

# Design; Beauty and User Satisfaction

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**Abstract** This study was about the relationship between product aesthetics and user satisfaction in some of user based design methods (UCD, KE, UX, and PD). Also we tried to know how beauty will appear in the product and perceived by users, and how can beauty result in user satisfaction by mentioned methods. So, we introduced some new models about beauty in the product and the way which user satisfaction is generated. According to these models, some of the methods with emotional approach were about to have more consideration to the perception of form in beauty and generating pleasure for satisfaction, and those with experimental approach, have focused on the experience of more function and less form in users' mind and then the satisfaction would be generated of fulfillment of expectations. Furthermore we discussed that satisfaction has two general types; beauty in the products would have different meanings in each level.

**Keywords** Design, Beauty, Aesthetics, User satisfaction, User based design methods

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## 1. Introduction

Throughout history, numerous definitions of beauty have been raised, whether in the context of its objective or subjective, whether it is in terms of its usefulness, its intrinsicity, etc. In some cases, these discussions have been presented with pleasure and the beauty ratio has been reviewed with pleasure and enjoyment. But will pleasure and beauty also bring satisfaction? Which standards satisfaction has and how can we be sure about reaching them?

On the one hand, in the course of history, different methods have been developed for product design; Part of these methods followed goals such as sales and intellectual practices of the designer or group of designers. And partly they were looking for scientific methods of design. In the scientific design process, focus has been on things such as market, production, environment, user, and so on. In the meantime, the attention paid to the user in recent years is more than the other, which has focused its ultimate goal on satisfying the user both at the time of choosing a product and after using it. The issue raised here is how well these user-based design methods can provide the beauty they expect. So can a new and comprehensive definition of beauty in products be presented?

The main purpose is to investigate the relationship between product aesthetics and user satisfaction in some of user-based design methods and to provide a new and

comprehensive definition of beauty in products or from the perspective of product users if possible. Research questions which will be answered by this research are:

What is the relationship between user satisfaction and beauty in the product?

How will beauty appears in the product and perceived by users?

How can beauty result in user satisfaction by user based design methods?

## 2. Background

So many studies discussed about the history of beauty definition through ages, among those, by Frohlich [14], Karvonen [24] and Tractinsky [47], Table 1. shows an overview of these definitions classified by the time and its founder.

Also, numerous studies show the influence of aesthetics on for instance trust and credibility, perception of usability, usability testing and overall impression [48]. Tuch et al. [48] identified some of experiments that had examined the relation between usability and aesthetics and summarized them into two tables. Most of them were in the field of HCI (e. g. [4], [8], [7], [16], [18], [25], [26], [27], [46], [47], [50] and [51].

A strong correlation between beauty and usability repeatedly emerged [18]. More attractive products are considered to be more usable [44]. Some studies showed the relation between usability and aesthetics, but not exactly reverse. It means that usable products can be beautiful but beautiful ones would not be usable at all [48]. Some studies found an increase in performance when a product was aesthetically appealing [43], some found a decrease in performance when a product was aesthetically appealing and

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some found no effect on performance at all [44]. Also, people appreciate beauty, but don't want to "pay" for it [12]. Diefenbach & Hassenzahl [12] as well, found in their study that the less beautiful but more usable product was chosen more frequently (p. 1425). The result of Tractinsky's study

showed that perception of usability (an attribute of interaction) and beauty (an attribute of graphical user interfaces) were related [28]. Also Lenz et al. [28] mentioned that Djajadiningrat et al. in 2000 were talked about "aesthetic of use" (p. 80).

**Table 1.** Definitions of "beauty" through ages which explained by Frohlich [14], Karvonen [24] and Tractinsky [47]

Founder	Time	Definition of beauty	Additional explain
Pythagoras	the 6 <sup>th</sup> century BC	Orderly proportions	
Kant	1750	In the eye of the beholder A subjective experience form of pleasure experienced in response to an object	So, it could therefore differ between people in response to the same object
Hogarth	1753	Objective property of objects related to their proportions	
Kirwan	1999	A rare kind of pleasure which is either invoked or not invoked by an object The vanishing point of our desire for happiness	
Norman	1998	Easiness of use	
Tractinsky	2000	What is usable	
Frohlich	2004	a rare subjective experience which Connection between the object and the beauty experience	Both objective and subjective

Some of the other results of the studies which done till now are that, people in a choice situation prefer a pragmatic to a hedonic good of the same nominal value, although people find the hedonic more attractive and would prefer it, if they would not have to justify their choice; People may be more satisfied with a beautiful product that performs sub-optimally than with a more usable but less appealing product [31]; The relative appeal of visual stimuli is closely related to both user satisfaction and perceived usability [31] and so on.

### 3. Materials and Methods

This is a descriptive and analytical study which has a critical and comparative view to some of user based design methods (User centered design, Kansei engineering, User experience and Positive design). Beauty definitions, satisfaction properties and identified design methods' processes are the raw materials of the study. So, the study will have three parts: Beauty, Satisfaction and Design.

### 4. Beauty

Aesthetics is variously defined as beauty in appearance, visual appeal, an experience, an attitude, a property of objects, a response or a judgment, and a process [31]. Beauty is a very old topic in philosophy. Early writers proposed that beauty was an objective property of objects, while later writers suggested that it was more of a subjective experience triggered by objects. This debate continues today around the

issue of taste in judgments of beauty, and whether or not there is such a thing as good taste in recognizing beauty to be found in the world [14].

Aesthetics originate from the theory of art and usually refers to beauty and more specifically, to the beauty of art [45]. In the context of a metaphysical consideration of the world's order, beauty is equated with its orderliness [Tractinsky's "classical aesthetics" and property of objects]. In the epistemological context derived from Baumgarten, beauty is thought of as adequacy to the mind in perception [Hassenzahl's "goodness", inside the viewer's head]. From the anthropological point of view it may seem to be nothing more than sensual attractiveness [Berlyne's work on arousal; Norman's [59] notion of "visceral emotion"] [31]. It is an absolute and a part of "the big three"; the beautiful, the good and the true [39]. Beauty illuminates, attracts, persuades, deceives and represents harmony, freedom, symmetry and proportion [45].

Aesthetics usually refers often to non-quantifiable, subjective, and affect-based experience of system use; usability is commonly measured by relatively objective means and sets efficiency as its foremost criterion [2], [47].

The tension between form and function has long been at the crossroad of artifact design. Whereas emphasis on function stresses the importance of the artifact's usability and usefulness, accentuating the artifact's form serves more the aesthetic, and perhaps social, needs of designers and customers. Until the first quarter of this century, the design of commodities and mass production artifacts were quite devoid of aesthetic considerations. Petroski (1993) credits two industrial design pioneers, Loewy and Dreyfuss, with

the introduction of aesthetic considerations to mass production and with the development of industrial design as an explicit marketing instrument. Evidently, aesthetics considerations gained importance quickly. About half a century later, Norman (1988; 1992) laments the appropriation of modern design by designers who place aesthetics ahead of usability. Similar sentiments concerning designers' priorities can be found in various areas of artifact design [47].

Aesthetics can be seen as an aspect of the broader concept of user experience, which can include usability, beauty, overall quality and hedonic, affective and experiential aspects of the use of technology [49]. Aesthetics is seen to have something to do with pleasure and harmony that human beings are capable of experiencing [31]. Lenz et al. [28] suggested a principle of an aesthetic interaction is the “fit” between interaction attributes and appropriate experience (p. 88).

Beauty is perceived immediately – it takes effect on product perception and evaluation right from the first glimpse [12]. Beauty in an interactive product might also indicate increased usability [18].

To the extent that aesthetics is a pleasant experience or an experience that leads to pleasure, it implies a relationship to emotion [31]. Desmet [9] classified product emotion in surprise emotions (e. g. surprise, amazement), instrumental emotions (e. g. disappointment, satisfaction), aesthetic emotions (e. g. disgust, attracted to), social emotions (e. g. indignation,, admiration), and interest emotions (e. g. boredom, fascination) (p. 6). Even if aesthetics is a property of objects, when confronted with an object of beauty, it does evoke a positive emotional experience in the viewer [31]. Products and services need a balance between pragmatic (e.g., usability) and hedonic quality (e.g., novelty) [53]. Aesthetic design can enhance the desirability of a product and greatly influence customer satisfaction in terms of

perceived product quality [5].

Hassenzahl [17] defined a judgment of beauty as “a predominantly affect-driven evaluative response to the visual Gestalt of an object”. Beauty is evaluated from the way the design is experienced in the user’s mind and is in interaction between the user and the artifact, i.e., as a quality of the interplay [29]. The term design aesthetics is employed in two ways: it may refer to the objective features of a stimulus (e.g. colour of a product) or to the subjective reaction to the specific product features [43].

According to the definitions of beauty hitherto, authors introduce a model that shows the area of beauty in products. As shown in figure 1. we have two main parts: Object or product and subject or user. Both of them can effect on beauty of the thing.

Beauty can be in an object or product, that has form and function as its contents. These two contents can merge to each other or be separated (but not fully separated). They are jointed to each other and the joint part can be narrower or wider depend on different designs. Usability and simplicity are properties of function and visual Gestalt refers to form of an object. Here by the one joint of these two contents we can have an angle between them that we call it “ $\alpha$ ” and will explain it in later sections.

Also, beauty can be formed in subject or users’ mind. Here we have three contents: perception, experience and judgment. Emotion and pleasure are some of examples of perception in subject or user’s mind and desire, need knowledge, etc. are some kinds of experiences which he/she encounter. Judgment would be the result of perception and experience which occur in the mind and would be the main part of this process. Perception and experience like form and function are jointed together and can overlap each other more or less with the angle between them which we call it “ $\beta$ ” and will explain it later.

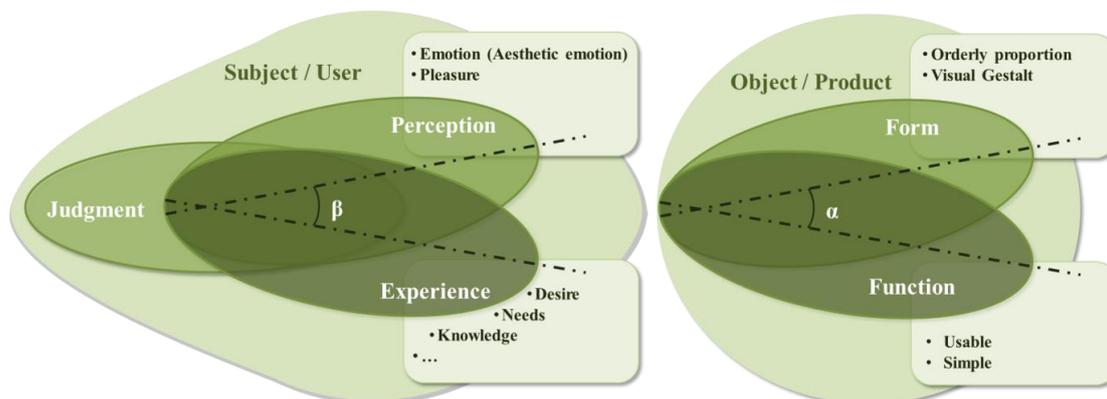


Figure 1. Schematic view of beauty area in products (source: authors)

## 5. Satisfaction

Customer satisfaction is the major concern and prerequisite for competitiveness in today’s global market [5]. Oxford online dictionary [64] explained satisfaction as “fulfillment of one’s wishes, expectations, or needs, or the

pleasure derived from this”, also Cambridge online dictionary [63] defined it as “a pleasant feeling that you get when you receive something you wanted, or when you have done something you wanted to do”, and “the act of fulfilling (= achieving) a need or wish”.

The judgment of how satisfied people are with their

present state of affairs is based on a comparison with a standard which each individual sets for him or herself; it is not externally imposed. It is a hallmark of the subjective well-being area that it centers on the person's own judgments, not upon some criterion which is judged to be important by the researcher [13].

If you are creating the product for use in your organization, you will want users to be more productive and satisfied [6]. User satisfaction is a statement about, or a judgment of, the user experience [31]. When systems match user needs, satisfaction often improves dramatically [6]. Satisfaction is an emotional consequence of goal-directed product use [18], [20]. Satisfaction may be a by-product of great usability in traditional office environments, and that satisfaction can be defined in terms of efficiency and effectiveness [32].

As stated by the ISO 9241-11 standard, user satisfaction is supposed to contribute to usability along with effectiveness and efficiency [32]. There, 'user satisfaction' is referred to in terms of 'attitude' and 'degree of comfort' and measured by a number on a 7- or 10-point scale [31]. Hansemark and Albinson [58] explained that "satisfaction is an overall customer attitude towards a service provider, or an emotional reaction to the difference between what customers anticipate and what they receive, regarding the fulfillment of some needs, goals or desire" [1].

The intensity, positive or negative, of the first impression is likely to set the scene for the amount of attention subsequently paid to experiential usability and pleasure-of-usage factors, which then culminate in that judgment of the experience that we might call user satisfaction [31].

Courage and Baxter [6] defined usability as the effectiveness, efficiency, and satisfaction with which users can achieve tasks when using a product (p. 747), while Maguire [59] explained the satisfaction as user comfort and acceptability (p. 603). In order to widen the notion of user satisfaction beyond efficiency and effectiveness of the user experience, researchers must start to think of usability as part of a satisfying user experience [32]. User satisfaction is a

complex construct that incorporates several measurable concepts and is the culmination of the interactive user experience [31]. In HCI the term satisfaction is often used synonymously with perceived usability or at least with the overall evaluation of a product [18]. User satisfaction is a judgment about the interactive experience with products [31].

Furthermore life satisfaction refers to cognitive, judgmental process. Shin and Johnson (1978) defined life satisfaction as "a global assessment of a person's quality of life according to his chosen criteria" [13].

Kano et al. (1984) developed a two-dimensional model to explain the different relationship between customer satisfaction and product criterion performance. The Kano model classifies product criteria into three distinct categories, as shown in Figure 2. Each quality category affects customers in a different way. The three different types of qualities are explained as follows:

1. The must-be or basic quality: Here, customers become dissatisfied when the performance of this product criterion is low or the product attribute is absent. However, customer satisfaction does not rise above neutral with a high-performance product criterion.
2. One-dimensional or performance quality: Here, customer satisfaction is a linear function of a product criterion performance. High attribute performance leads to high customer satisfaction and vice versa.
3. The attractive or excitement quality: Here, customer satisfaction increases super linearly with increasing attribute performance. There is not, however, a corresponding decrease in customer satisfaction with a decrease in criterion performance [5].

Furthermore some other models exist for customer satisfaction, which are national models, e. g. SCSB (the Swedish Customer Satisfaction Barometer), DK in Germany (the Deutsche Kundenbarometer), etc. [1]. Here we are going to introduce and manipulate American one.

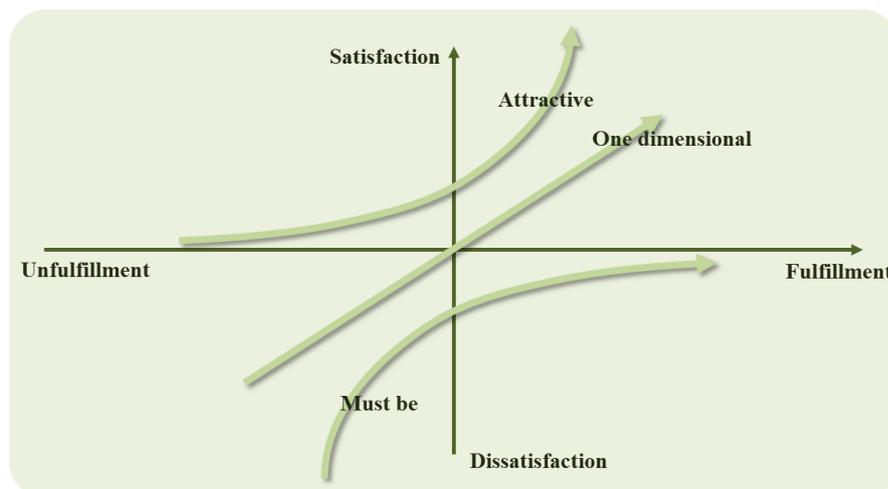


Figure 2. Kano model of customer satisfaction [55]

The American Customer Satisfaction Index (ACSI) is the national indicator of customer evaluations of the quality of goods and services available to U.S. residents since 1994. It is the only uniform, cross-industry and government measure of customer satisfaction (Figure 3.) [1].



Figure 3. American Customer Satisfaction Index (ACSI) model [1]

As shown in Figure 3, overall customer satisfaction (ACSI) has three antecedents: perceived quality (the served market's evaluation of recent consumption experience, and is expected to have a direct and positive effect on overall customer satisfaction), perceived value (the perceived level of product quality relative to the price paid), and customer expectations (measures the customer's anticipation of the quality of a company's products or services) [1].

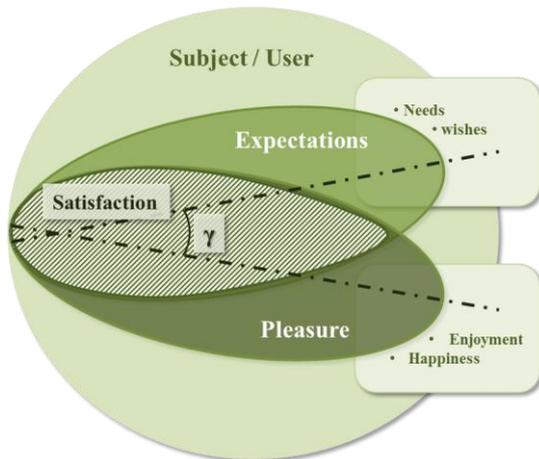


Figure 4. New satisfaction model with two main elements; expectations and pleasure (Source: authors)

In addition to mentioned models, authors have introduced a new model for satisfaction about a product or service (Figure 4.). As shown in Figure 4, we have two main elements (expectations and pleasure) in our mind that effect on satisfaction, and arranged angularly (we call this angle “ $\gamma$ ”); The lower the angle, the greater the intersection of these two elements, and thus the more satisfaction. In fact, the area between these two elements creates satisfaction. So, the lower “ $\gamma$ ”, provides the wider satisfaction area.

Also, according to what have been explained about satisfaction, it seems that there are two kinds of satisfaction; which are short term satisfaction (e. g. user satisfaction of specific product or service) and long term satisfaction (i. e. life satisfaction). The first is mortal and thematic, and the second is more constant and it extends to other matters in life. The short term satisfaction per se has two parts, which are primary satisfaction and afterward satisfaction. The primary

satisfaction occurs when someone faces to specific product and satisfy by his/her perception of the product's beauty and usability. The afterward satisfaction however arises after using the product and its ownership for a few time, so it will be closer to the real and comes from more logical judgment.

## 6. Design

Product design is a problem-solving activity, whose purpose is to develop a successful product fitting consumers' needs. To achieve this goal, systematic methods have been used by designers to obtain an optimal solution through the process of data collection, analysis, synthesis and decision-making [22]. The trend of product development is becoming toward the consumer-oriented, namely the consumer's feeling and needs are recognized as invaluable in product development for manufacturers [34]. User based design methods are abundant, like User centered design, emotional design, user experience, etc. Here four of user based design methods will be discussed; what they are, what is their main purpose, and how they are used.

### 6.1. User Centered Design

User requirements refer to the features/attributes your product should have or how it should perform from the users' perspective. User-centered design (UCD) is a discipline for collecting and analyzing these requirements [6]. Furthermore, UCD is a general term for a philosophy and methods which focus on designing for and involving users in the design [61], and is a product development approach that is concerned with the end users of a product and the philosophy is that the product should suit the user, rather than making the user suits the product [6].

UCD allows users to participate throughout the design process of a product that will fulfill the demands of the user and improve the usability of the product. Brown and Mulley's research demonstrated that UCD shortens overall development time and costs by reducing the number of changes required in the later stages of the design process which results to better quality products [54].

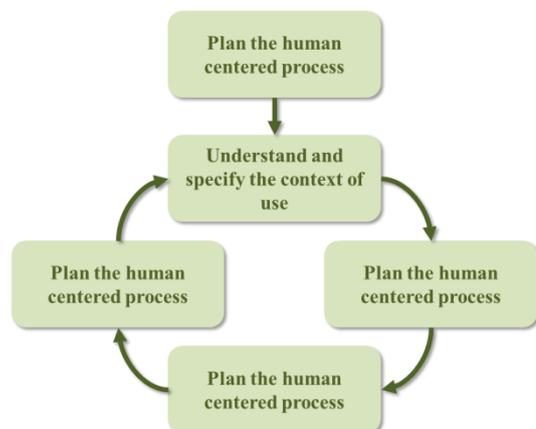


Figure 5. UCD cycle [59]

The User-Centered Design (UCD) model described by Buurman [3] advocates a design process that involves users in the whole design process in order to match the product to the user requirements and to increase its practical use. The process, unlike the common, technology and market driven model which most products follow, leads to more useful and usable products [54].

Maguire [59] mentioned a cycle for UCD process (from ISO 159 13407) (Figure 5.). It starts with planning the human

centered process and continued with the cycle with four main steps: understanding and specifying the context of use, specifying the user and organizational requirements, producing design solutions, and evaluating designs against requirements.

There are three key principles of UCD: An Early Focus on Users and Tasks, Empirical Measurement of Product Usage, and Iterative Design [6].

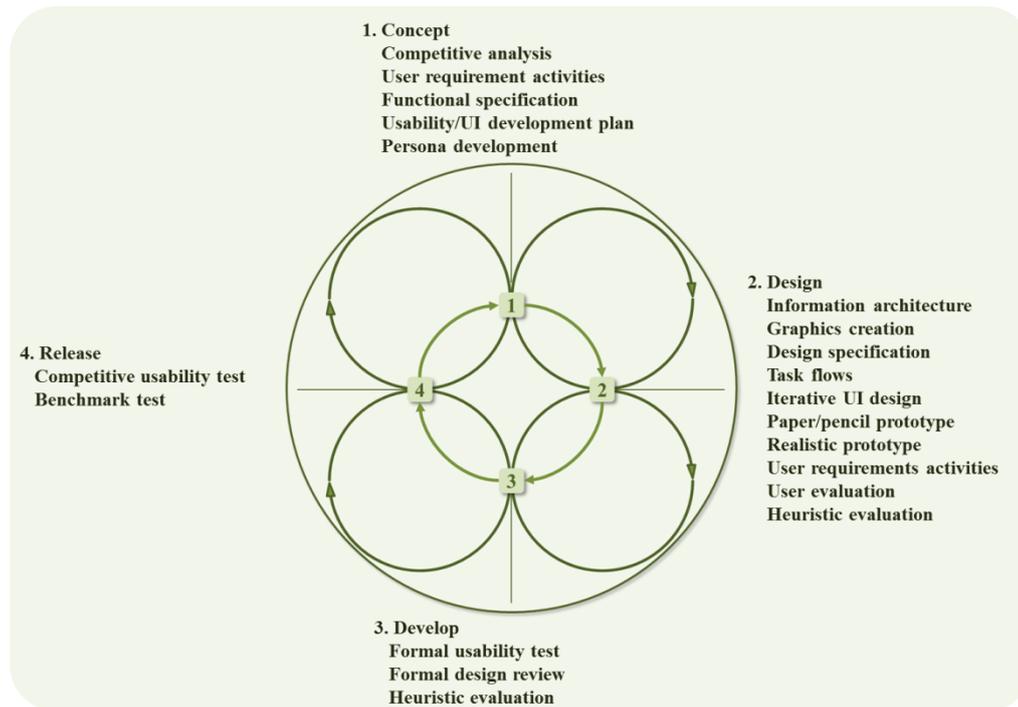


Figure 6. Product lifecycle with UCD processes incorporated [6]

Furthermore Courage and Baxter [6] introduced another model which shown in Figure 6. and has 4 stages; Stage 1, the “Concept” phase, encompasses the “early focus on the user.” The “Design” phase (stage 2) ideally incorporates the “early focus on the user” and “empirical measurement” principles of UCD. The “Develop” and “Release” phases (stages 3 and 4) tend to focus on the “empirical measurement” principle of UCD. Sample activities in each phase are discussed in this section (p. 6).

For many companies, usability begins and ends with the usability test. There is a clear difference between usability testing and user requirements gathering. Usability testing determines whether a given solution is usable. Requirement gathering provides insight into the many possible solutions and allows a person to select and investigate the best solution from the users’ perspective [6].

The most important thing in UCD process and philosophy is to focus on users from the early sections of design process and gathering user requirements and needs to reach more user satisfaction. Also how they work with the product is the main issue which designers must notice while using this method.

## 6.2. Kansei Engineering

The Japanese word, Kansei has the significance of feeling, impression and/or emotion [62] and means sensibility, feelings and cognition [23]. When translated into English it might mean ‘consumer’s psychological feeling and image’ [35], [42].

Professor Nagamachi began Kansei Engineering (KE) by combining psychological measurement and analysis methodologies with ergonomic measurement techniques. KE is indispensable for successful product development [23]. KE is a proactive product development methodology, which translates customers’ impressions, feelings and demands on existing products or concepts into design solutions and concrete design parameters; it is mainly a catalyst for a systematical development of new and innovative solutions, but can also be used as an improvement tool for existing products and concepts [42]. KE collects and organizes tools coming from other fields of research (mathematics, computer science, psychology...) in order to evaluate users, impressions [30]. Japanese designers have used KE as a consumer oriented ergonomic technology for developing new products [33].

There are six technical styles of KE methods; Type I through Type VI. Type I KE means Category Classification from zero- to nth- category. Type II uses a computer-aided system. Type III utilizes a mathematical framework to reason the appropriate ergonomic design. Type IV refers to KE system constructed by the forward and backward reasoning and Type V combines KE technology with Virtual Reality. Type VI is a new system of Collaborative Kansei Designing System in which the designers apart from each other collaborate to make a new design through an intellectual Internet using the kansei databases [36].

A flow of the KE Type I explained by Nagamachi [37] shows that it will start with the decision of strategy, and continues with collection of Kansei words, setting of SD scale the kansei words, collection of product samples, a list of item/category, evaluation experiment, analysis using multivariate statistical methods, interpretation of the analyzed data, explanation of the data to designer(s) and check of designer's sketch with KE candidate (p. 2).

### 6.3. User Experience

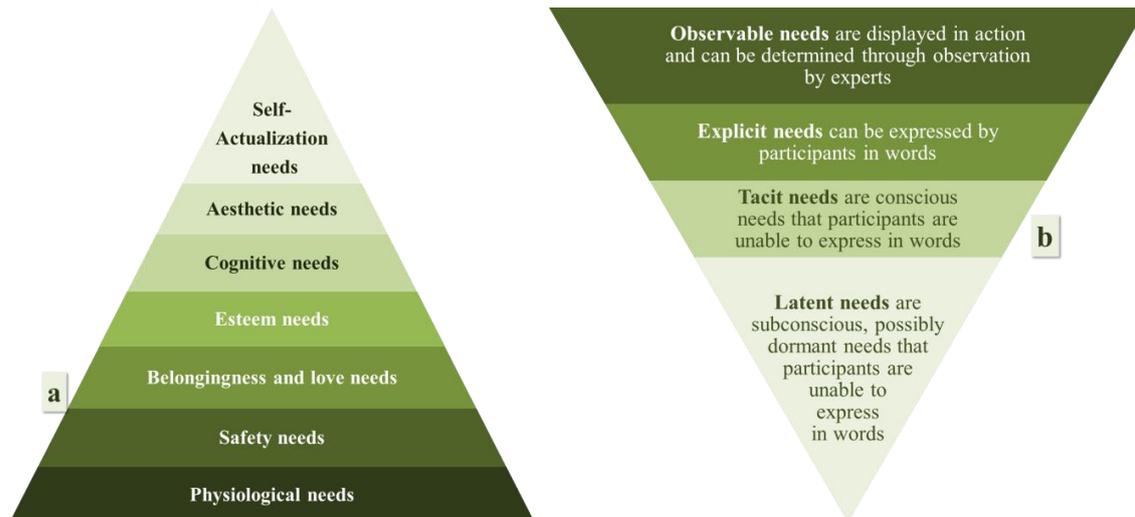
In the user-centered design process, we are focused on the thing being designed (e.g., the object, communication, space, interface, service, etc.), looking for ways to ensure that it meets the needs of the user. Also, in user-centered design, the roles of the researcher and the designer are distinct, yet

interdependent. The user is not really a part of the team, but is spoken for by the researcher [40]. User experience is a change from a user-centered design process to that of participatory experiences. It is a shift in attitude from designing “for” users to one of designing “with” users [40].

Design is about user experience rather than about the creation of products [31]. We understand an experience as “an episode, a chunk of time that one went through—with sights and sounds, feelings and thoughts, motives and actions, closely knitted together, stored in memory, labeled, relived, and communicated to others; An experience is a story, emerging from the dialogue of a person with her or his world through action” [19], [21].

The aim of “Experience Design” is to design users’ experiences of things, events and places [40]. There is a common understanding that UX is holistic – it emphasizes the totality of emotion, motivation, and action in a given physical and social context – and that it is subjective – focusing on the “felt experiences” rather than product attributes [53]. People can tell whether their experience had been positive or negative (i.e., affectivity) [21].

“Needs” would set the stage for Experience Design [21]. Maslow’s hierarchy of needs is shown in Figure 7 a. By explicitness of the needs, Sanders [40] had showed another pyramid that classifies these needs into 4 levels (Figure 7 b.).



**Figure 7.** (a) Maslow’s hierarchy of needs, (b) levels of need expression [40]

Sanders [40] mentioned that for understanding about what users experience, we can learn from what they say, think, do, use, know, feel and dream; and these communications depends on the levels of their needs (Figure 7 b.). She emphasizes that for accessing experience we must investigate what people say, do and make. Also Hassenzahl et al. [21] claimed that any experience has an “emotional thread” (p. 22).

Garrett [15] has introduced a model for user experience (Figure 8.) that starts with defining the strategy (user needs

and product objectives), the next step is defining the scope (functional specification (when get a product as functionality) and content requirement (when get a product as information)), next one is defining structure plane (interaction design and information architecture when get a product as functionality and information respectively)), skeleton plane is the other step (Interface design, navigation design and information design), and the last step would be surface step (sensory design).

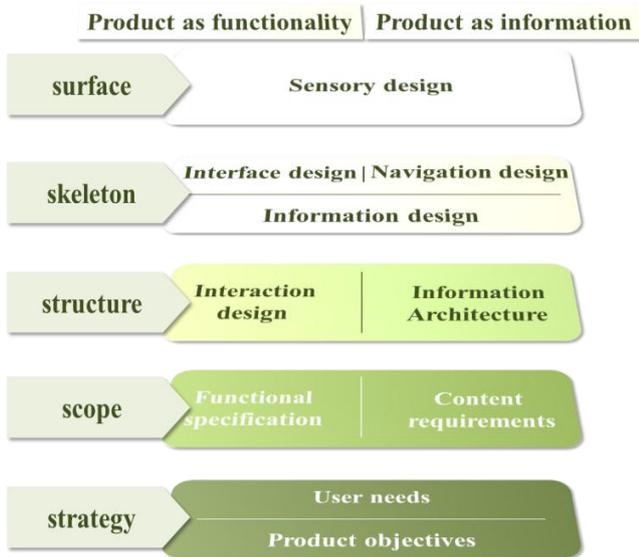


Figure 8. 5 levels of UX [15]

Zheng et al. [57] explained that “a proposed conceptual framework of UX-based personalized product development process consists of three models: physical model, cyber model and UX model. Physical model stands for the physical products (e.g. wrist band) and services (e.g. app subscription) in the real world. In personalized product development process, it mainly contains three parts: 1) personalized attributes, such as unique appearance or functions; 2) 3D-printed product prototype, which is utilized for rapid prototyping in a tangible way; and 3) smart functions, which act as the services attached to the product. Cyber model stands for the web-based virtual co-design resources. It normally consists of: 1) CAD models, which is the virtual presentation of the real product; 2) co-design product configuration system (or embedded co-design toolkits), which aims to facilitate the complicated co-creation process in a user-friendly manner; and 3) social media tools support, such as online community (e.g. Facebook, Twitter), which is mainly adopted to discover latent design information. UX model stands for the user’s affective factors (e.g. emotions) and cognitive behaviors (e.g. feedback) in the context of product development stages. Mostly, 1) marketing strategies (e.g. focus group, questionnaires), 2) real time analysis (e.g. eye tracker), and 3) design and usage context (e.g. virtual environment or physical environment) are exploited to modeling the UX. In the personalized product development, each model interacts coherently with others in a certain product development context. The existing physical model can be utilized for new design concept generation for product innovation; while in return, the established cyber model will be manufactured into the physical one as the end product. Also, users can obtain either tangible experience in a physical model or a visible experience in the cyber model, and reversely, specific co-design behavior or product-service evaluation can be derived based on the cyber model and physical model, respectively”.

#### 6.4. Positive Design

Positive design (PD) follows subjective well-being which based on positive psychology [10], [11]. At the end of 20<sup>th</sup> century and primary years of current century Positive psychology was raised by Martin Seligman and Mihaly Csikszentmihalyi to focus on mental health rather than mental illness [52]. Seligman [41] said that design, entertainment and technology can increase positive emotion and happiness in people. So, PD translates the elements of wellbeing and strategies that support the pursuit to live not only a good – but also a fulfilling life which into actionable design solutions [38].

Numerous studies have confirmed that it is not personal resources that make a person happy, but rather how those resources are exploited [11]. PD initiatives deliberately intend to increase people’s subjective well-being and, hence, increase an enduring appreciation of their lives. The PD framework combines three key components of subjective well-being (Figure 9.) [11].

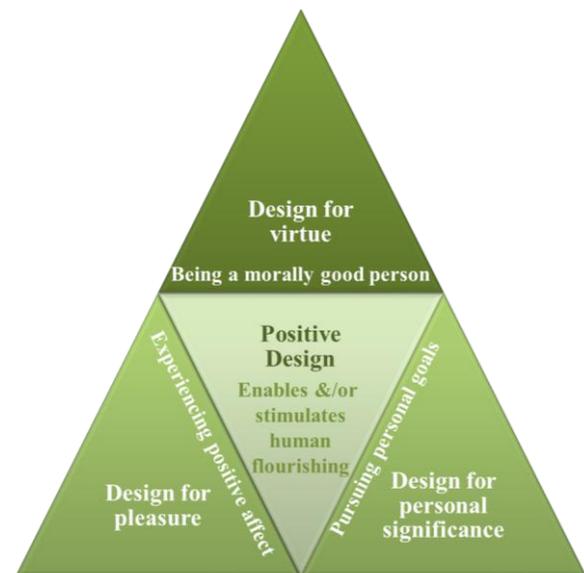


Figure 9. Positive Design (PD) framework [11]

Each ingredient independently stimulates subjective well-being; PD sits in the “sweet spot” where all three ingredients intersect. This intersection is where people flourish [11], which is having sense of meaning, engagement, interest and purpose in life in addition to positive emotion [41]. PD is design in which all three ingredients are deliberately designed for (see Figure.). It does not mean that the result should always address all three to the same degree, but it does mean that there should be no incongruities produced among these elements [11].

There are three parts in which the card-set can be applied: 1) understanding nuances in positive emotions 2) determining emotional intention of a product 3) facilitating creativity in design conceptualization. Part one by itself has 2 steps which are getting an overview of nuances among positive emotions, and identifying user emotions in relation

to a product, second part has 2 other steps: identifying activities to address, and specifying positive emotions to design for and third part has 3 steps: understanding eliciting conditions, generating ideas, and elaborating initial ideas [56].

It is not the products nor their material value, but what we do with products that can make us happy [11]. PD tries to give meaning to individuals' life, which will result in life

satisfaction not just limited satisfactory of one definite product, so it would shape the way which individuals live.

**6.5. An Overview of the Methods**

As stated about four of different kinds of user based design methods, here the outline of each method are presented to have a better overview of them in Table 2.

**Table 2.** The outline of four user based design methods (UCD, KE, UX and PD)

Method	Matter	Purpose	How to do
UCD	<ul style="list-style-type: none"> <li>• Focus on users from early sections</li> <li>• Empirical measurement of product usage</li> <li>• Iterative design</li> </ul>	<ul style="list-style-type: none"> <li>• Needs coordination</li> </ul>	<ul style="list-style-type: none"> <li>• Plan the UCD process</li> <li>• Understand and specify the context of use</li> <li>• Specify the user requirements</li> <li>• Product design solutions</li> <li>• Evaluate designs against requirements</li> <li>• Collection of Kansei words</li> <li>• Structuring SD scale</li> <li>• Collection of specimens</li> <li>• Classification of item/ category</li> <li>• Evaluation experiment</li> <li>• Statistical analysis</li> <li>• Interpretation of the analyzed data</li> <li>• Identification of influential design elements</li> <li>• Investigating what people say, do and make</li> </ul>
		<ul style="list-style-type: none"> <li>• User satisfaction</li> </ul>	
KE	Exploring emotion	<ul style="list-style-type: none"> <li>• Awakening pleasant feeling</li> </ul>	<ul style="list-style-type: none"> <li>• marketing strategies</li> <li>• real time analysis</li> <li>• design and usage context</li> <li>• personalized attributes</li> <li>• 3D-printed product prototype</li> <li>• smart functions</li> <li>• understanding nuances in positive emotions</li> <li>• determining emotional intention of a product</li> <li>• facilitating creativity in design conceptualization</li> </ul>
		<ul style="list-style-type: none"> <li>• User satisfaction</li> </ul>	
UX	<ul style="list-style-type: none"> <li>• Design experiences instead of products</li> <li>• User collaboration in all of design stages</li> </ul>	<ul style="list-style-type: none"> <li>• Experience coordination</li> </ul>	<ul style="list-style-type: none"> <li>• understanding nuances in positive emotions</li> <li>• determining emotional intention of a product</li> <li>• facilitating creativity in design conceptualization</li> </ul>
		<ul style="list-style-type: none"> <li>• User satisfaction</li> </ul>	
PD	<ul style="list-style-type: none"> <li>• Focus on users about their positive emotions</li> <li>• Guiding users to achieve better life</li> </ul>	<ul style="list-style-type: none"> <li>• Well-being</li> <li>• More happiness</li> <li>• Flourishing</li> <li>• Life satisfaction</li> </ul>	<ul style="list-style-type: none"> <li>• understanding nuances in positive emotions</li> <li>• determining emotional intention of a product</li> <li>• facilitating creativity in design conceptualization</li> </ul>
		<ul style="list-style-type: none"> <li>• Well-being</li> <li>• More happiness</li> <li>• Flourishing</li> <li>• Life satisfaction</li> </ul>	

As raised here, these four methods are similar to each other but a few differences make them separated. All of them are with the focus on users but with some differences; some of them focus on users to define their needs and some for defining their emotions and some focus to understand about both needs and emotions. The other thing that is important is that all of these methods want to be resulted in user satisfaction except PD that tries to get long term satisfaction.

**7. Discussion**

Due to the models that suggested by authors for beauty (Figure 1.) and satisfaction in the products (Figure 4.), we can find a relation between each of mentioned design methods with satisfaction and beauty in products. Figure 10. shows this relation about UCD method.

On the one hand, aesthetic judgment per se could lead to user satisfaction, in this way, the relationship between beauty and satisfaction in the product is shaped by aesthetic

judgment; Naturally, this judgment will also affect the person's pleasures and expectations. On the other hand, according to the UCD features, the most important point in this method is the product usability. So, the satisfaction and beauty which would be perceived from the product, would have a relation with its function. In the case of beauty, both experience and perception could get the product's function as beautiful and in the satisfaction case, the function would fulfill user's expectations and this fulfillment would be result in pleasure; however UCD's goal is not to create pleasure in the users, so here the pleasure has less space. The smaller the angle "α" in the object/product, the form will be more considered in the UCD process. UCD also tries to minimize the angle between experience and perception (β).

KE is about users' emotion, and tries to fulfill psychological needs more, so form is more important in this method. Pleasure plays the powerful role in the satisfaction case. It would have an effect on expectations, and is derived from both form and function of the product. But the pleasure

derived from the form is more important and noticeable than the pleasure derived from the product's function. Furthermore the perception in the beauty section is more important than experience, and would shape it sometimes.

The perception is also made about a form in the product (Figure 11.). The lower the “ $\alpha$ ” angle, the more and more powerful pleasure would be received, so the satisfaction will increase.

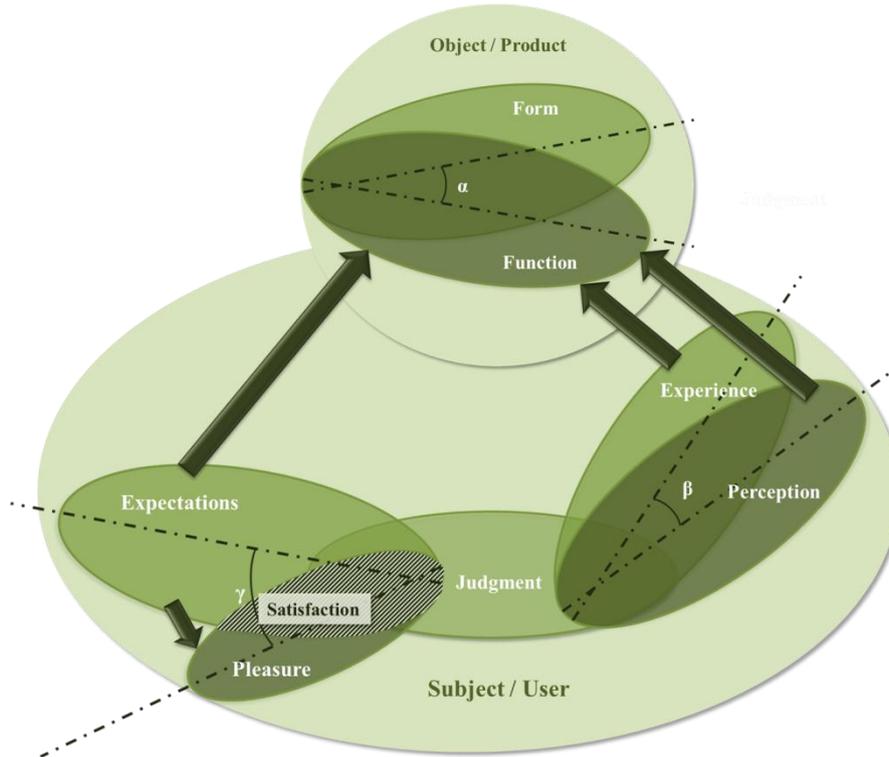


Figure 10. Relation between beauty and user satisfaction in UCD method (source: authors)

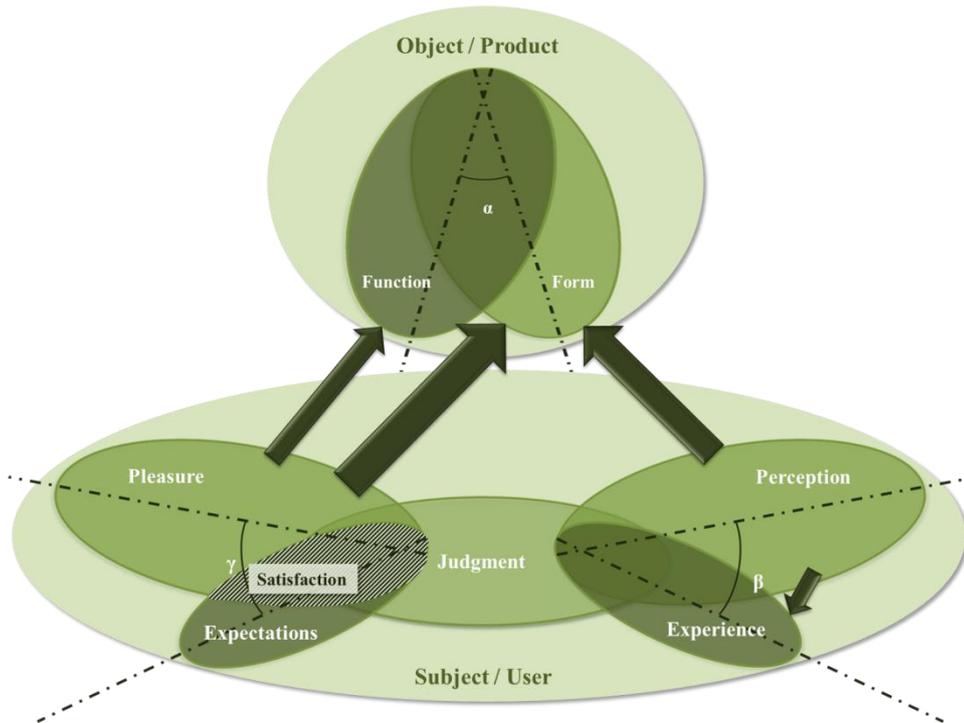
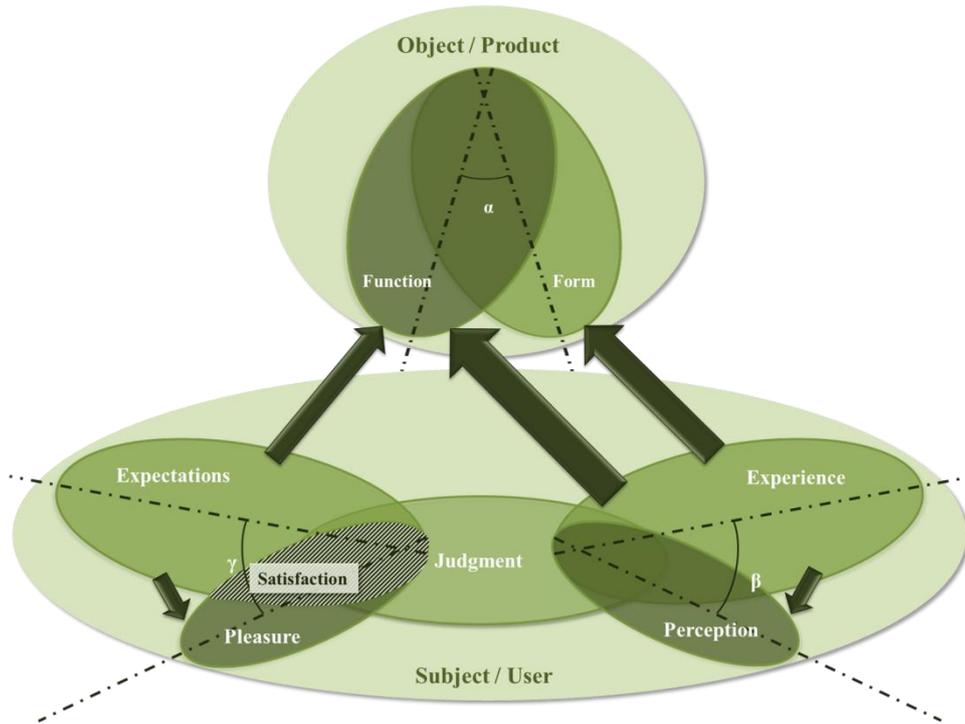
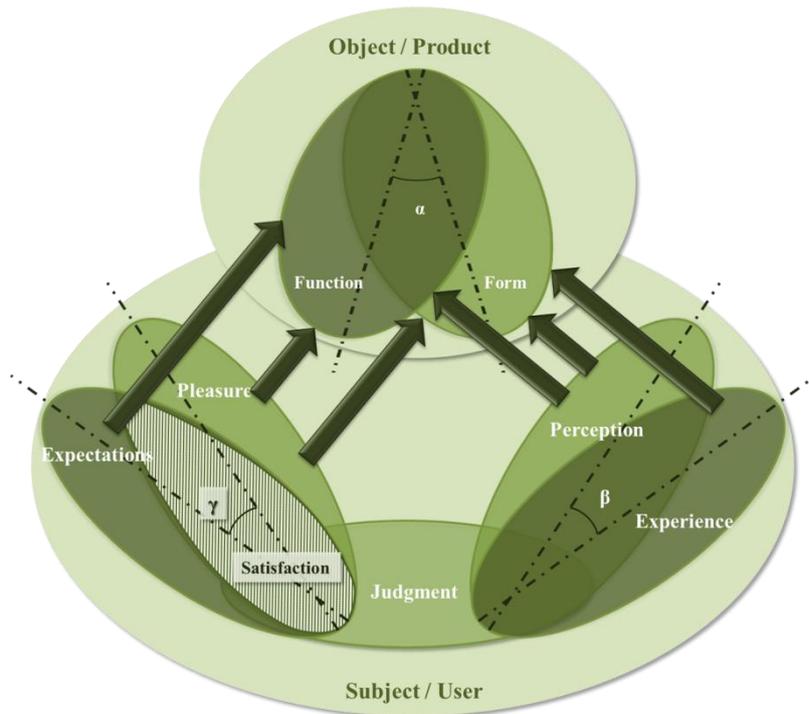


Figure 11. Relation between beauty and user satisfaction in KE method (source: authors)



**Figure 12.** Relation between beauty and user satisfaction in UX method (source: authors)



**Figure 13.** Relation between beauty and user satisfaction in PD method (source: authors)

UX is the method which summarizes everything in experiences, so the experience phase of beauty section is the most important part of the chart, and will have a relation with both form and function of the product; however the experience of function is more powerful but the form experience is important too (Figure 12.). This experience will shape the perceptions in beauty section. The lower angle “β” means that designers received better result of their

studies and perception is going to be a part of experience. At the other hand the expectations, mostly about the products function, are more important and if fulfilled would result in pleasure. It turns out that the smaller the angle “α”, the smaller the angle “γ” will be and satisfaction will grow.

PD seems to be more comprehensive method than previous mentioned. Positive emotions that it expects from the design to flourish will not be created just by the form of

the product. There must be that experience which UX discussed and so the whole product must change the way that users live. But here we are exploring about beauty in product and the formation of satisfaction. So by these data, perception and experience are with the same area and so closed to each other (so " $\beta$ " is low in this model), experience would be about form of the product according to emotional aspect of PD, and perception would be about both form and function. Also the pleasure is more important in the satisfaction section but expectations are closed to that and the " $\gamma$ " would be small. Pleasure relates to form and function of the product and expectation relates to function. In this model if " $\alpha$ " angle becomes narrower, it may be possible to estimate more satisfaction.

Moreover, Karapanos et al. (2009) identified three different phases of product use that lasted between 1 and 3 weeks: orientation (user's first experience with the product), incorporation (integration of the product into the user's daily life) and identification (product becomes part of the user's self-identity). In each of the three phases, particular product qualities are appreciated by users. In the orientation phase, important product characteristics are learnability and aesthetic stimulation (e.g. 'my first impression when I saw the box was WOW, very nice'). In the incorporation phase, aspects such as long-term usability (e.g. 'when I wear gloves, I am not able to work with the product') and usefulness (e.g. 'I could not believe it but it had no zoom!') become more important to users. In the identification phase, personal and social aspects of the product experience gain in importance (e.g. 'I felt good about having a better device than my colleagues') [44].

We classified satisfaction already in two main types; short term satisfaction and long term satisfaction, which short term satisfaction, had two levels, primary satisfaction and afterward satisfaction. With explanations of Karapanos et al. primary satisfaction of product would be in the orientation phase, afterward satisfaction would be in the incorporation phase and long term satisfaction would be generated at the identification phase. So beauty would have different meanings in each phase. As an example in orientation phase, beauty is about orderly proportions of the form and what users perceive and experience about it. In other phases the consideration of beauty would shift to product function, usability and what users experience about the relation of form and function. However, the long term satisfaction by mean of life satisfaction would not be generated just with three weeks usage of specific product and maybe for this kind of satisfaction more factors are needed.

According to Hassenzahl [18], Hedonic quality is related to Beauty both before and after use. Pragmatic quality and Hedonic quality are related to Goodness before use, but only Pragmatic quality is related to Goodness after use [49]. So primary satisfaction would be about the beauty of the product and beauty plays a dimmer role in other kinds of satisfaction.

The other point that can be mentioned here is about Figure 2. the Kano model, which identified three important quality for the product. Among these qualities, must be qualities can be the product function and the form which shapes that, and each product is included. One dimensional quality can be the product with additional functions and more beautiful forms; designers try to give this quality to all products. And the last quality (attractive quality) is what user based designs try to add to product design, like more need coordination, emotion, experience, and positive emotion and positive experience.

## 8. Conclusions

This study was about the relationship between product aesthetics and user satisfaction in some of user based design methods (UCD, KE, UX, and PD). To get this purpose we tried to introduce some new models about beauty in the product and user satisfaction. Also we tried to know how beauty will appear in the product and perceived by users, and how can beauty result in user satisfaction by user based design methods. So we introduced some new models about beauty in the product and the way which user satisfaction is generated. According to these models, we could show how beauty and satisfaction in relation to each other will connect to each of mentioned methods. The results show that beauty which will arise from UCD is about function of the product and experiences in users' mind and the satisfaction will be generated of fulfillment of users' expectations. In KE, perception of form awakens emotion and makes good experiences (beauty) and satisfaction would be about the pleasure which users find more in the form and less in function of the product. UX tries to make good experiences of product form and function, and this would have effect on users' perception. Also satisfaction in this method would be about fulfillment of expectations which will result in pleasure of users. In PD method there would be more connection among pointed factors; both perception and experience about form and function of the product are active and in other part, both of the fulfillments of expectation and pleasure would have effect on satisfaction.

Furthermore we discussed that satisfaction has two general type, short term satisfaction and long term satisfaction, and the short term one has two levels, primary satisfaction and afterward satisfaction. Beauty in the products would have different meanings in each of these types and levels. In primary levels it would more about form and its perception, and the more we go ahead, it would be about function and its experience.

Moreover, according to Kano model, beauty can be considered in one dimensional and attractive quality, which would be result in more and more satisfaction of the products. It seems that both form and function are important in these two kinds of quality and perception and experience of them also are consequential.

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