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A Research on the Importance of User-Centered Design in Furniture

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Abstract

Furniture design is an important factor influencing the quality of life. Today, more attention is paid to the comfort, safety, and health of the users in addition to the visual appearance in the design of the furniture. Therefore, it is necessary to make designs for the characteristics of the user who uses the furniture.

The user-centered design (UCD) is used in the interior design of all kinds of motor vehicles, office furnitures, educational institutions' furnitures, home furnitures and hospital furnitures, that is, every area in which the person himself/herself is located.

In this study, a general research has been carried out on the importance and necessity of implementing "UCD" in furniture design, which has been rapidly increasing recently.

Keywords: CAD, ergonomics, furniture, human factor engineering, user-centered design.

Mobilyada Kullanıcı Odaklı Tasarımın Önemi Üzerine Bir Araştırma

Öz

Mobilya tasarımı, insanın yaşam kalitesini belirleyen önemli bir etkendir. Günümüzde mobilyaların tasarımında görselliğe ek olarak kullanıcının rahatlığına, güvenliğine ve sağlığına daha fazla önem verilmektedir. Bu nedenle mobilyaları kullanan insanın yani kullanıcının özelliklerine yönelik tasarımlar yapmak gerekmektedir.

Kullanıcı odaklı tasarım; ofis mobilyalarında, eğitim kurumlarının mobilyalarında, ev mobilyalarında, hastane mobilyalarında ve her türlü motorlu taşıtların iç dizaynında yani insanın bizzat bulunduğu her alanı düzenlemekte kullanılmaktadır.

Bu çalışmada, son günlerde önemi hızla yükselişe geçen "kullanıcı odaklı tasarımın" mobilya tasarımında uygulanmasının önemi ve gerekliliği hakkında genel bir değerlendirme çalışması yapılmıştır.

Anahtar Kelimeler: CAD, ergonomi, mobilya, insan faktörü mühendisliği, kullanıcı odaklı tasarım.

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1. Introduction

It is only by the end of 19th century that human beings started to understand that while changing the environment they live in, they change themselves indirectly. The idea that the arrangements made in the environment and all the materials, tools and architecture in the environment should be convenient for people have only arose in the second half of the 20th century. All these aforementioned findings indicate that while designing the living spaces, human beings have a conscious attitude (Kalınkara, 2003).

Sheltering is an indispensable basic need in a phase of human life. In addition to the quantity of the shelters, their qualities are highly important in psychological terms. People meet this sheltering need in long and short terms in various areas such as houses, hostels, hotels, guest houses, and dormitories. These spaces which bring significant contributions to the sheltering needs could have positive or negative effects on the physical and psychological health, quality of life and happiness of an individual. These aforementioned effects could be related to such factors as the location, physical features, size, intensity of equipment and their features (Işık, 1970; Peck and Kay Stewart, 1985; Yıldırım and Uzun, 2010).

The historical development of the discipline of industrial design indicates that the products produced and consequently, the product development processes focused on different criteria in different periods. The intensely decorated products of a period were replaced with more plain ones with the increase in the importance of functionality and functionality dominated the process of designing (Margolin, 1988; Cagan and Vogel, 2002; Pantzar, 1997). Later, the increasing competition brought along the quality movement and industrial design served to develop quality-focused products (Jenson, 2002; Margolin, 2002; Coates, 2002). In the last ten years, companies which have started to have an equality in terms of functionality and competition started to focus on users in order to form difference and stand out in the market (Nussbaum, 2005; Rothstein, 1999).

Companies and designers, who turn towards users in order to develop innovative products and form a difference, argue that these sources of inspirations should be examined as “human” rather than “user” (Sanders, 2002; Buchanan, 2001). Compare to the past, they attach more importance to researching people, understanding their need, likes and wishes. Therefore, the concept of “user” has an increasing importance in the process of design. Through using research models adapted to design from physical sciences (Dodd, 2001; Sanders, 2000), such systematic methods as design, participatory design, ethnographic research have become frequently used methods lately (Cagan and Vogel, 2002; The Design Council, 2006). The designer who uses research methods as a tool in his/her way to his/her target uses this information to develop “user models”, to see the World from the perspective of those people and to empathize with the users (Sanders and Williams, 2002; Martin and Schmidt, 2001). User experience becomes more and more important in terms of product and service quality. Therefore, companies pay more importance to UCD. In addition, companies see UCD as a competition element. As a result, there is an increase in the number of studies on UCD (Öktem, 2014).

The aim of this research is to examine the methods developed by furniture industry product designers in Turkey, a developing country and abroad to connect with the users and to evaluate the importance and necessity of “UCD” in furniture design.

1.1. Definition and Classification of Furniture

The term “furniture” is derived from the Latin term “supellectilem” and is called “mobili” in Italian, “meubles” in French, “möbel” in German and “möbler” in Swedish (URL-1, 2017). It is known to come from Italian language into Turkish (URL-2, 2017).

Furniture is defined as the general name given to somewhat large movable items which provides us easiness and comfort in doing such things as sitting, eating, working and sleeping etc. (Şanıvar, 1968; URL-2, 2017). Today, in addition to the basic massive and wood materials, furnitures are produced in a more modern and functional style with the use of such materials as composite materials, metal components, plastic pieces, upholstery materials (textiles, leather etc.) and other complementary materials (glass, screws, springs etc.). Examples of today's interior and exterior furniture are shown in Figure 1.

Figure 1. Examples of today's interior and exterior furniture (URL-3, URL-4, URL-5 and URL-6, 2017).

There has been a tremendous increase in furniture demand lately. The main reason behind preferred wood material in furniture is because working, assembling, changing when it wears and doing the top surface treatment can be done easily and it has a high resistance (Erdem, 2007). It is seen that product diversity in the furniture industry, which has an outstanding place among traditional sectors in terms of employment and production, is quite a lot. The Furniture industry is partitioned into distinct product categories such as office furniture, kitchen furniture, bedroom furniture and dining room furniture, all of which has separate market divisions (Yılmaz, 2014).

Furniture can be classified as shown in Table 1 based on their function, area they are used, structure, purpose, styles, materials and top surface treatment.

Table 1. Classification of furniture (Aksayar, 2006).

Usage	Type of Furniture
Depending on where it is used	Interior or exterior furniture
Depending on individual or collective use	Personal furniture, urban furniture, industrial furniture
If the furniture units are combined side by side, one over another or connected to each other	Modular furniture
Depending on the geographical region they are shaped	English, Italian and Scandinavian furniture
If they are produced with lamination technique and through the modelling of laminated and wood materials	Laminated furniture
If they are made to serve different purposes	Multi-functional furniture
If they are manufactured according to the style before or after the industrial period	Classical or modern furniture
Depending on its mounting	Demounted or mounted furniture
Depending on how it can be used	Fixed or movable furniture
If it is designed for specific areas	Kitchen, living room, bedroom, Office furniture etc.
Based on its style	Rustic, avantgarde etc. furniture
Depending on the material used	Wood, panel, wicker furniture etc.

1.2. Computer-Aided Design (CAD)

CAD is based on the ICG-Interactive Computer Graphics system. The user mentioned in these systems is the designer himself; the person ensures the data communication and ensures that various images and drafts are

formed on the screen by issuing a command to the computer through various input formats (Keskinel, 1985).

Of all CAD software, the most widely used one all around the world is accepted as "AutoCAD®". That the AutoCAD® covers the whole world in CAD programs is understood by the fact that its ".dxf" and ".dwg" file formats are accepted as a standard in CAD systems (İdemen, 2015). In addition to AutoCAD®, there are many other programs such as the 3ds Max®, in which reality stands out in terms of visuality and which are used in the design.

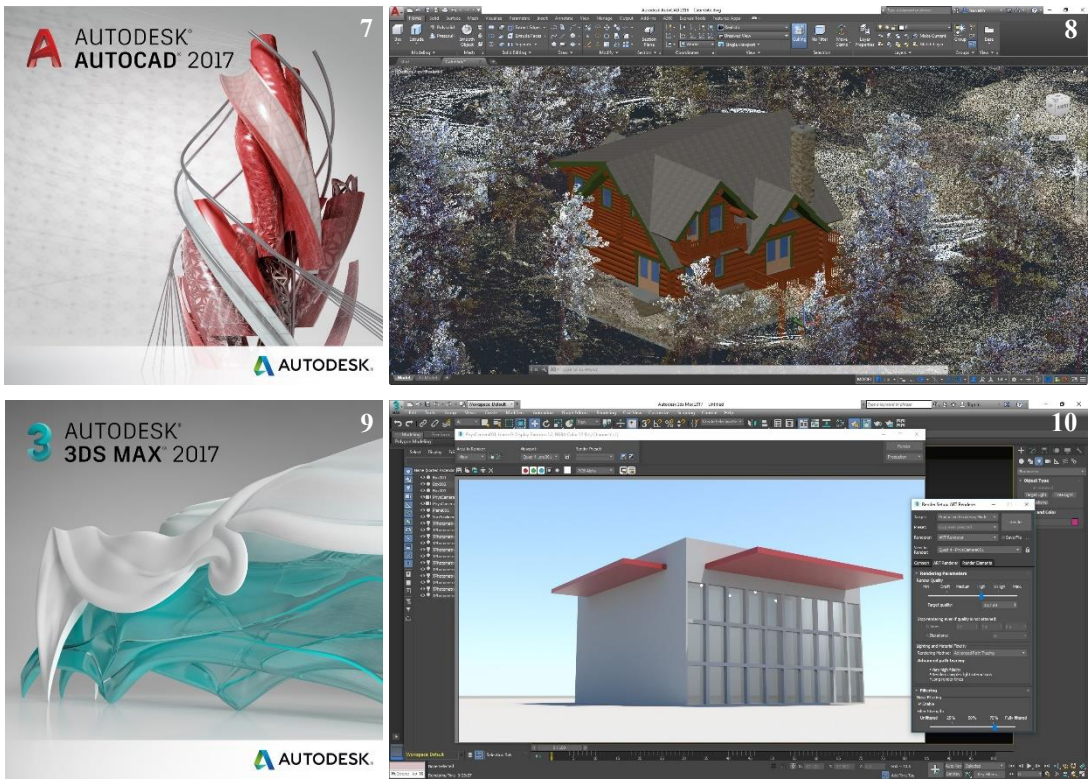

Figure 2. AutoCAD® and 3ds Max® programs which are often used and their interfaces (URL-7, URL-8, URL-9 and URL-10, 2017).

The benefits of CAD systems in the process of design can be listed as below;

- Increasing the productivity of the designer,
- The possibility to make revision in the process,
- Saving time and human power,
- Increase in productivity,
- Lower design cost,
- Shorter Project period,
- Increasing the quality of design,
- Making in-depth analysis,
- Easily providing design alternatives at desired numbers,
- Reducing errors to minimum,
- High drawing quality,
- Ease of standardization and design documentation
- Interpersonal and interdepartmental communication,
- Ease of communication between different disciplines (Aydoğan, 2015).

There are many work flow diagrams made using CAD in UCD work. An exemplary work flow diagram of CAD is shown in Figure 3.

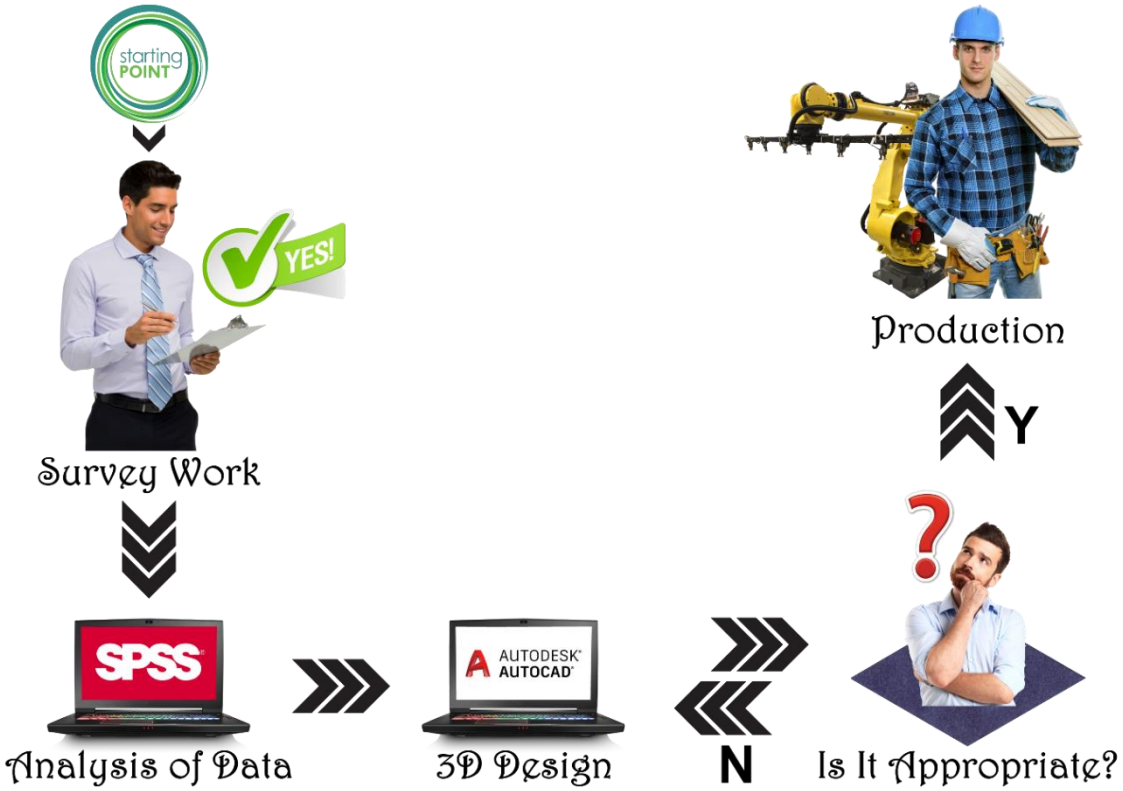

Figure 3. An exemplary work flow diagram showing that CAD technique is used.

Due to numerous updated features of CAD software and high program sizes, designers working with such software need strong and up-to-date work stations in order to form high quality and easy designs.

1.3. Ergonomic Design

International Ergonomic Association-IEA claims that the term ergonomics is derived from the Greek ergon (work) and nomos (laws) and is defined as "a science of work". In addition to being a system-oriented discipline, it helps to harmonize the things/objects interacting with human in terms of their needs, knowledge and skills and their restrictions (Rowbotham, 1838; IEA, 2015). Also defined as the interaction between human and working environment, ergonomics is known as "human factors" as well and is a design science which takes human to the center in working environment (Stone and McCloy, 2004; Mary Hilfiker et al., 2010; IEA, 2015). The term used for ergonomics in the USA is "Human Engineering" and "Human Factor Engineering" whilst it is "Biotechnology" in the Scandinavian countries. However, widely used term in international literature and in Turkey is "Ergonomics" (İlçe, 2007). Human factors and ergonomics is the method for creating safe, healthy, comfortable work systems, resulting in numerous benefits to the systems and to the elements of the systems (Güngör, 2009).

Ergonomics is UCD and is based on user interest and needs (Norman, 2002) by making goods and services usable and understandable. It is expressed as defining the interaction between human and machine. In this context, it would be right to define ergonomics as the human-system interference technology (Hendrick, 1996).

With the developing technological opportunities, as it is shown in Figure 4, whether the designed product is appropriate for human ergonomy can be done using CAD (Jack and Jill, Anybody, Delmia, and Catia) in the form of virtual reality (VR) in virtual environments and with digital models.

Figure 4. Some ergonomic analysis programs used in ergonomic designs (URL-11, URL-12, URL-13 and URL-14, 2017).

Table 2. Benefits related to certain ergonomics activities (Beevis, 2003; Jonathan Puleio and Jenny Zhao, 2015).

Ergonomics intervention	Costs saved	Costs avoided	New opportunities
Define user needs	✓	✓	✓
Identify operating, support, and maintenance notions	✓	✓	✓
Define and control factors that limit user performance	✓	✓	
Define user functions and duties	✓	✓	✓
Define and control extreme user workload	✓	✓	
Ensure an admissible working environment	✓	✓	✓
Define and control extreme user stress	✓	✓	
Define and implement user population cliches		✓	✓
Design for full range of possible users (gender, size, strength, vision, clothing, etc.)		✓	✓
Improve for user admissibility		✓	✓
Improve for width of use			✓
Decrease occasion for user mistake	✓	✓	
Decrease requirement for user guides	✓	✓	✓
Decrease needs for new abilities	✓	✓	✓
Decrease probability of ability decay	✓	✓	✓
Decrease personnel needs	✓	✓	✓
Improve minimum expenditure education system (capital and/or operating expenses)	✓	✓	
Develop personnel choice system	✓	✓	
Contribute to personnel holding	✓	✓	
Decrease time lost owing to accidents or injuries	✓	✓	

1.4. User-Centered Design (UCD)

According to Product Development and Management Association (PDMA), "user" is the person who uses a good or a service to solve a problem or obtain a utility whether they buy it or not (Rosenau, 1996; Öktem, 2014).

Eason (2005) divides users into three categories: first users (those who continuously have), secondary users (those who use a product through someone), tertiary users (those who are impressed with the product and decide to buy it). Marzano (1997) divides these three type of users by naming them as the "buyers" of a good or service, "owners" of the good or service and "users" of the good or service. According to his opinion, clients can be perceived from different outlooks and they have particular roles as "users", "owners" and "buyers". The role, "user" mentions to the human being who is only the user of a product. Conversely, the "buyer" role represents the "purchaser" or "customer" of a product or service and "owner" represents the "consumer" (Mutlu, 2003).

DESIGN DISCIPLINE	MARKETING DISCIPLINE	FIRM OWNERS
• User	• Consumer	• Customer

Figure 5. Definition of user from different perspectives (Oygür, 2006; Öktem, 2014).

First of all, UCD is a developmental approach that first focuses on the users, their needs, and requirements (ISO 9241, part 210).

The expression UCD was first coined in the research laboratory of Donald Norman in San Diego University in California in 1980s. The term later started to be used widely after the publication of co-authored "User-Centered System Design: New Perspectives on Human-Computer Interaction" book (Norman and Draper, 1986; Cao, 2014). In his "The Psychology of Everyday Things (POET)" book, Norman (1988) discusses the concept of UCD (Salvendy, 2012; Stephanidis C et al., 2012; van den Hoven et al., 2015). The design process of UCD is shown in Figure 6.

Figure 6. User-centered design process (URL-15, 2017).

In today's rapidly changing design world, the places go out of fashion so quickly and therefore, participatory processes only seem like a waste of time. The design processes change continuously. Similarly, demands from

the places change as well and they are expected to respond to more than one function. It is obvious that the old methods should be revised and adapted to new design processes and approaches. If the subject of UCD is put to the center of education, although there might be differences in interpretations, it will be possible to get rid of spaces without an identity that do not respond to needs (Hasırcı and Demirkan, 2003; Fender and Crowley, 2007; West et al., 2007). Table 3 summarizes advantages and disadvantages of UCD.

Table 3. Advantages and disadvantages of UCD (Abras et al., 2004).

Advantages	Disadvantages
Products are more efficient, effective, and safe.	It is more expensive.
Helps in managing users' expectancies and levels of satisfaction with the product.	It takes more time.
Improve a sensation of ownership for the product on users.	May require the participation of additional design team members (e.g. ethnographers, usability experts) and wide range of stakeholders.
Products require less redesign and integrate into the environment more rapidly.	May be difficult to interpret some types of data into design.
The cooperation process generates more inventive design solutions to difficulties.	The product might be very certain for more common use, in this way not easily transmissible to other customers; so more pricey.

4. Result and Suggestions

There is an increasing interest on UCD works all around the world. Similarly, UCD has started to gain importance in Turkey as well. It is seen that rather than financial reasons as the cost, the main purpose of UCD is the quality of physical and psychological well-being of the individuals.

Domestic companies active in furniture sector in Turkey know in theory that the user demands should be taken into consideration and yet in practice, neither the user demands are tested scientifically nor the necessary professional work is done in the implementation of the production. Designers working in the domestic companies active in furniture sector generally try to empathize with the users while designing the products. Our national designers do not know the UCD process very well, that the design process in the domestic companies engaged in furniture manufacturing in Turkey are not carried out professionally or they do not have financial opportunities. Of course, designs made under these conditions can not give clear answers to "To what extent, does the design meet the expectation of the user?" question. As another matter, the fact that furniture pieces designed for user-centered products in the design phase are of European origin show that there is a need for domestic and national production of such simple but functional parts.

As a result, more research should be carried out and implemented towards UCD in our country as a developing country. As in all around the world, it is necessary to provide all necessary opportunities including finance to designers and enterprises for people to have healthier, safer and more comfortable lives in our country.

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