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APPLICATION OF ERGONOMICS AND THE PRINCIPLES OF UNIVERSAL DESIGN IN THE CREATION OF ACCESSIBLE SHELF FOR LIBRARY

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Abstract:
This paper presents the development of study and design of a library shelf which aims accessibility to wider range of potential users, based on the principles of universal design, meeting and so respecting any individual needs in order to generate equality and avoid the embarrassment of users with any need. The bookshelf design placed great emphasis to use issues, comfort and safety, seeking in ergonomics usability solutions. So ergonomic studies have shown to be very relevant to the development of this interdisciplinary project as supplemented and improved the design of an ergonomic equipment focused on the end user.

Keywords: Ergonomics. Bookcase. Accessibility.

1 INTRODUCTION

The project consists of developing a library shelf, based on ergonomic principles and universal design, which is versatile and innovative based on analyzes of existing products and multidisciplinary studies. The product to be developed seeks to serve the widest possible range of users, regardless of their physical individualities, disabilities or disadvantages.
To contextualize the topic, we start from what the Human Rights Law assures us, which says: "All human beings are born free and equal in dignity and rights. Endowed with reason and conscience, they must act towards each other in a spirit of fraternity". Every human being has the right to a dignified life, and having access to culture, information and knowledge is part of a dignified experience. Humanity as intellectual and rational beings does not only live by feeding the body, but also the mind. And people with some need, disability or disadvantage often experience some type of embarrassment in a place that should be for leisure, for intellectual growth, discouraging people from frequenting these spaces.
The traditional shelves found make life difficult for people with special needs. Therefore, based on this perceived demand, it is essential to redesign these shelves, making them accessible to any public. Access to culture and knowledge is fundamental for the evolution of human beings, and we often lose great potential because they do not have easy access to the information present in books.

2 Theoretical Framework

The theoretical framework comprises the review of ergonomics and universal design concepts, based on accessibility. A search was also carried out using images for similar products found in common libraries, which are used to store and display books.

According to the 2000 Census of the Brazilian Institute of Geography and Statistics – IBGE, 14.5% of the total population has some type of disability or disability in Brazil, which represents a total of 25 million people with daily difficulties in interacting with people. the environment that surrounds us. The assumption that man must adapt to environments, and not the other way around, highlighted the exclusion of those who do not fit the standard.

When thinking about the need to design space for everyone, and not differentiate it for people with disabilities, Universal Design introduces a new vision for the conception of inclusion.

> Universal design is not a technology aimed only at those who need it, it is for everyone. The idea of D.U is to avoid the need for special environments and products for people with disabilities, in order to ensure that everyone can use all components of the environment and all products. There are four basic principles of universal design: the first is to accommodate a wide anthropometric range, and this means accommodating people of different sizes: tall, short, standing, sitting, etc.; the second principle is to reduce the amount of energy required to use products and the environment; the third is to make the environment and products more comprehensive and the fourth principle is the idea of systems design, in the sense of thinking about products and environments as systems, which perhaps have interchangeable parts or the possibility of adding features for people who have special needs. (Edward Steinfeld, 1994).

Based on this concept, universal design is made up of the following basic principles: a. equalization in possibilities of use; B. flexibility in use; w. simple and intuitive use; d. information capture; It is. tolerance for error; f. dimension and space for use and interaction. Based on these principles, universal design plays a decisive role in the design of spaces, artifacts and products that aim to simultaneously serve all people, with different anthropometric and sensory characteristics, in an autonomous, safe and

comfortable way.

In turn, ergonomics allows us to use determining design parameters in the design of library shelves, as through anthropometric studies and sizing analyzes it is possible to design aiming for comfortable, safe and efficient use by users (IIDA, 1995).

The ergonomic factor plays an important role in the development of the product in question, due to its great interface with direct users who have physical limitations or special needs. According to Slack (2002), ergonomics or "human factors engineering" is also concerned with the way in which people's sensory capabilities are affected through the neurological aspects of design.

Hendrick (1993) proposes a particular concept for ergonomics, as he states that:

> Ergonomics as a science deals with developing knowledge about the capabilities, limits and other characteristics of human performance that relate to the design of interfaces between individuals and other components of the system. As a practice, ergonomics comprises the application of technology in the human-system interface, to system designs or modifications, to increase the safety, comfort and efficiency of the system and quality of life. (p. 43)

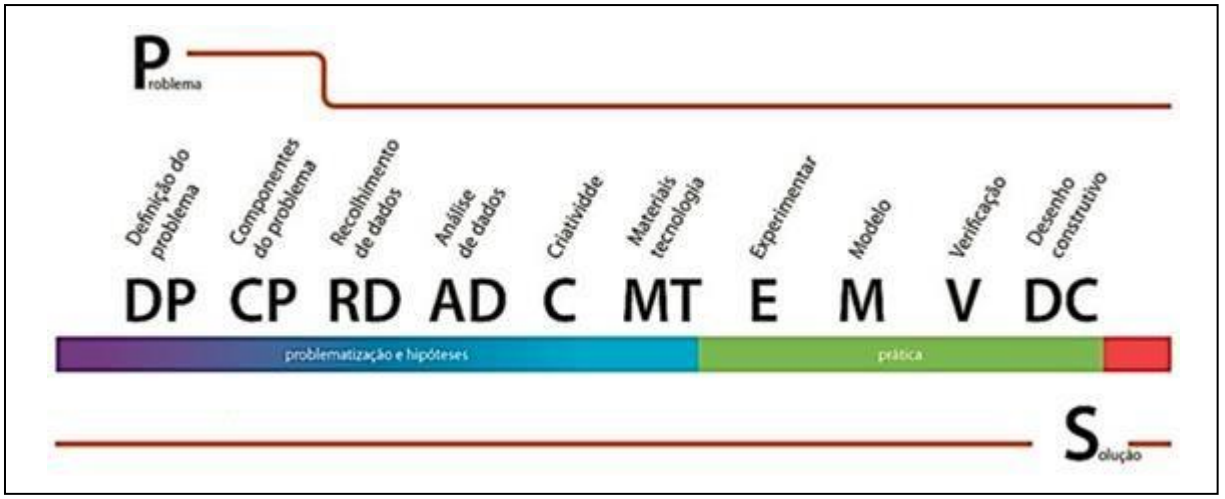
In the case of products intended for people with special needs, these are products that, due to their adapted ergonomics, allow these groups the right to belong and be included in a society, valuing diversity (SLACK, 2002).

3 Materials and Methods

The main purpose of the product development process is to design a new product or service for the market. For Rozenfeld et al. (2006, p.3), developing products consists of: "A set of activities through which we seek, based on market needs and technological possibilities and restrictions, and considering the company's competitive and product strategies, reach design specifications for a product and its production process, so that manufacturing is capable of producing it" (ROZENFELD et al., 2006, p.3).

The methodology used to guide the development of this product project is the methodology of Munari (1998), the author states that designing is easy when you know what to do. Defining the method as a series of necessary operations arranged in logical order, dictated by experience.

Figure 1– Development process.



Source: Munari, 1998.

The first stage of the project involves identifying the problem or need, thus clearly defining the project objectives, along with the components of the problem, dividing the problem into smaller and simpler problems to be solved.

The second stage refers to data collection and analysis, where studies of similar products are carried out, thus making recommendations for the new product.

In the third stage, alternatives are generated, in which each alternative created goes through an analysis, study of materials and technologies, and positive points are highlighted, in order to generate new alternatives.

The fourth stage of the project consists of experimenting and creating the model, thus identifying and resolving any problems.

Finally, in the fifth stage, product verification and construction design are carried out, in which the final product undergoes evaluations that prove that the product meets the initial project requirements.

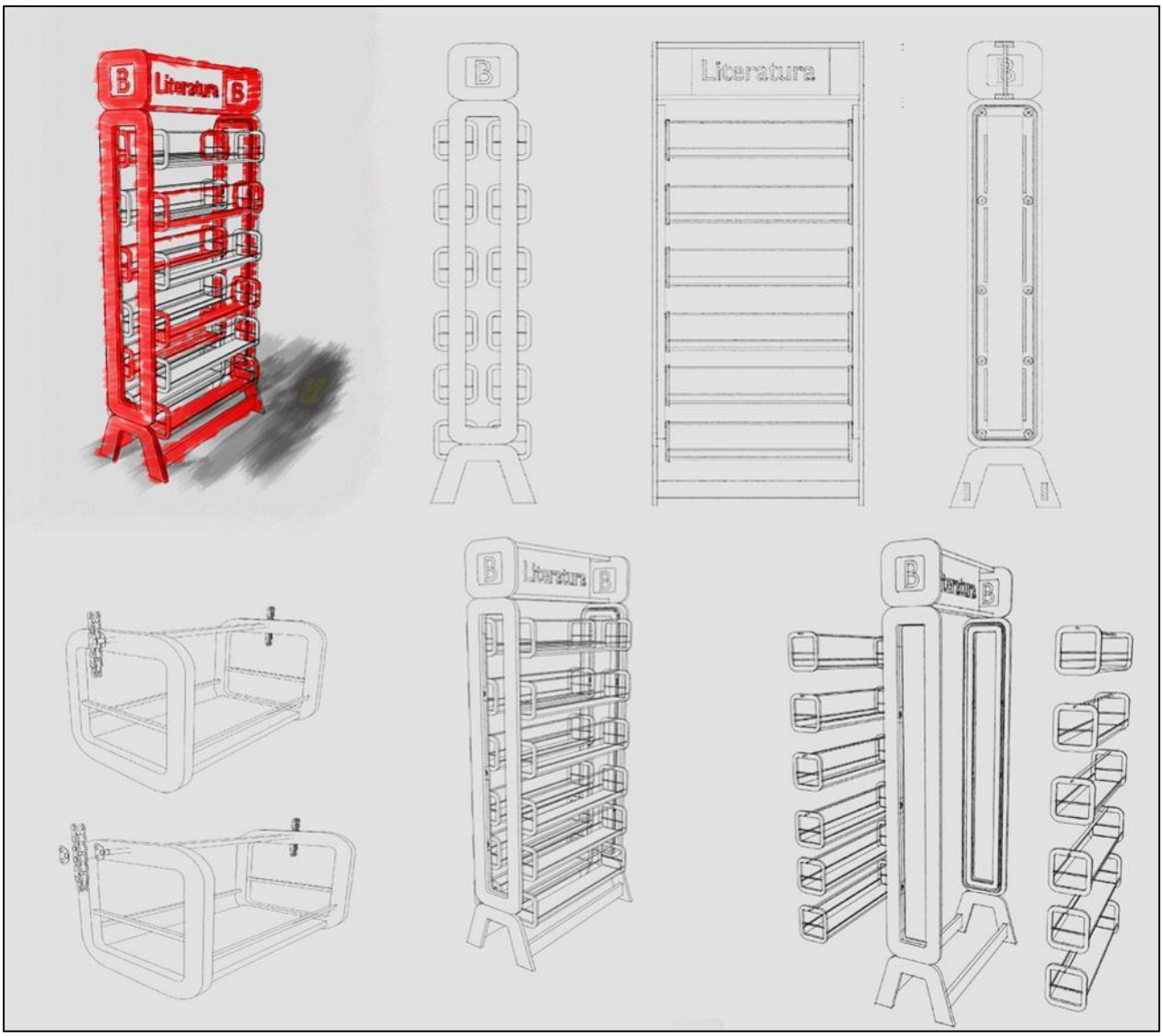
The design method is not something established, the designer has the freedom to improve the process according to his needs. For this to happen, it will depend on the creativity of the designer, who, when using the method, has a vision of what can be improved in the execution of his project (MUNARI, 2008, p. 11).

4 Results

Based on the identification of the problem and data collection through bibliographic review and analysis of design parameters considered important for the design and development of the product, the result of the process of creating the shelf for use in libraries is presented. Figure 2 presents the result of the shelf model created after using Munari's (1998) design methodology previously proposed.

The question considered for the development of this project and perhaps one of the most promising, innovative and challenging for professionals who work with the product development process is: How to develop industrial products that enable the use of different users?

Figure 2: Shelf model

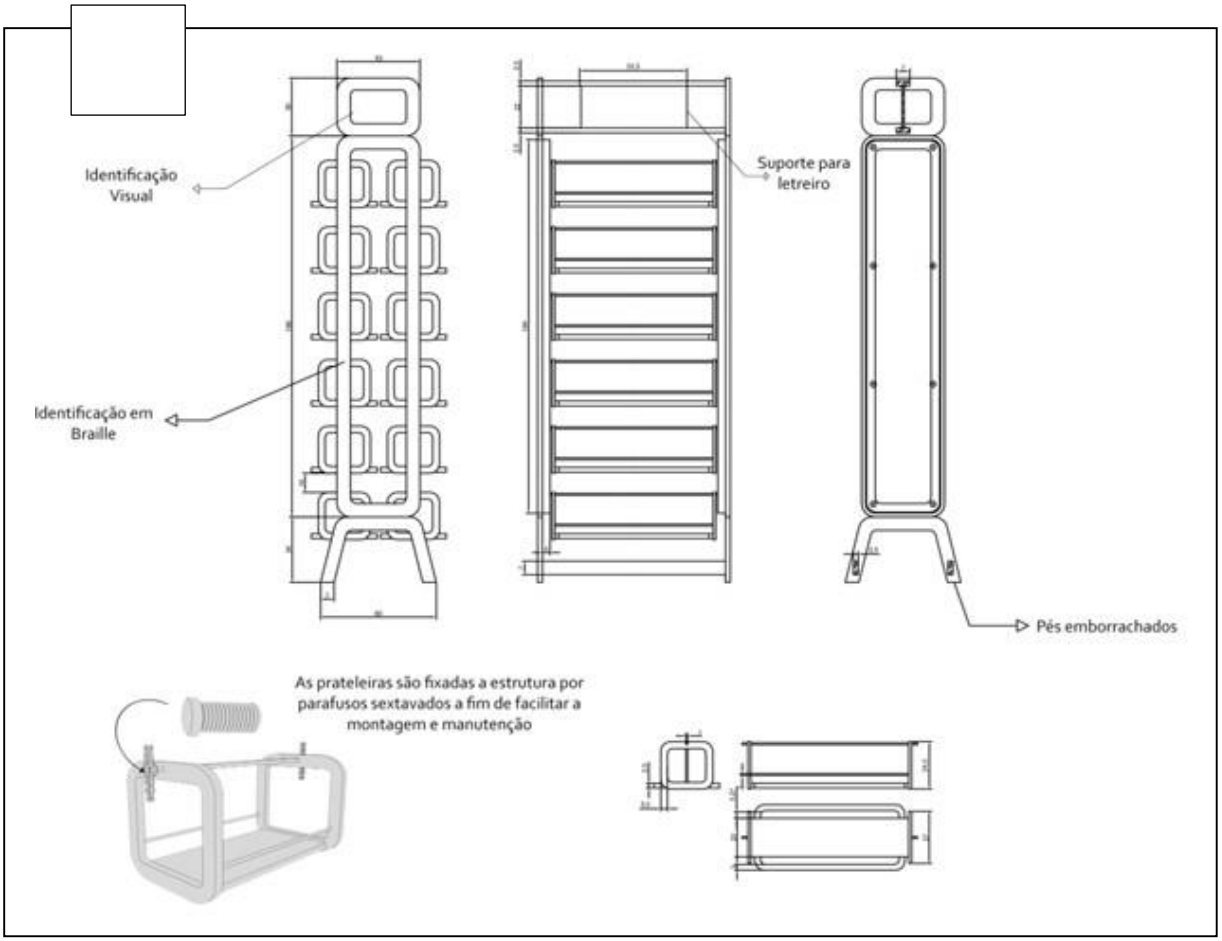


Source: Author

The defined solution is a structure made of tubular steel and steel sheets, which has an interconnected system of crowns that enable rotary movement. This structure also has support for signs, and can come in a variety of colors. These colors are characterized by their lightness, giving life to the environment without compromising the readers' concentration. The colors play a fundamental role in guiding the user. The shelves are of interspersed colors, also helping the user's orientation, and providing rhythm and harmony to the composition in terms of visual language. Its shapes also work harmoniously, the curved corners, in addition to providing safety, also subjectively communicate how it works.

In Figure 3 it is possible to better observe its structural conception and functioning, it also makes use of the pragmatic dimension, which would be the relationship between the signs and their users, that is, their interpreters, description of the logical understanding of the product, how it is formed, its laws of operation, its usefulness. These elements work together to make the product intuitive, making aesthetics functional, not merely aesthetic (BURDECK, 2010)

Figure 3: Shelf structure.



Source: Author.

The predominant material, steel, was defined based on analyzes of similar products, the cost-benefit ratio is almost indisputable, even more so due to serial production and common and simple machining processes. Any company in the metallurgical sector has the appropriate machinery for its preparation, making production cheap. Even though the project did not stipulate a ceiling value, we opted for the feasibility of execution, with accessible materials and processes, creating something truly plausible to the reality of the environment in which the product was conceptualized.

The rotating system makes it possible to adapt the height of the shelf to the user's reach, making the activity enjoyable for anyone. The product does not have exposed gears or any part that could pose a risk to the user, everything has been carefully covered, but in such a way that maintenance can be carried out without major difficulties. The system also allows the use of space, allowing for taller shelves, and the occupation of dead spaces, such as shelves that are located on the walls. The external parts of the lateral structural bars have Braille writing, making the shelves accessible to users with visual difficulties. Its shelves have handles that help with the activity of switching shelves.

The final product proved to be interesting and efficient from the point of view for which it was designed, aiming at equitable use and minimizing physical accessibility problems, and at the same time intuitive, solving visual accessibility problems, serving all audiences in a pleasant way. , making the shelf available to the user and also communicating and helping to locate a book, in addition to being visually pleasing, giving vitality to the

environment.

5 Conclusion

Ergonomics and universal design were fundamental to the result obtained in this project, as the final solution was generated from the study of these themes, which proved to be highly effective, meeting all the requirements that the project intended to cover, making the shelf library a product accessible to any user in an equitable and intuitive way. Finally, it can be said that the product strictly met the proposed specifications, solving the defined problems efficiently, through ergonomic aspects it sought to meet all the principles of universal design, thus having the potential to fulfill its social function, making the library a better environment.

In conclusion, the product fulfills its function by bringing equality to the user, giving independence to people who previously depended on assistance. With this, the project aims to transform the library into a leisure, comfortable and attractive space, welcoming the public. Ergonomics in this case has become one of the fundamental factors in improving users' quality of life.

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