered are primarily that of eating and the placement of devices and objects for entertainment purposes. Necessary elements are to create recesses in appropriate dimensions and to add a non-slip surface to securely support all of the above. The ability to detach this surface will make it possible to place it on the patient's bed when he is there. It will also be possible to place it on any other surface desired by the patient.

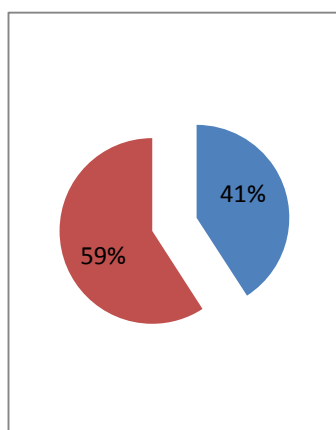


Fig. 1.

Persons who were in their immediate vicinity a person who could use the particular furniture.

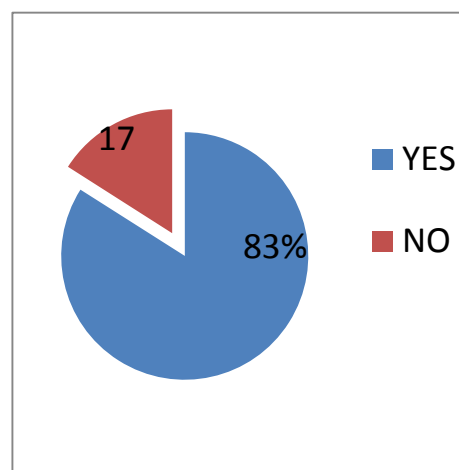


Fig. 2.

The importance, of removing the horizontal surface from the base frame.

- Day care and survival processes
- Fun, table games, reading books and more
- Communication, telephone, internet and more
- Creativity, embroidery, knitting, modeling constructions

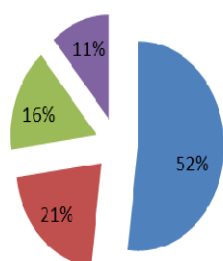


Fig. 3.

Daily activities that are lacking or that are difficult for people in recovery.

- Very much
- Much
- Moderate
- Minimum
- Not at all

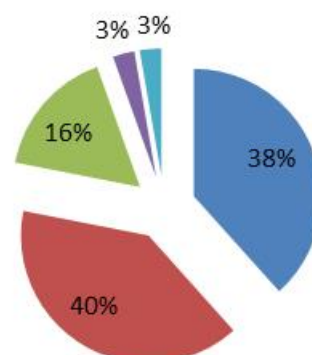


Fig. 4.

How much help would offer such furniture to people with temporary difficulty in movement.

Most respondents (52%) believe that daily activities that are lacking or that are difficult for people in rehabilitation stage are the daily care and survival processes. Then they are considered to be lacking entertainment (21%) (TV, board games, reading books etc.). The next activity that is considered to be lacking or becoming difficult is communication (16%) (phone, internet etc) and the last activity they are lacking is creativity (11%) (embroidery, knitting, modeling constructions etc.) (Fig.3). In Fig. 4 are presented the answers about how useful it would be a furniture like this, so 28 (38%) respondents answered "very much", 29 (40%) people answered "very much", a smaller percentage of respondents (16%) answered the help it could offer would be "modest" while only two of them (3%) responded minimally, and 2 others (3%) said that such furniture would not provide any assistance to people with difficulty in moving.

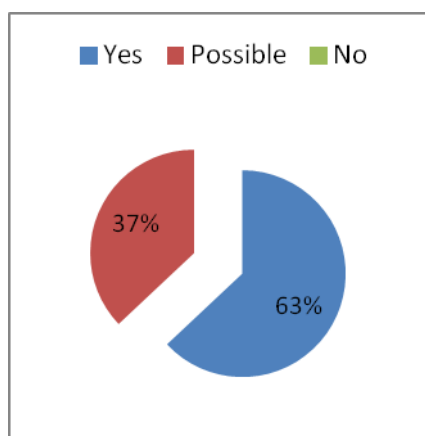


Fig. 5.
How important is furniture dimensions to be adapted?

Regarding to how necessary it would be, the dimensions of this auxiliary furniture to be adapted to the user, most of the respondents 63% (46 people) responded positively and a fairly large number 37% (27 people) replied that this possibility would be "possible" necessary. It is worth noticing that none of the respondents answered negatively to the possibility of adapting the dimensions of this auxiliary furniture to the individual user (Fig. 5).

At the same time, the market research showed that the most popular device used by patients is the walker. The research carried out showed that auxiliary furniture should meet the following objectives: a) To offer any improvement to the new conditions of their everyday life b) To make pleasant and productive, for people with temporary difficulty in the movement, to stay in the home area c) To support the communication with their relatives additional functions despite the difficulty of moving outside the home d) to give those who use it the impression of temporary use rather than a permanent status e) to offer in a successful way the impression of minimizing the diversity of the people who make use of auxiliary furniture. (f) its construction is such that it is easy to move and detach its individual parts from the user himself.

BRAINSTORMING

Brain Storming is called the process where the constraints set are to be addressed and met by targeted solutions and proposals, a team of designers, through a process of creative search for new ideas, solving problems, meeting the constraints and leading to innovative solutions. The goal of a brain storming is to externalize different ideas from team members. The process begins by identifying the problem, as well as determining queries that will stimulate creative thinking. The main purpose of brain storming for the design of auxiliary furniture is to meet the needs of the users and the functions that it should cover. The need to support in the home, but also to meet the basic necessity of the food is where the priority was given. Great importance should also be given on the ergonomics of furniture based on anthropometry (Yayici 2016). Special attention was also given to safety factor so that furniture can safely support the user when moving in the house. Considerable care should also be given to the design of the auxiliary furniture, with the auxiliary surfaces that it will have to include for the installation of a mobile phone, laptop, tablet etc. Also, the materials should not have a heavy weight.

STORYBOARD

The aim of the Story Board is to help the designer understand the user's needs, the content and use of the product, the interactions between the users - products. Story Board is used throughout the design process, from the birth of the idea to its evaluation. Through this the emphasis was placed on the operation of the product and the intended behavior of the product. It also helped to pay attention to the technical functions of the product as well as to psychological / social / economic / cultural functions. Finally, the Story Board tried to answer questions like Where? When? What? Why? With whom? For how long?

MIND MAP

This method is being used at the beginning of "Searching for the Idea". The designer begins by creating illustrations on how to develop opportunities for innovation development. A thematic core is defined in the center of the map (Bednar 2009). Mapping our ideas shows the potential relationships that develop (or are about to being developed) from the opportunities or solutions that the designer discovers through the map. It is a map depicting specific relationships and hierarchies. Such a tool helps the designer to develop discussions to find the solution. The method helps to further detect and develop a concept. On the map to be developed in five stages: a) Definition of the Thematic Core and related sub-themes b) Mapping of the Thematic Core and related sub-themes c) Exploring the potential opportunities around the Thematic Core and related issues d) Improving the Thematic Core map according to the initial requirements e) Map analysis and identification of final areas for further exploration.

CONCEPT DESIGN – CAD MODELING

The concept design refers to the initial design of ideas in sketches. Sketches should capture design suggestions that meet the user's needs as outlined in the previous steps. The idea that will be selected by the evaluation will be detailed below in CAD Modeling. After selecting the final idea, follows the stage of 3d modeling where the pre-designed idea should be designed in every detail. The design software is AutoCAD 2018. During the detailed design process, the designer is able to identify any errors or omissions that were not detected earlier. It is likely that significant improvements will emerge, or even changes in the central concept, so that the furniture - product is constructively and structurally correct.

RESULTS AND DISCUSION

The research carried out showed that auxiliary furniture should meet the following objectives: a) To offer any improvement to the new conditions of their everyday life b) To make pleasant and productive, for people with temporary difficulty in the movement, to stay in the home area c) To support the communication with their relatives additional functions) despite the difficulty of moving outside the home d) to give those who use it the impression of temporary use rather than a permanent status e) to offer in a successful way the impression of minimizing the diversity of the people who make use of auxiliary furniture (f) its construction is such that it is easy to move and detach its individual parts from the user himself. The main purpose of brain storming for the design of auxiliary furniture is to meet the needs of the users and the functions that it should cover. The need to support in the home, but also to meet the basic necessity of the food, was where the priority given. So the detached surface should initially be a simple horizontal surface for any use that would be necessary to the patient. Placing a food, a reading book or an electronic device (tablet, laptop) is the most necessary need that should definitely be served. In a second year, a glass and some daily use items such as a mobile, a pen and a paper, paper towels, glasses and other items of everyday use would be very convenient for the patient to be placed on the detached surface of the furniture.

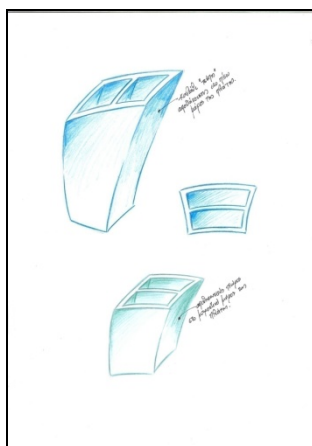
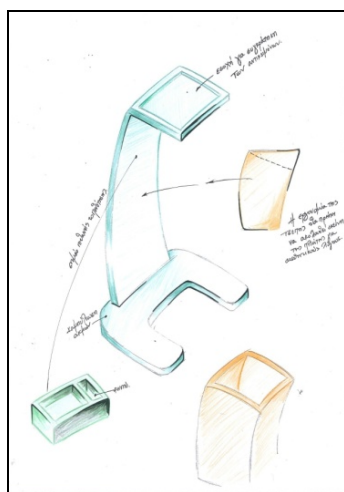
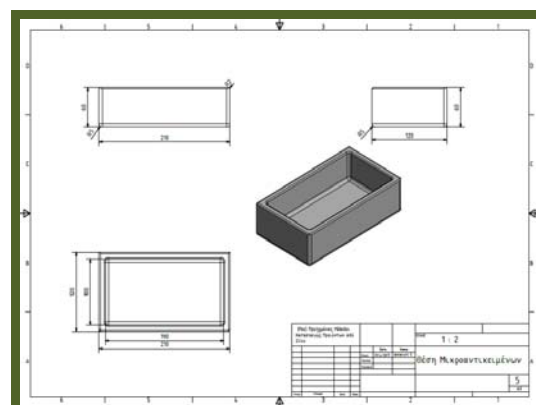
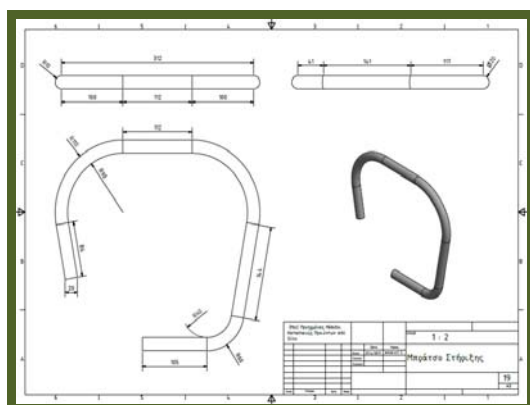
Great importance should also be given on the ergonomics of furniture based on anthropometry. Particular attention was also given to the issue of safety to the safety factor so that the furniture safely supports the user when moving within the home. Considerable care should also be given to the design of the auxiliary furniture, depending on the auxiliary surfaces that it will have to place for the installation of a mobile phone, laptop, tablet etc. Also, the materials should not have a heavy weight (Fig.6).



Fig. 6.
Brain Storming.

[illegible]

Covering the needs of patients through the ergonomic design of the furniture is the basic criterion for choosing and developing the final design concept. In the initial sketch we try to give a basic shape in the furniture (Fig. 9). The final idea was chosen based on the following criteria as they emerged from the mind map: a) Ensuring the stability of the furniture when moving the patient inside the house b) Choosing the least volume and weight design c) The ability to store the user's personal small items d) Allowing the user to move freely. The final form of the auxiliary furniture is shown in Fig. 10

[illegible]

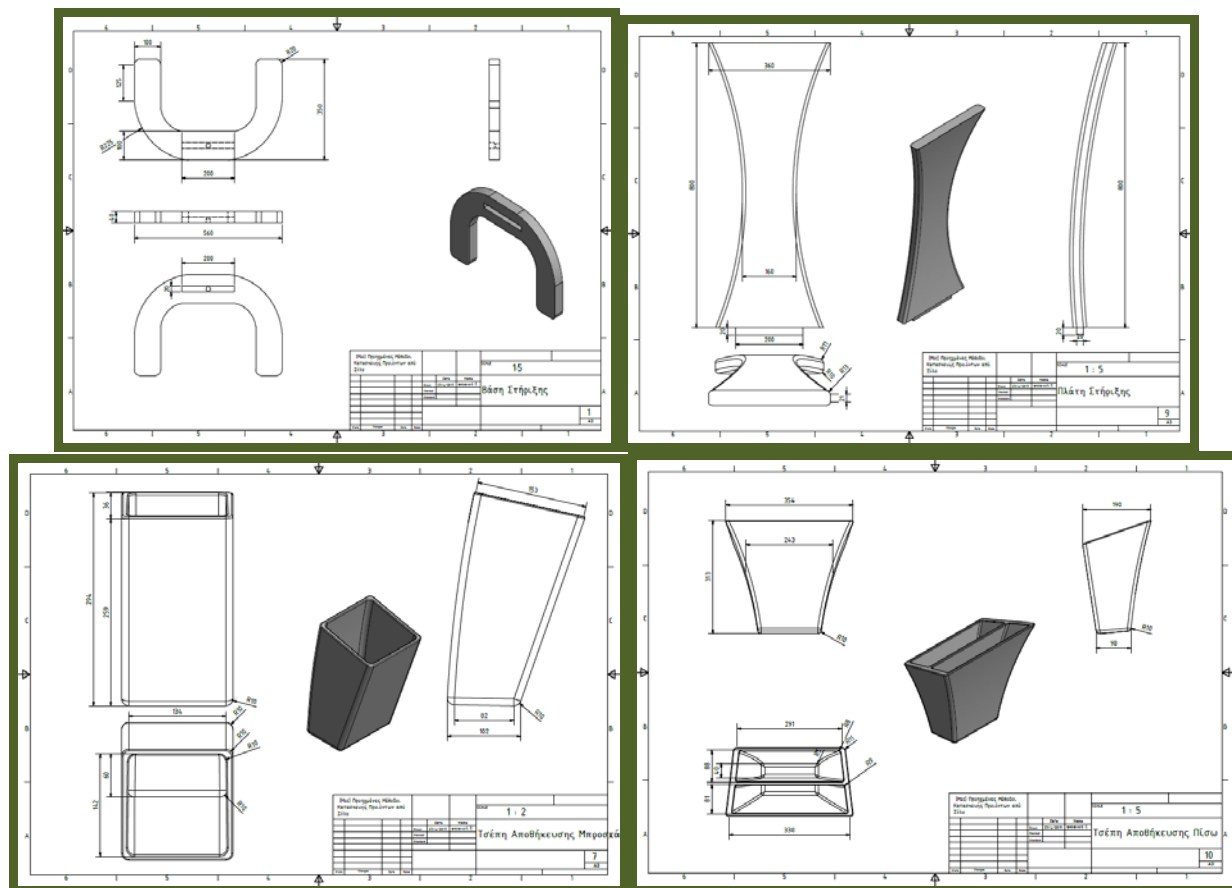


Fig.10.
Final Sketch.

FINAL 3D CAD MODELING

The final sketch design is the guide for the 3d model in AutoCad 2018 (Fig.11, 12), during modeling process we are able to find mistakes in initial design and to correct them. After the 3d model design we have to make the construction drawings.

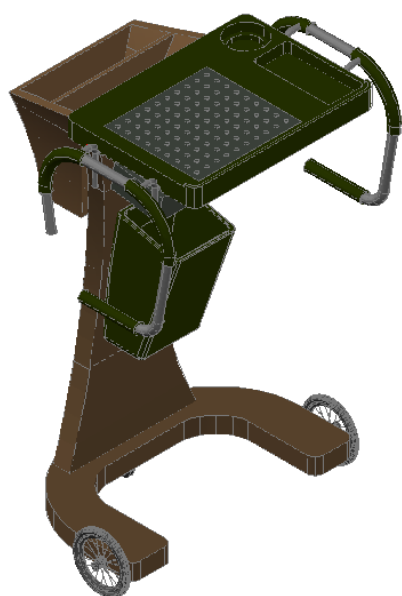


Fig. 11.
Final 3d Modeling.

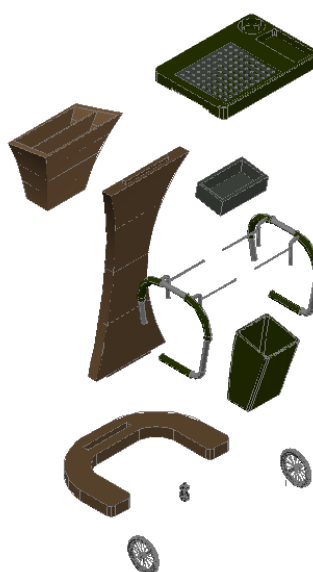


Fig. 12.
Exploded view of 3d Model.

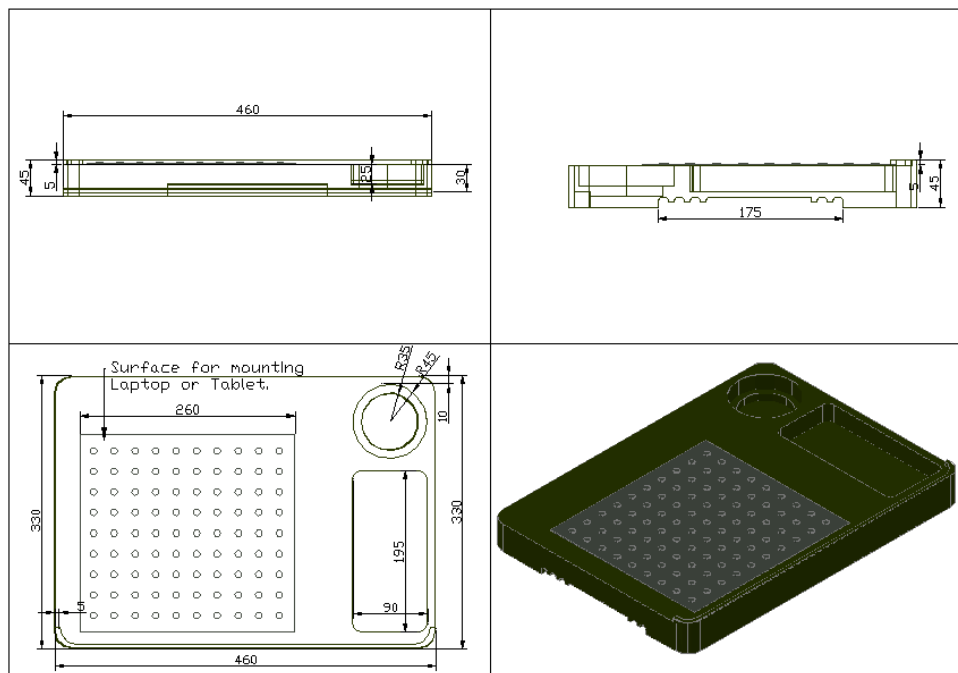


Fig. 13.
Horizontally detached surface.

CONCLUSIONS

The idea of designing an auxiliary furniture started from the need of people who, after a surgery involving the vertebral region and then at the stage of rehabilitation. During the rehabilitation phase, the patient should be able to serve their needs at home in the best possible way. This is where the present research focused. It was considered necessary to provide answers to questions concerning the process of patient transition from rehabilitation to normal lifestyles. In the first stage, what is deprived of these people as well as the needs that are created by returning to the home, since others are less able to self-serve. Those who know best this information are none other than the patients themselves for whom it is intended to design such auxiliary furniture and by themselves to use it. So it was to draw up a questionnaire which would include all those questions that would be able through the answers that would emerge to "describe" the form, the functions, the materials, the design, any additional benefits but and the cost of furniture.

The analysis of the results of the questionnaires in conjunction with brainstorming, mind map and storyboard determine the initial design of the auxiliary furniture. The answers to the questionnaire show that users would like to have such furniture. They expressed their opinion on the cost of auxiliary equipment, their preference for the construction of the morphology and the use of its parts, as well as the existence or not of auxiliary storage areas. Finally, it was considered very practical to be detached into the individual sections and said that after the recovery phase it could be used as a daily use furniture.

The functional and morphological features which proposed in the questionnaires are those that were depicted in the first sketches. The general morphology of the furniture should give a picture of robust design and stability, while at the same time it should serve in a distinctive way the very specific needs of the users. Storage spaces should be clearly visible and serve accordingly, giving many activities to the user of the furniture. Its basic functions should be user-friendly and easy to implement. The ease of moving within home was also considered a very important feature of the furniture.

In the final sketches, we had to include the income data from the previous stage. Keep those data that are thought to meet the purpose for which they were designed and meet the ergonomic and functional requirements. There were also some new sketches, which better cover the need for discretion. Among other things, some thoughts had to be made about the future use of furniture with a different function. The final drawings, based on the final drawings, provide detailed design details of the resulting design data.

Some further thoughts on improving the furniture are presented below: a) Add sensors to avoid collision with furniture and surfaces inside the house. This function on such furniture could be a further advantage for the added safety of the users. It can be an extra function which could be a choice to purchase the furniture b) Choosing colors in the different parts of the construction. Different coloring of the parts of the furniture could be a choice of users c) use by people with different mobility problems after the design changes d) Second use of the furniture after the first one.

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