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Alternative Materials to Improve the Assembly Process of Furniture Focused on Sustainability Design

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ABSTRACT

The design of furniture is an area in constant evolution. The development of new materials (especially wood panels and transformed special metal hardware) allied to modularization and standardization has facilitated the process design. The aspects of sustainability (social, economic and environmental) must be present in furniture design. It is considered as a tendency that furniture should be designed so that assembly could be made without screws or tools. For this, the use of alternative materials like bamboo, coconut fibre, sisal, recycled materials and hemp can contribute in the reduction of the environmental impact. Assembly with these materials is simpler. The entire process contributes to the understanding of the real meaning of the LCD (Life Cycle Design) and designing for the life cycle.

Key Words: Sustainability; Materials; Furniture; Design.

1. INTRODUCTION

Furniture is part of our everyday lives, and over the centuries, it has evolved to meet consumer needs. The development of new materials (especially wood panels and transformed special metal ironmongery) allied to modularization and standardization has facilitated the design of kitchens and cabinets in general, for example.

The assembly of the furnishing, though, is a relatively complex process, and often requires qualified professionals to perform it. Few companies provide the public detailed and easily understandable instructions that would allow the installation, even to those who are unaware of the concepts of technical drawing. A relatively large amount of tools is also required.

On the top of that, various social factors are leading to a behavioural change. Nowadays the homes tend to be unoccupied during office hours, when it would be most proper for assemblers perform their job. This problem is mainly due to two main factors:

- The absence of the figure of the housewife. The rising cost of living coupled with the arousing of the women workforce in the labour market, allied to others women's achievements in the professional field have virtually extinguished the wife as the housekeeper, or housewife, as it was commonly called the woman who did not work (except at home);
- The rising cost of living and labour achievements of domestic workers increased their wages and benefits, so many families have dismissed such workers.
- The reduction of the nuclear family (nowadays is common for couples to have a maximum of 2 children, whilst on the 70's the average was 4 children, and on the 50's it was 6 (IBGE, 2013). This fact, associate with the low-sized apartments trend, reduces the housework considerably.

Thus, during office hours, parents work, children go to school and the houses are empty. The assembly of the furniture by professionals is subject to alternative schedules, making the installation time longer than its delivery time. This fact generates frustration and annoyance for both sides: the seller wants to complete the service and the client wants to use the appointment, especially because the payment has often been made. Many consumers prefer assembling the furniture they have purchased, to avoid waiting for that long. Some stores even offer different prices for those shoppers that purchase, take and assemble the furnishing themselves, which reflects the adoption of a new strategy.

When addressing this problem, it was decided to import the study of furniture connect design to project disciplines, as a part of design project. Designers need to consider the mounting procedures by the user's point of view, in order to make it as easy as possible, so it can be done by unaware people. This requires an interdisciplinary approach in design practice, working in the area of Product Design (furniture design), Industrial Design (design for assembly, component design and manufacturing) and Graphic Design (instruction manual and assembly procedures for users). Sometimes even to Animation Design, creating animated videos with assembling procedures by internet.

The "Do It Yourself" (DIY) approach has disseminated to other areas, and one of these is the house-building sector. In this field, the DIY methods brings new initiatives which always use the local materials available, as clay or bamboo, and not-necessarily includes the prefabrication method, although it could implicate on performing.

This paper presents the partial results so far obtained from projects realized on a subject of an Design, Architecture & Urbanism and Civil Engineering brazilian courses, which focus are furniture that can be assembled by the user, using alternative or not conventional materials. In second plan, it's considered the expansion of the DIY approach to housing construction, by the use of local available materials, through experiments involving the Architecture & Urbanism and Civil Engineering courses.

2. LITERATURE REVIEW

Romeiro Filho *et al* (2010) have demonstrated the importance of project integration, so the intended objectives are achieved in the present study. In accordance with the foregoing designers, planning often requires mental strategies and external representations as modelling and prototyping.

This research has applied the concepts associated with “design to the life cycle” along with development of product concepts, emphasizing the early stage of use. So the concepts approached were the ones presented by Manzini and Vezzoli (2008) and LCD (Life Cycle Design) and Rozenfeld and others (2006).

The worries about the furniture assembling are evident. Most companies of furnishing sector have been endeavouring in this sense, even draftsmen and furniture designs have already noticed that it’s a crucial point to the craved success.

According to design sites (DOPLUDO, 2013), the russian designer Lesha Galkin, along with Dopludo Collective, make the furniture they design together available through internet files. The point is releasing pictures and videos explaining the assembly process so the user can build it by himself.

The idea behind the project is to share information (participative design) and then making the original files available. The point is that any assembling may be realized by the user. The most recently project created by them, called APTEK Bar, is already available. The typical design projects are simple furniture, even though they are creative and modern.

The company MVX Móveis Planejados, for example, provides an assembly manual in an easy understanding and viewing form. The mostly furniture are assembled only by a Philips key and a hammer. Although, when it is necessary something more, they describe it in detail on the guide - the manual contains information for unaware users in assembly, as example “Why is affixing the bottom important?” or “before removing the internal shelves make sure the doors and drawers are closed”. However, on the company’s site, there are recommendations for hiring an assembler (MVX Móveis, 2013).

Today, most companies which sells appointment by the internet do not offer the installation of their projects. It would be unsustainable, since they deal with large areas. By the other way, they can sell their products on a lower price, since it does not have the setting tax. And that is an advantage of buying furniture by internet. Nevertheless, the most part of the producers recognize that the users are not able to do some parts of the assembling, compromising the quality of the product or even being in a risk situation. So, it is necessary the project to forecast that, what is not necessarily occurring.

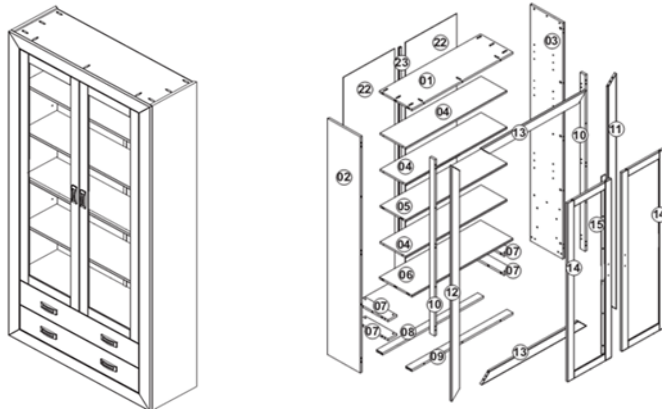
The approach “Do It Yourself” emerged in 1950s at USA, aiming to low the service-cost. Then, in an amateur way, by the theory of “try and error”, corporative managers start developing products easy to install, with appropriate package and construction guide. Nowadays, furnishing projects demand a specialized service with knowledge that overcomes the user’s one. The personal requirements to apply for an assembler’s job are a proof of that, like the examples below:

- Founded in a job-offer site (VAGAS, 2013), the requirements refer to an assembling job offer in Grande Florianópolis, Brasil: “Will be responsible for delivery/assembling of company’s products in the costumers homes, using appropriate tools and equipment, checking all components, avoiding defects.”
- Alike the first one, many others can be founded in a simple search in specific sites and newspaper, as an announcement for a Curitiba – PR – Brasil company (Emprego Certo, 2013): “Will work with conventional and planned furniture assembling. Preview experience and knowledge in conventional and planned furniture is required. Must know to handle tools and piece finishing.”

These demands show how the appointment building process is difficult, specialized and expansive. And, by the end, all the seller wants is to conclude the selling and the client wants to see the furniture in use,

because the disbursement has already been made in most cases. So, the consequence is that many consumers prefers to assembly the furniture by themselves, in order to not expect so long. But, the lack of experience may harm them. The results may compromise:

- the aesthetic factor: incidence of uneven surfaces, finishing problems at all, etc;
- the technical aspect: doors that do not close properly, problems in composing modules, for example;
- security issues: misplaced screws and bushings, risk of injury by improper lifting of loads and uncomfortable positions in the assembly.



Some stores offer different prices to the user who purchase, take and assemble their own furniture. This reflects a new strategy adopted by them. Designers and others professionals from the area have noticed the problem and started developing guides increasingly detailed. They explain all the tools that are needed, the assembly time and steps. Figures 1, 2 and 3

represent the proceeding used by a supplier. Figure 1 shows a perspective view of a shelf and figure 2 shows the exploded perspective view, aiming to help on the pre-classification of the pieces, making the building up easier. Figure 3 details the basic ironmongery (quantity and types of screws, bushing, etc).

Fig. 1: Shelf in Perspective.

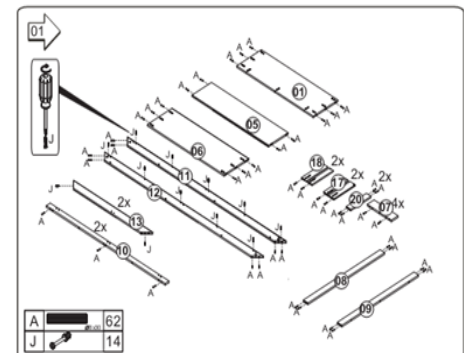
Fig. 2: Exploded shelf perspective.

Fig. 3: Basic ironmongery details.

Source: <http://meumoveldemadeira.com.br>, 2013

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Usually, the companies also provide information about how many people are needed (2 people, for example), the necessary tools (as hammer, Philips keys, etc.) and the estimated time for assembly.

The “Do It Yourself” (DIY) approach has disseminated to other areas, and one of these is the house-building sector. Obviously, some of the traditional characteristics, as prefabrication and installation facility, were updated and modified in reason of the local resources available. Many of these, as bamboo, requires a different way of designing and building, where the designer often interacts with the construction and ends being the final user of his product.

Many examples of DIY can be found: from pallets houses to earth bag and lumber ones. In these cases, not necessarily they present an easy assembly, although the use of alternative material is a common characteristic. An important example of DIY on civil construction is the “Paper Log Houses”, originally created by Shigeru Ban Architects (SBA), where the construction structures are made by paper tubes. The first models were built in 1995, aiming to shelter the victims of the Kobe earthquake in Japan. Due to be large constructions, the professional assistance may not be dismissed. However, during the constructive process, volunteers and community can freely be the constructors by themselves.

Some of the Shigeru Ban observed requirements to use the paper tube construction method are: 1) it must be easy to assemble and disassemble the components, in order to reuse them in the future; 2) it must use local materials, with practical fabrication and modelling, in reason to include community in the constructive process; 3) thermal comfort and favourable aesthetics; 4) respect the needs, privacy and culture of the users, aiming to build a dignified temporary shelter; 5) the construction time must to shelter the needed as soon as possible.

3. METHODOLOGY

The methodological procedures of this study were: defining the problem (presenting the proposed research to the students group), literature review, field research (visits have occurred to furniture fabrics), conceptual designing, laboratory tests (model building, drafting the assembly instructions, testing the assembly feasibility), considerations and adjustments.

Figure 4 illustrates the searching process used, showing the main steps.

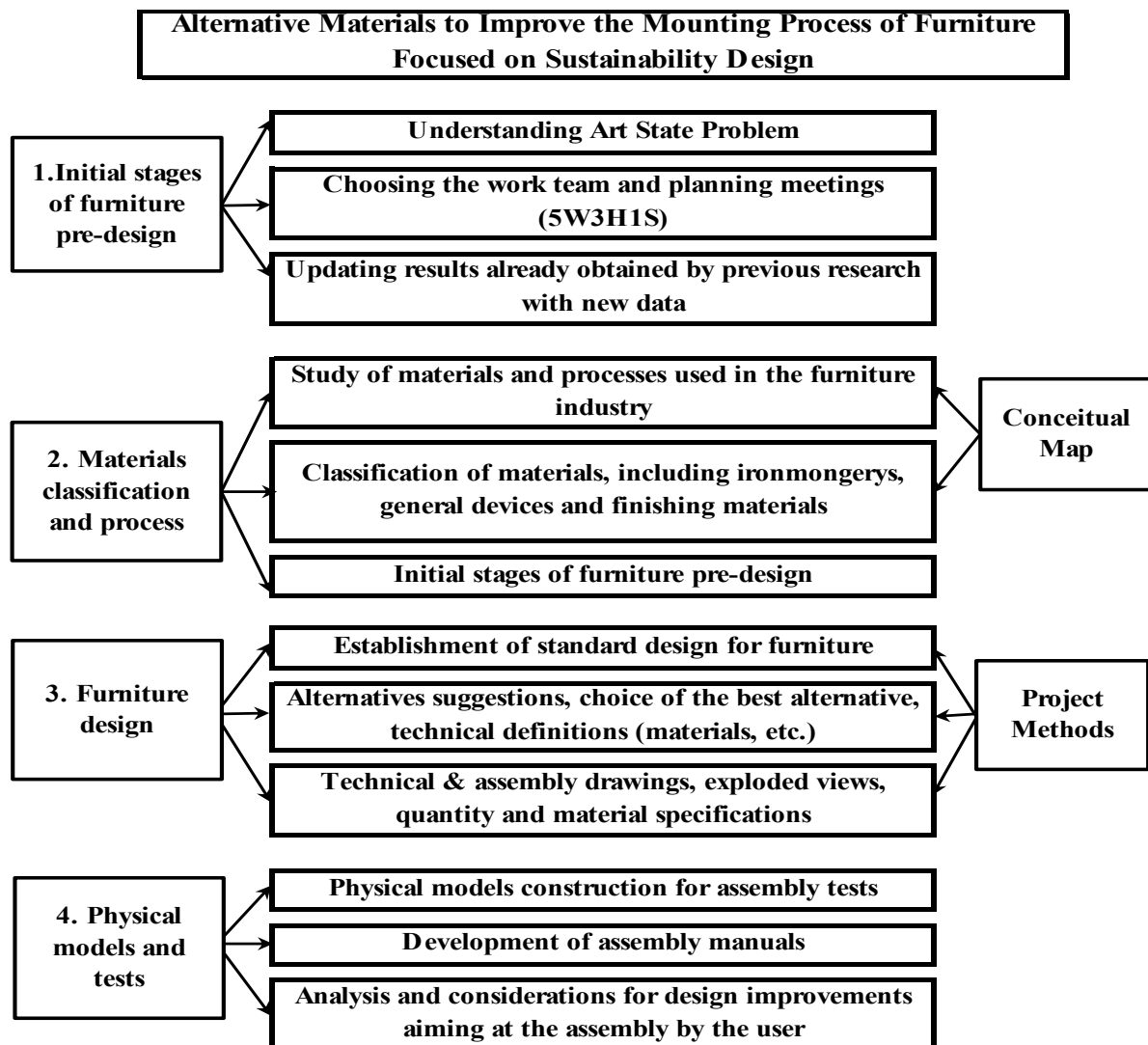


Fig 4: Searching process.

4. PROCESS

The assembly procedures were incorporated into the furniture project, and were confectioned small-scale physical models. The construction was conceived in order to simulate real situations, where the designers studied the metal ironmongery, the weights and proper procedures for non-professional customers.

The final step is constituted of exchanging guides and improving them: one group, using other's one guide, tried to assemble the appointment, checking for possible problems. Considering the comment received, they reformulated their guides, making the installation easier.

Has been settled as an assembling standard that the user should need just two tools: Phillips keys and hammer. Both should be provided to the client with the bought furniture. To simplify, was settled that would be used just 3 different screw sizes.

The final results were: a booklet to be delivered accompanying the furniture with step-by-step instructions; a basic tool kit, which was added to the assembling kit; and a virtual instruction manual, with the assembly procedures available online. The entire process contributes to the understanding of the real meaning of the LCD (Life Cycle Design) and designing for the life cycle.

Keeping the DIY approach, it was realized the assembly of a bamboo housing modular prototype (figure 5), in partnership with Architecture and Urbanism Department of UFSC, (VITOR, 2018). The author and engineer realized the project and the construction, also trained the team for construction, intervening in all stages of the process. One of the biggest results was the importance to align engineering and design, which must be included as a parallel form of construction, inside the engineering precepts.



Fig. 5: Bamboo habitation prototype. Source: Victor (2018)

5. FINDINGS/RESULTS

The project is still in progress, and so far it can be concluded that is possible make available, in large scale, pieces of furniture that can be assembled by non-experts. Other way is the simple fitting process of furniture construction, eliminating the use of screws and other tools. In habitation, the DIY approach using non-conventional or alternative materials like bamboo rise the necessity of a new culture of design and construct with the users participation. In a general view, the necessity of a deeper research with unaware public was noticed, in order to verify their behaviour about lecture and interpretation of guides.

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