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STUDY ON ECODESIGNING EDUCATIONAL FURNITURE FOR CHILDREN

Abstract: *The paper presents the research and design of children furniture used in different public spaces, like waiting rooms, that is intended to have an educational function, besides the usual functions of a piece of furniture. The focus is on chairs and benches that should be structurally and ergonomically fitted to children activities and giving them the opportunity of having new experiences provided by this object. Also, this study has an environmental-connected side, trying to provide eco-friendly design solutions for the chairs and benches construction, aspect which is also part of the children ecological education.*

Key words: *Ecodesign, educational furniture, chair, bench, eco-friendly products, ergonomics, children furniture, eco-materials.*

1. INTRODUCTION

Furniture design is today a highly dynamic domain. This is possible because of the new opportunities provided by newly invented materials or even by the old ones for which new production methods have been developed. The design challenges are increasing because the people requirements and expectations are even higher and the fast changing fashion might change the objects of desire into obsolete ones.

The target group in this case is represented by children; hence the design outcomes should be adapted to this particular customer. The furniture for the children should always be safe and attractive for them. In this paper we propose not a different, but a more complex approach in designing furniture for children, giving it a supplementary function, the educational one. Moreover, the pieces of furniture were carefully designed, using eco-friendly solutions, from raw materials choice to the final product, fulfilling the ecodesign objectives [1].

The design intention is that the sensory contact of the children with these objects (pieces of furniture) to represent a new and positive experience for them. Ease of perception, understanding the objects forms and colors and learning their significances is part of the design objectives requiring the designer's experience both as adult user and as professional.

Design for interaction is another objective regarding the solution, starting from the necessity of encouraging the children to interact to each other and interact with the object. For fulfilling this objective, the furniture must capture the child attention and keep him busy for a longer period either he is alone or playing with other children. The requirement related to time is given by the situations when the children come in contact with this furniture, such as the waiting rooms (Figure 1).

2. WAITING ROOMS FOR CHILDREN

The waiting room is a part of a building or a room, which is created to accommodate, for a shorter or longer period, the people who are waiting for a provided service. Two types of waiting rooms exist. In the first type, people are waiting and then are moving individually towards the place where they have an appointment or a meeting (e.g. medical/lawyer cabinet). In the second type, people are waiting and then moving in groups (e.g. airports, railway stations, etc.).

The furniture presented in this paper can be used for both types of waiting rooms. The design is focusing on comfort and safety (ergonomics) aspect and well-fitting to the layout (aesthetics), friendly with the environment and entertaining the users (children).

Figure 1 Waiting room layouts revealed by the research activity [2].

Children are part of this "waiting" activity and are subjected to the problems generated by the lack of activity during this time. Both for a shorter or longer waiting time, children will be bored, and one of the objectives of this paper and project is to design waiting room furniture which should capture their attention and can keep them "busy".

The waiting rooms/play grounds for children may be necessary in the following situations:

- Commercial areas, like hyper/super markets;
- Waiting rooms/public rooms in airports, stations, public institutions, etc.
- Health institutions, like hospitals or medical cabinets.

The time necessary to spent in such areas depends on the context, being different for each of the presented situations. For example, the average time spent in a doctor cabinet is 10-20 minutes, whilst the average time spent into an airport is 30-40 minutes. Consequently, the conditions are different, so the output of the design process might be different.

2.1 Research on furniture for waiting rooms

The main objective of the research activity is to find information on the existing designs from different producers and on children with different requirements according to the context they are using the furniture.

Figure 2 Interactive chairs [3], [4].

The research on existing solutions was focusing on chairs (Figure 2) and benches (Figure 3), these being the most familiar pieces of furniture used in waiting rooms. For this target group the most adequate colours and shapes and their meanings were investigated. Also, different toys were explored and the possibility to include them into the design.

The research on users was centred on children up to 10 years old, on identifying and understanding their needs for spending some good time waiting for something like a travel (in a bus or railways station, even airport), a haircut or for a medical examination. The observation revealed that small children might be standing on the sitting area and definitely should be together with their parents; therefore a piece of furniture with multiple places would be required. Older children might stay alone, so single-place furniture, like a chair, might be the most appropriate solution.

Observing the children interaction with the objects was helpful for the materials choosing, the processes and finishes, leading the design to a more eco-friendlier solution.

Figure 3 Educational benches [5].

2.2 Requirements for the products

The research performed upon the existing products was helpful in identifying some specific requirements. They are briefly presented as follows:

- The product addressability is for children up to 10 years old, so all elements should be adapted to the physical and mental capacities of this target group;
- The product should not be harmful for the children;
- The product should be interactive, meaning the children are using (parts of) the furniture for resting and having fun as well, and receive a certain level of feed-back to their actions;
- The materials and processes used for making the products should be environmentally friendly with a special concern because the end-user of the products are children;
- The product should have an acceptable life span ensuring a rational level of durability;
- The product should have good aesthetic qualities (architecture and design) of the spaces where they are placed;
- The product should be visually attractive and stimulate the children in using them. They should use an appropriate language, specific to children of this age.

The user requirements combined with the designer experience created the premises for the design process that started with the idea generation for the desired pieces of furniture.

3. PROJECT DEVELOPMENT

The design should be adapted to the target group, which, in this case, are children, and be interactive. This "interactive" aspect is intended to keep the children interested capturing their attention for a longer period, fulfilling the objectives for keeping them busy and having fun as well. For this reason, the furniture should be attractive, challenging and educational. Consequently, the design was focused on chairs and benches, these being the most usual pieces of furniture used in waiting rooms and offering large opportunities for fulfilling the goals.

First, some sketches were created starting from the initial ideas. The most significant sketches were selected for developing into concepts/solutions (Figure 4).

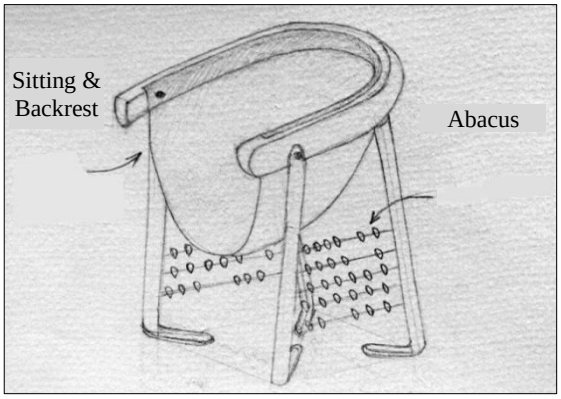

Figure 4 The chair sketch.

The chair is provided with an abacus, this element is both for fun and education. The chair shape is designed as a wrapping surface giving to the child a feeling of protection. Also, the object is comfortable, fitting to the different anthropometric dimensions of the children.

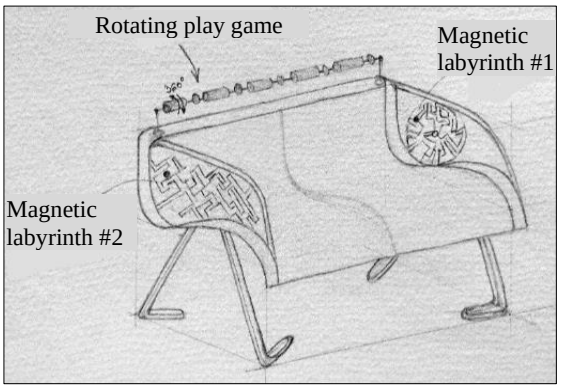

Figure 5 The bench sketch.

The bench is designed as a comfortable object as well, and having funny connotations, like the legs shape that look like human ones. It is provided with some elements which should be attractive for the children, like drawings, magnetic labyrinths, or rotating figures, fitted for children of different ages (Figure 5).

While the chair is designed for individual use, the bench gives the children the opportunity of socializing. Several children, 2, 3 or more, can sit and play together, stimulating each other making the time spent in the waiting room more attractive.

The selected concepts were then developed and the design process moved into the construction/embodiment stage. The 3D models were created and the dimensioning process required a research on materials.

The materials used for the furniture need to respect a number of constraints. These constraints on materials cover a large area, starting with appropriate mechanical characteristics and workability, to cost and ecological aspects. The research included standards study, like EN71, regarding the toys design, which refers to children safety, or EN 1021, regarding the ignitability of upholstered furniture [10].

Wood was chosen for building the structure of the furniture because is a friendly, "warm" material. It is workable, it is safe, can be protected by covering it with a thin layer of water-based lacquer, and as a resource, a fast growing species can be chosen to entirely fulfil the ecological requirements. Wood fits well in almost any layouts, in combination with any other material. It permits different finishes according to the object destination, including furniture for children. It is resistant ensuring good behaviour and durability to the product. Because of its good qualities, like durability and bending possibilities, birch wood is the final option.

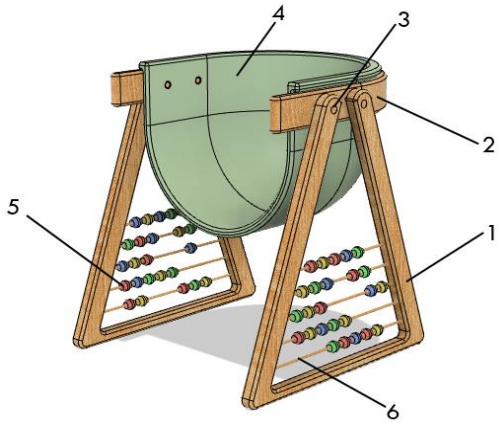

Figure 6 The chair 3D model with its components.

For the seat and the back rest, considering the shape of them, a thermoforming composite material was used, HI-MACS [7]. It is a combination of aluminium and plastic (PMMA) which have excellent modelling qualities, is resistant, safe and easy to clean and maintain. The bench seat is also made from this composite, while the laterals are from transparent PMMA, which has good properties, like stability to UV radiations and hardness (resistant to scratches).

The chosen materials respect the imposed conditions and are suitable for building the furniture, being resistant, safe for the children, and environmentally friendly.

The 3D model of the chair was created starting from the detailed sketches and using the information on materials resulted from the research activity. The components of the chair are as follows (see Figure 6): 1 – Legs, 2 – Back rest support, 3 – Assembling elements, 4 – Seat and Back rest combo, 5 – Abacus elements, 6 – Abacus strings.

Also, the 3D model of the bench was created. The resulting drawing is presented in Figure 7. The components of the bench are as follows: 1 – Playing element; 2 – Seat; 3 – Arm rest; 4 – Legs. For safety reasons, the bench has been designed to be fixed to the floor, while the chair is an independent piece.

3.1 Form design

The chair is a functional unit of the waiting room. A waiting room chair for children should have a form that supports both the usefulness and aesthetic functions and also should enhance the product-user interaction [8].

The seat and back rest of the chair are a unique curved surface, almost a quarter of a sphere, comfortable for the children and making them feel secure, like in the mother's lap, especially when waiting for a medical examination. The legs design describes the necessary area for the chair stability requiring no floor-fixing. The chair gives the child a certain level of privacy when doing individual activities, like reading. On both sides the legs contain the abacus, the educational and funny element for the child-furniture interaction.

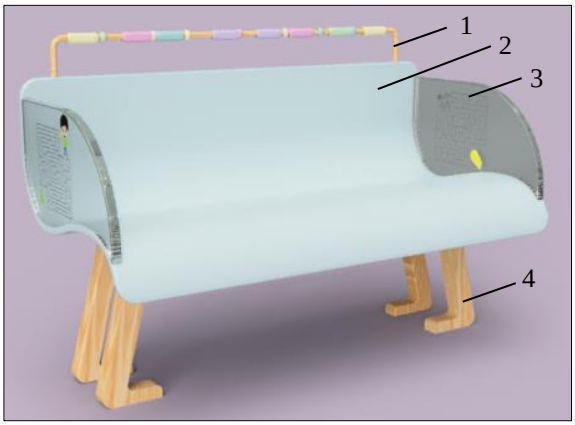

Figure 7 The 3D model of the bench.

The bench aesthetic is also adapted to children necessity, the bright colours, rounded forms and smooth textures contributing to their good taste education. The arm rest contains games, children can play with; also above the back rest a toy has been placed targeting the smaller children who stand on the bench seat.

3.2 Ergonomic design

This shape of the chair seat is suitable for children of different ages, more precisely with different anthropometric dimensions [9]. The chair and bench height permits a good accommodation for the children between 2-10 years, which have been considered the target group. The bench seat is curved providing a comfortable and correct position for the users (Figure 8) and preventing the objects (toys, luggage) to roll down.

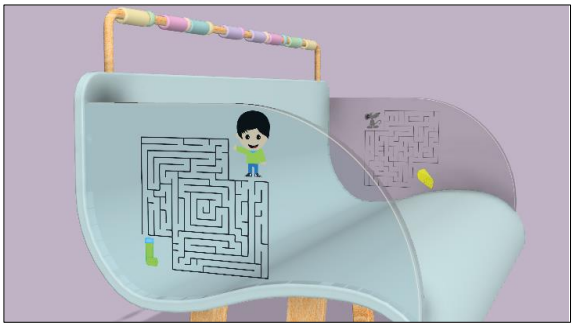

Figure 8 The 3D model of the bench – detail.

The chair and bench edges and corners are rounded viding a safe use, also contributing to the object aesthetics.

4. CONCLUSIONS

In conclusion, the paper represents a synthesis of the study on designing pieces of furniture for children, for use in the waiting rooms.

Based on the research activity, a list of requirements was formulated, containing items regarding the user-product relationship. The design activity was human-centred, focusing permanently on the final user and experimenting new solutions for their benefit.

The designed pieces of furniture can fit in different environments, for all the identified situations that involve children spending time into a waiting-room.

The materials are chosen to obtain the designed shapes and textures and to fulfil the ecodesign requirements. The resulted objects are equally comfortable and funny creating the child the opportunity to have new pleasant experiences.

The designed pieces of furniture fulfil the formulated requirements because they are comfortable, attractive, and safe, contain entertaining elements and are environmentally friendly solutions.

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