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Chapter 1

**THE RELATIONSHIP BETWEEN
ERGONOMICS, SAFETY AND AESTHETICS
IN THE DESIGN OF CONSUMER PRODUCTS
AND SYSTEMS**

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ABSTRACT

The mutual influence of ergonomic, safety and aesthetic properties of products has so far not been analyzed in literature. In the area of consumer products, the researchers were focused only on the impact of aesthetics on the perception of the usability of products. In addition, previous studies had not taken into account the impact that aesthetics can have on the ergonomic properties of the products. So, the manner in which aesthetic properties of products affect the ability and the way of using products from the ergonomic aspect has previously not been

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considered. In addition, in the area of consumer products, it is very difficult to find a study that deals with the problem of the influence of aesthetic characteristics of the products on their safety during use. In the framework of this study, a connection has been established between the aesthetic, ergonomic and safety properties of product design solutions. The analysis is focused on the influence of the aesthetic properties of consumer products on the ergonomic and safety properties. Two case studies that were carried out in the framework of this research and other listed examples have shown that, in order to achieve a quality design solution of a consumer product or system, it is very important to take into account the aforementioned mutual influence when designing.

Keywords: consumer products, ergonomics, safety, aesthetics, design

1. INTRODUCTION

A product design solution consists of several basic components - the basic construction of a product, ergonomic properties of a product, safety properties and aesthetic properties of a product (Figure 1). The quality of consumer products, their features, performances, functions, method of use, durability, reliability and satisfaction with the use depend directly on the above mentioned components.

The basic construction of the product implies the basic structural characteristics of the product, i.e. its basic structure, which allows the fulfillment of the basic functions of the product, as well as the realization of the basic product performances. The ergonomic properties of a product imply those characteristics that determine the human interaction with a product. The safety properties of the product imply those properties that allow safe operation of the product, i.e., a functioning that prevents the emergence of injuries to the user and the occurrence of damage to property or the environment. The aesthetic properties of a product imply those characteristics of a product that enable the sensory experience of the product in terms of liking.

Without any doubt, each of the mentioned components of product design has its own function and importance. However, the mentioned components do not exist separately from one another. In certain cases, a design solution of a component may affect the function and performances of another component, or all of the other components. For this reason, it is very important to carefully consider the function and importance of each component during the designing

of a product, as well as their individual impact on other components of the product design solution.

Although significant, for a large number of designers, ergonomic properties of products are still an obscurity to a greater or lesser extent. Industrial and product designers make aesthetic design decisions largely on the basis of their intuitive judgments, “talents” and “educated guesses” [1]. In practice, many designers on the intuitive basis solve problems of ergonomic design, without the use of ergonomic knowledge related to the product that they design. This has particularly been the case earlier, when even the very notion of ergonomics for many designers was unknown. Such a situation earlier has caused the emergence of many problems in product design. This primarily refers to the relation that exists between the basic construction and ergonomic properties of a consumer product. Traditionally, ergonomists had to wait until the prototyping stage, to be able to apply certain ergonomic design solutions [2]. However, under such circumstances, many ergonomic solutions would become inapplicable, or for that purpose it was necessary to perform major changes in the basic construction. However, such changes usually require a lot of extra time and money.

The impact of the basic construction on other components of a product design solution is not the subject of this chapter. The aim of this chapter is to point to the connection that exists between ergonomic, safety and aesthetic properties of design solutions of consumer products. This connection, which is shown in Figure 2 as a whole, was not previously considered in the literature.

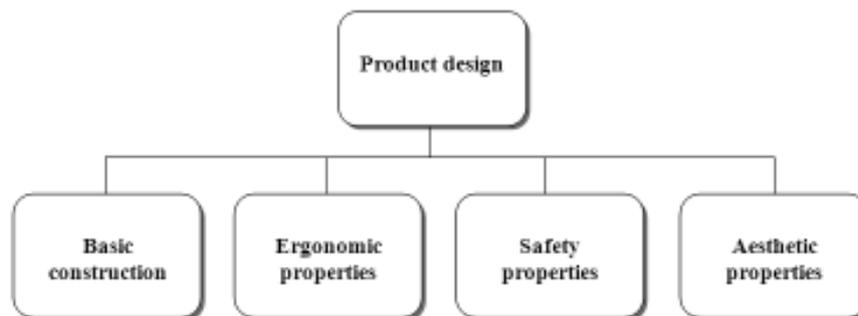


Figure 1. Basic components upon which a consumer product design solution depends.

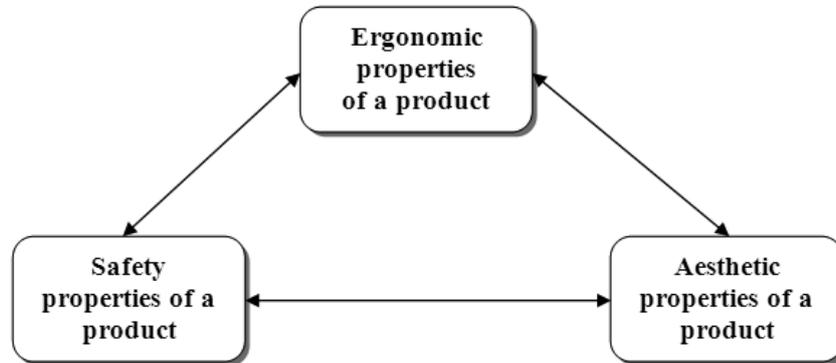


Figure 2. Mutual relatedness of ergonomic, safety and aesthetic component of a product design solution.

2. A GENERAL VIEW ON MUTUAL INFLUENCE OF THE ERGONOMIC, SAFETY AND AESTHETIC COMPONENT OF CONSUMER PRODUCTS DESIGN

For it to be possible to adequately consider the mutual influence between the ergonomic, safety and aesthetic component of the product design solution, it is necessary to start from the basic definitions. Ergonomics “is that field which is involved in conducting research regarding human psychological, social, physical, and biological characteristics, maintaining the information obtained from that research, and working to apply that information with respect to the design, operation, or use of products or systems for optimizing human performance, health, safety, and/or habitability” [3]. From this definition, it can be observed that one of the segments which ergonomics covers is the safety of products and systems. From there it follows that the quality ergonomic solutions already include the aspect of safety. In other words, ergonomic designers when proposing or implementing specific ergonomic solutions must also take into account the properties of systems and product safety.

Bearing in mind what was previously mentioned, quality ergonomic design solutions cannot have negative consequences on the safety properties of a product. In the vast majority of cases, opposite rule is also valid, i.e., that well-designed solutions in the field of safety do not affect the ergonomic properties of the product. However, this may not always be the case. If people who are dealing with product safety do not have the knowledge in the field of

ergonomics, they can design a solution that is safe, but which can reduce some ergonomic properties of a product. For example, a safety engineer can set a fixed guard at the operating point of the machine. Such a guard can successfully perform the safety function. However, if such a guard impedes the vision of workers, control of the process can be burdensome, which can slow down the production process and cause a higher percentage of waste. Therefore, the performance of workers interacting with the machine will be reduced, which means that the ergonomic features of the product will be violated. In order to prevent such occurrences, it is necessary that safety engineers and ergonomists cooperate closely.

Situations in which a safety feature of a design solution endangers an ergonomic characteristic of the product are relatively rare. A more frequent case is the mutual influence of aesthetic and ergonomic characteristics of a product, as well as the aesthetic and safety features of the product. However, this mutual effect is often not obvious to customers and users, but also to designers.

3. MUTUAL INFLUENCE OF THE ERGONOMIC AND AESTHETIC COMPONENT OF CONSUMER PRODUCT DESIGN

Aesthetics refers to the sensual experience that is caused by a product, and to the extent to which this experience fits individual preferences and goals [3]. According to Honderich, the use of the notion “aesthetics” is primarily associated with the theory of art [1]. Although aesthetics have always played an important role in product and system design, this role has been increased dramatically in the 21st century. This is because society and market are becoming more sophisticated, as well as due to the rapid development of manufacturing technologies. Although there have been calls for the expansion of the research area of Ergonomics in the direction of inclusion of emotional aspects of design, aesthetics is generally not considered as one of the central topics of ergonomic research [1].

Any ergonomic component of a product can be viewed through the prism of the aesthetic dimension. However, the acceptance of any aesthetic dimension of a product depends on individual factors, such as gender, age, race, culture and personality traits., Different individuals may have different aesthetic responses to the same product, because it can carry different

symbolic or connotative meanings, as well as an evocation of memories or mental associations [1]. In this regard, it is often considered that the symbolic meaning that a product has for the user can affect its acceptance in terms of aesthetics. Given the aforesaid, in the goal of adopting some ergonomic components of a product from an aesthetic point of view, it is necessary to take into account aforementioned factors when designing it.

If, for example, we take age as a factor when designing, it should be noted that the aesthetic qualities of the product can primarily be dominant for the younger population. For the older and more thoughtful population, ergonomic properties can be primary when deciding for some product. However, the safety properties of the product are equally important to both the aforementioned population, although they often do not attach equal importance to them.

Viewed as the whole, the mutual influence of the ergonomic and aesthetic component of the product design so far has not been considered in the literature. Only one important segment of influence between the ergonomic and aesthetic component of the design has been considered, which concerns the relationship between usability and aesthetics of products. This interplay will be described below.

Acceptance of any technical system by consumers, among other things, depends on two important elements - usability and aesthetics. The aesthetic aspect is the important determinant that reflects in the willingness to accept and purchase a product in the area of popular consumer electronics [5]. However, a growing number of consumers are becoming aware of other qualities that a product can possess, such as usability [6]. As well as the aesthetics, an appropriate level of usability of a product can also cause emotional reactions of users, as shown in the experiment described in [4].

According to Hassenzahl, the aesthetics of system design certainly impacts the perceived quality of use [4]. In order to determine the impact of aesthetics on the perception of usability by consumers, several studies with different products were conducted. Tractinsky et al. performed an experiment to test the relationships between users' perceptions of usability and computerized system's aesthetics [7]. Perceptions were recorded before and after the participants used an Automated Teller Machine (ATM). A strong correlation between the systems perceived usability and perceived aesthetics for the pre-experimental condition was obtained. The strong correlation remained intact according to the post-experimental results.

In the human - computer interaction domain, on the basis of conducted experiments, Tractinsky has shown that a very high correlation exists between

perceived aesthetics of the interface and a priori perceived usability of the system [8]. Thuring and Mahlke have compared aesthetics and usability properties of portable digital audio players [4]. They found an interconnection between the visual aesthetics factor and the perceived usability. However, the results of the experiment have shown that the factor usability had no effect on the perception of visual aesthetics. Besides, these authors argue that the influence of perceived usability on the overall appraisal of the system is higher than that of the aesthetic factor.

Other studies have also confirmed the relationship between aesthetics and the perception of usability. In a research that was realized by Kurosu and Kashimura, usability was evaluated higher for an aesthetically pleasing ATM interface, compared to ATM interface that was visually unappealing [6]. In studies conducted by Kurosu and Kashimura, Lavie and Tractinsky, as well as Schenkman and Jönsson, high correlations between usability and aesthetics were found [6, 9].

It makes sense to explore the impact of aesthetics on the perception of usability before using the product and after the purchase and use of the product. Testing before factual use of the product is done in order to study the reactions of potential users, in order to determine whether a user would purchase a product with the projected level of usability. Testing after use of the product is done in order to investigate changes in the attitude of users regarding the usability. From the change of attitude, in fact, depends satisfaction related to the use of the product. In most cases, before factual use of the product, aesthetically beautifully designed products have a positive impact on the assessment of the usability of the product, although there are also exceptions that did not confirm the existence of this correlation, as in the case of tin snips [6]. After using the product, in most cases, the impact of aesthetics on the assessment of the usability is less pronounced. However, in this case, there are also exceptions. In the experiment that is described in [9], testing of the correlation indicates that the phones' pre-experimental aesthetics and post-experimental perception of usability are mutually connected. This means that no matter how usable a phone actually was, a highly rated beauty of design affected the perception of usability in a positive direction.

However, definitely, more data are necessary to clarify the relationship between perceived usability and aesthetics [4]. There are a couple of compatible explanations relating to the explanation of the impact of aesthetics on the perception of usability. One explanation is given in the paper of Tractinsky et al. [9]. The authors argued that an affective response in relation to the aesthetics of a design solution may elevate users' mood and their global

estimation of a system. Another explanation is based on the “halo effect,” which has been described by Sears et al. [9]. The halo effect reflects in the assumption that a person or thing that has one good quality (aesthetics), will also have other good qualities (usability, etc.). In the case of consumer products, the impact of aesthetics on the perception of usability can vary depending on the extent to which it is expected of a particular product to be aesthetically beautifully designed. If it is expected from the products to be aesthetically beautifully designed, it can be assumed that the impact of aesthetics on usability evaluation will be higher.

Theoretically speaking, in a broader context, ergonomic solutions and product characteristics can also affect the aesthetics and aesthetic experience of the product. For example, if for the purpose of coding a control device we apply a rough surface in order to recognize that device by the sense of touch, such a surface in the aesthetic sense will not be a suitable solution for customers who prefer a smooth surface. Similarly, in order to increase the contrast, a combination of colors that is justified from the ergonomic aspects can be applied, but which may be inadequate from an aesthetic point of view. However, experimental studies that are focused primarily on this aspect of mutual influence of ergonomics and aesthetics have not yet been performed.

4. MUTUAL INFLUENCE OF THE SAFETY AND AESTHETIC COMPONENT OF DESIGN OF CONSUMER PRODUCTS AND SYSTEMS

There are very few studies that have addressed the influence of aesthetics on the safety of products and systems. In addition, scientific studies that have examined the impact of safety on the aesthetics of products and systems are not known. In the following, examples that show the importance of this issue will be presented.

Drottenborg considers the impact of road aesthetics on certain aspects of traffic safety [10]. From the drivers’ point of view, there are four kinds of traffic environments: safe/beautiful, dangerous/beautiful, safe/ugly and dangerous/ugly. Drottenborg tested whether drivers generally show different behavioral aspects (speed of driving as a safety factor) in aesthetically different environments. The measuring of speed in aesthetically different traffic environments shows that aesthetics have the tendency to induce changes in drivers’ behavior in a positive direction.

However, not all elements that contribute to the aesthetic experience of the roads are safe for all road users. In [11] it is emphasized that setting up a row of trees directly along the way can pose a risk to motorcyclists. Minor deviations from the path in this situation may result in potentially serious accidents due to the contact with a fixed object, especially at high velocity. Some issues of landscape designing, which may influence safety, include the following [11]: lateral offset placement of trees and landscaping, proximity to driveways, proximity to intersections, providing a clear vision of space, maintaining a proper visual perception.

Mueller points to the relationship between aesthetics and safety in the design of bathrooms [12]. United States Centers for Disease Control (CDC) provided statistics regarding injuries in the bathrooms. Nearly 250,000 people every year fall in bathrooms. Falls are the most common reason of traumatic head injuries. Above 60% of injuries happen around or in the tub and shower [12]. For this reason, when designing aesthetically appealing bathrooms, special attention should be paid to the safety aspects of the solution.

5. CASE STUDIES RELATED TO THE INFLUENCE OF AESTHETIC ON THE ERGONOMIC AND SAFETY COMPONENT OF DESIGN SOLUTIONS OF CONSUMER PRODUCTS

From the preceding analysis that relates to consumer products, we can see that the attention of researchers focused on determining the impact of aesthetics on the perception of usability. In other words, the attention was focused on the aesthetic impact on the assessment of the level of product usability. However, the usability is not the only ergonomic property of the products to be considered. In addition, previous studies have not taken into account the impact that aesthetics can have on the ergonomic properties of the products. So, the manner in which aesthetic properties of products affect the ability and the way of using products from the ergonomic aspect has not previously been considered. In addition, in the area of consumer products, it is very difficult or almost impossible to find a study that deals with the problem of the influence of the products aesthetic characteristics on their safety during use.

In the following two case studies will be shown. First, a more detailed study, refers to the impact of aesthetics of bike seats on their ergonomic and

safety properties. Another study regards the impact of aesthetics of a chair on its ergonomic and safety properties.

5.1. Impact of Aesthetics of Bicycle Seats on Their Ergonomic and Safety Properties

The bicycle saddle (seat) is above all, the most important accessory of a bike. It is the most difficult to ergonomically design, because it must accommodate the anatomically complex perineum [13]. Thus, modern saddles should have an innovative design, ergonomic fitting and top quality of used materials.

Certain questions emerge, about choosing the ergonomic bike seat, like: is that seat ergonomically designed? Can someone enjoy bike rides using this saddle? A beginner often feels discomfort during bike riding because of his bicycle saddle. On the other hand, many experienced cyclists with ergonomic seats will report that they can enjoy lengthy rides with limited or no discomfort at all! A beginner naturally experiences a little or moderate soreness after riding, because his body is getting adjusted to the cycling position and riding needs. However, if the soreness doesn't go away after some days of riding, then it must be concluded that the saddle is not the proper one for him and his riding habits. Between genders, the most frequently mentioned complaints made by men are painful pelvic bones, sexual organ numbness and pain in the region of the perineum. Female cyclists complain about painful pelvic bones, irritated genitals, burning skin and a painful coccyx [14]. Males sustain seat pressure values 51% greater than females [13]. The work rate and hand position are additional factors influencing seat pressure and males and females respond differently to adjustments of these factors [15-16]. Studies report that saddle sores and pudendal neuropathy influence between 35% and 81% of bicyclists following short- and long-distance rides [15, 17].

Research and development among the saddle manufacturers led to defining exclusive patents regarding the shape, curvature and the dimensions of various parts that make up the saddle. The majority of "aware" cyclists are looking for a high performance seat, which can fit their personal needs and prevent health problems.

The anatomy of the pelvis bone and the musculature around it, like every other physical characteristic, is unique and specific for each individual. We can find anthropometric studies identifying "percentiles and types" of pelvic

width, but within them, the morphological variability of the various structures is quite limited [14]. Finding a compromise is often the norm. With regard to the saddle geometry, there's a limited correlation between the pelvic bone distance and the preferred saddle width. This finding could be a consequence of the effect of other factors, such as the materials of the saddle that were used in the measurement, buttocks width, overall geometry of the saddle, etc. Additionally, overall measures of the bicycle depended on individual preferences, without a clear relationship with physical measures. In order to get an optimal fit when buying a new bicycle, individual measures of the buyer should be performed by the retailer [14].

Important parameters which influence the feeling and use of the saddle, are the body position during riding and also the broadness of the legs during cycling, which depends on the type of cycling (leisure or speed). There is a variety of saddles with different widths and designs. A seat designed with no protruding nose does not transfer pressure to the anterior perineum and may be helpful in preventing some pathologies such as genital numbness and erectile dysfunction, because it helps to shift the body weight from the seat to the handlebars, because there is a smaller area of support of the anterior perineal region [13]. Cycleryusa [18] argues that the ideal width of a seat is a "rear shape that fits the width of the ischial tuberosities" or, sitting bones, which must be centered over the rear of the saddle. Anatomic bumps can often be found in that area for this purpose. Many modern saddles have a groove or hole, which has been cut out of the top of the saddle, in order to remove the part of the saddle that's usually responsible for pressuring sensitive tissues and causing numbness and pain. Although a grooved seat allows better preservation of the seat/symphysis space than a standard seat, the rider's body position is also important for preserving the seat/symphysis space and the reduction of compression. Compared to narrow seats, a grooved seat reduces the risk of compression, but only when the rider is leaning forward at a certain angle. However, the rider's position can have a greater role than seat design in potential compression [19].

Although there's a plurality of manufacturers and design solutions, this does not necessarily mean that it is an easy task for someone to choose the proper seat for his needs. When purchasing a bicycle saddle, one of the key points is the time which a cyclist spends on the bike. If a cyclist does not ride too often, almost any saddle may be used. There are certain informal, but helpful tips, when someone is looking for the proper saddle. Asking a friend who rides, is one of them, especially if he has a similar build. There are also bicycle dealers who are quite experienced to guide someone, knowing which

saddles are popular and why, as well as the quality of the materials and the models to buy. They are able to suggest a few adjustments to make riding more comfortable. Another error might occur when buying online. This approach may provide a good price, but it is really important that a user knows the product and to test it before buying, or he should find clear and scientifically supported specifications.

A central question concerns the choice criteria and possible mistakes during the election of an ergonomically designed “risk-free” saddle, and an aesthetically designed “ergonomic like” saddle with a long term risk for pathological incidents. Evolutionary psychology argues that we aesthetically prefer features that are beneficial for the development of the functioning of senses and our survival in general [20]. We need to see how the aesthetic experience links to the experience of the majority and on which level the dictum “form follows function” can be achieved. *Product experience refers to the consumer - product interaction*, either before or after purchase. Basically, this interaction includes the aesthetic experience, the experience of use (physical), and the emotional experience. Thus, the “aesthetic approach” of a product primarily refers to the sensory perception and understanding.

If we slightly apply the modified model of Leder et.al [21] to the aesthetic experience that someone has with a finely designed saddle, then the process can be divided into certain steps: the buyer of the saddle starts with a perceptual analysis of the product, visually compares it with other saddles with which the user had experience, classifies it into a category and subsequently interprets and evaluates it, resulting in an aesthetic judgment, an aesthetic emotion and finally a physical experience. According to the process, during the first two (or three) mostly automatic stages, the perception focuses on design, whereas the accent is on the degree to which our perceptual system manages to detect structure and to assesses the novelty of a design solution. So, those stages are connected with sensuous delight (or displeasure), whereas at later stages, higher cognitive, physical and emotional processes shape the experience.

If someone wants to choose a saddle for a bicycle, there are two distinctive scenarios, with two variables, the experience and the type of the rider.

- The rider who buys a bicycle for leisure and exercise, without special (expert) knowledge about the bike, usually chooses the bike as a “Holon” (whole), without paying specific attention to the sub-parts and the choice is mostly based on the price and surely the aesthetics.

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Possibly, this rider, later or sometimes quite early, will experience a “bad saddle.” Later, he will run and change the saddle, but again, if his knowledge and the information which he could get from the seller are limited, he will choose with the same criteria, based on aesthetics and price and sometimes the familiarity with the brand name.

- On the other hand, the rider who’s “active and aware” about bicycling, even for leisure and exercise or even more for athleticism, buys a bicycle as a “Total” of sub-parts, where each one has special characteristics and functions. His focus on the performance and safety results into joy and success. In this case, the aesthetics of the saddle isn’t of much importance and works as a dependent variable. The main parameters that will define the buying will be ergonomics and the safety of the rider, based on the technical characteristics of the product.

Persons with less experience would probably choose the less ergonomic, much aesthetic saddle, on the basis of visual impression, but without further processing. On the other hand, persons with experience and proper knowledge about ergonomic and safe cycling will go further, judging it by the physical experience, taking into account other saddles, classifying it into a category, and subsequently interpreting and evaluating it. The final judgment would be undoubtedly in favor of the more ergonomic and safer saddle, even if it is less attractive.

As a verification of the above analysis, we conducted a study, with freshmen university students, with no special knowledge of ergonomics and especially bicycle ergonomics, asking them to choose between three pairs of saddles. The test included one pair of aesthetically fine designed saddles, with one saddle that was more ergonomic than the others. One pair of aesthetically less designed saddles but both ergonomic, and one pair that consisted of one aesthetically fine designed - less ergonomic saddle, and one aesthetically less designed but more ergonomic saddle. When they made the selection from the first pair of saddles, there was an almost split selection, with no statistical difference. The same happened during the selection from pair 2. Eventually, when they had proceeded with the selection from the third pair, the majority had chosen indeed the aesthetically fine, less ergonomic saddle. There was no purpose to test the second cohort with experienced cyclists, because the aesthetic parameter would be a dependent variable for them and the criterion for selection, thus the independent variable would be the ergonomics and safety that they were already aware of.

The appearance of the bike seat influences the consumers product choice in several ways. A person perceives interaction with the product through six different roles of product appearance: communication of aesthetic, symbolic, functional and ergonomic information, attention drawing and categorization [22]. Thus, the seat's appearance can initially have aesthetic value for the buyer, and later ease of use and safety (ergonomic value) will come into focus. Under these conditions, the key parameter which influences the final judgment is the experience of the buyer regarding the bicycle saddle, as well as the access to the supportive information related to the product. So, probably the best way to choose the product with optimal characteristics is to make lots of trials with different products. When it is not possible, the user should make the choice on the basis of relevant information about the product. In other words, in most situations, only an experienced and the well-informed consumer will be able to differentiate and to make the adequate choice between an aesthetically well designed but less ergonomic product, and an aesthetically but at the same time ergonomically well designed article, independently of the price and trade mark.

5.2. Impact of Aesthetics of a Chair on Its Ergonomic and Safety Properties

The basic aesthetic features of chairs that may affect their ergonomic and safety properties are shape, dimensions and material. The shape of the chair, in essence, determines from the ergonomic aspect whether the chair possesses all components that provide comfortable seating. The shape also in ergonomic terms determines whether the form of the chair is harmonized with the shape of the human body.

The dimensions of a chair in the ergonomic sense determine anthropometric compliance of the size of a chair with the dimensions of the human body. The material of a chair in the ergonomic sense determines the possibility of comfortable seating, especially over a longer period of time. For the purpose of practically determining the possibility of the impact of the chairs aesthetic properties on its ergonomic and safety properties, the chair that is shown in Figure 3 was tested.

In order to assess the aesthetic value of the chair, seven subjects aged 19-75 years were tested. A picture of the chair was shown to the subjects. They were then asked to mark on a scale from 1 to 10 their estimation of the aesthetic impression of the chair. Then, a hypothetical question was posed to

the subjects whether they would buy such a chair. Based on the test results, it was found that the average score of the chairs aesthetics amounted to 7.14. The chair would be bought by 57.14% of surveyed subjects. This indicates that the tested chair would have customers on the market.



Figure 3. The chair that was used in the case study.

After that, we performed an ergonomic expert assessment of the chair. The seat of the chair basically consists of 4 squares whose sides amounts to 16 cm. In relation to the central square, the lateral squares are at a slight angle (the area for sitting is not flat). Not taking into account the purpose of the chair, the ergonomic analysis revealed the following shortcomings of the chair:

- The chair does not possess a backrest, which affects the possibility of maintaining the proper sitting position and the appearance of premature fatigue.
- The chair does not possess armrests, which also influences fatigue and the ability to maintain proper seating positions.
- The chair possesses a fixed footrest that dictates the position of the legs while sitting.
- The area for sitting is not of appropriate dimensions. It does not allow the entire surface of the gluteal region to fit on the surface for sitting. As a result, the supporting parts of the gluteal region suffer higher pressure, which could result in impairment of comfort and greater fatigue.

- The material used for making the surface for seating is wood. This material is less suitable for long-lasting seating in comparison to a chair which is lined with a soft material.

This chair is primarily designed to attract potential customers with its unusual design. However, the conducted ergonomic analysis showed that the shape, dimensions and material used for making this chair are not suitable from the ergonomic aspect. In most cases, the tested chair will not be comfortable for use from the ergonomic aspect. In addition, each object that is intended for human use represents a safety risk to people, if their health is endangered due to its use. The tested chair obstructs proper maintenance of body position over a longer period of time. If it is used over a longer period of time during the day and if used for several years, it can cause musculoskeletal disorders. In this way, it can impair the safety and health of users.

CONCLUSION

The necessary attention has not previously been devoted to the impact of the aesthetic properties of the products on their ergonomic and safety properties. In the area of consumer products, the impact of aesthetics on the perception of usability was only previously considered in the literature. This study has shown examples and realized case studies that indicate that the impact of the aesthetic properties of the product on its ergonomic and safety properties should not be ignored.

In general, the aesthetic experience connected to a product or system involves the interplay between a person's visual, auditory, tactile, olfactory, haptic, and even proprioceptive system. However, it is important to distinguish how a particular product affects the senses in terms of aesthetics, and how in ergonomic terms, especially in terms of perception. Therefore, the product can in one way affect its aesthetic comprehension via senses and it can affect its perception from the ergonomic aspect in another way. Inadequate perception can lead to inappropriate use of the product, which may adversely affect the fulfillment of the task. In addition, if the system is not designed to support the process of perception in accordance with ergonomic requirements, safety in certain situations may be impaired.

Considering that the ergonomic properties of the product often can not easily be spotted (especially when purchasing products), many designers opt to put primary emphasis on the aesthetic characteristics of the product. In some

cases, from the aforementioned reason, the ergonomic properties of products can be completely or partially ignored when designing. Therefore, it is very important when designing consumer products and systems to include a multidisciplinary team, which is composed of constructors, ergonomists, designer stylists, as well as experts in the field of safety.

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