NordDesign 2006
August 16 – 18, 2006
Reykjavik, Iceland

An Ethnographic Study of Product Form Perception and Usability

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Abstract

This paper applies ethnographic methods to understand the nature of product form and the influence of usability, using experimental methods to investigate how users perceive and enjoy products, and investigate the commonalities and differences among different types of persons in perceiving product form.

Instead of simply tracing users' perception of product form, we also try to obtain data on how usability influences users' perception of products. Selecting the media player as an example, 24 industrial design students were asked to operate the real products, reveal the deficiencies of current mode of operations, suggest improvements of the product operations reliability, and then dictate the product form they expected. 10 experienced designers were asked to design a media player for University students. Protocol analysis and design sketch were adopted to analyze the acquiring and representing of designers' perceptual image of products' form. The results revealed that users thought of factors related to products' usability more than designers did, they proposed much more ideas of usage mode than designers. A 9-point Likert Scale method was then used to access designers' and users' preferences of 24 media player samples. Conjoint analysis method was applied to analyze the relation between preference and product form factors. Experiment results showed that there was a distinct difference between the designers and users, and it testified that the users concentrated on the product's usability.

Using ethnographic methods in human-centered product design helps designers analyze products' usability and design new products more adapted to users. The research also gave insights that led us to a user-participant view, rather than a production perspective in design study, would be necessary for success.

Key words: Product design, ethnography, perception, usability, conjoint analysis.

1 Introduction

In today's highly competitive market, it is a crucial issue to design new products that meet users' needs and tastes. To improve attractiveness, a well-designed product must not only satisfy users' physical requirements but also their psychological needs [1].

With the increasing attention to users' feelings regarding product design, some techniques have been used to access this information. However, the understanding of the links between the product characteristics and the users' feelings for the product is still limited. The difficulty lies in the fact that the users' feelings regarding a product are very complex cognitive processes and many intricate factors contribute to the perception mechanisms [2]. Besides explicit demands, there are implicit feelings in a user's mind. These implicit feelings are personal, context-specific, and therefore hard to formalize and communicate. It is related to people's personal experiences, values, beliefs, and perceptions of what a product means, etc [3]. Some systematic methods [4] dealing mainly with product's usage functions have been developed in engineering design to obtain successful products. Simultaneously, there are many industrial designers working hard with the products' aesthetic functions, and applied research methods from fields like cognitive ergonomics and technical psychology. These methods are frequently applied in the design of products, in order to prevent misunderstanding, or to reduce the users' mental confusion when they are using the product. However, the form of a product is often depending on the industrial designer's taste not on the users' feelings.

The aim of this study is to explore whether product usability would influence the users' emotion and recognition. In this study, we compared and contrasted the knowledge we acquired from users while they were operating media players with the experiences of media player designers. Ethnographic method, protocol analysis, the 9 point Likert Scale method and conjoint analysis method were used to access the data.

2 Research methods

2.1 Ethnographic Methods in Product Design

It is recognized that human, social, and cultural factors have a significant impact on product design. Ethnography is a branch of anthropology that seeks to understand and describe human activities from the perspective of the people in a certain culture and environment [5]. However, a perceptual image is sensory and perceptive. It is difficult to code and measure. Ethnographic methods, as a form of observational research, has been carried out in some universities and companies in order to address the tacit needs of certain sets of users [6]. Employing the process of watching without interfering as a phenomenon occurs in the natural environment, ethnographic methods concentrates on viewing the users doing their everyday activities in their own environment. It works on the governing principle that knowledge of how users use products tells us more than the users themselves can [7].

2.2 Verbal Protocol Analysis

Verbal protocol analysis [8] is a method that relies on self-reporting. It has been increasingly common in research on human's cognition, which is usually difficult to undertake in direct observation, by analyzing their verbal reporting.

2.3 Semantic Differential Method and 9 Point Likert Scale Method

To study people' implicit knowledge of product form, Osgood et al. [9] applied the Semantic Differential (SD) method. This study applied the similar 9 point Likert Scale method, where the subject's perception of product form is quantified on a 9 point Likert scale. The data will be analyzed by statistical techniques to extract possible significant patterns.

2.4 Conjoint Analysis

Conjoint analysis [10] is a statistical technique that originated in mathematical psychology. Today it is used in many of the social sciences and applied sciences including marketing, product management, and operations research. It is a tool that allows a subset of the possible combinations of product features to be used to determine the relative importance of each feature. The objective of conjoint analysis is to determine what combination of a limited number of attributes is most preferred by respondents. It is used frequently in testing customer acceptance of new product designs and assessing the appeal of advertisements.

3 Case Studies

This study uses the portable media player as object, investigates the relation between a product's usability and human's perception, and tries to identify differences between users' and designers' perception of products.

3.1 How to Access the Perception Image of Designers and Users

This study employs protocol analysis and ethnographic method to elicit the relevant data of designers' and users' feelings of the media players.

3.1.1 Designers' Perception of Media Player

In this step, protocol analysis and real-time drawing were adopted to acquire and represent designers' perceptual images of media players. The experiment was conducted in an open atmosphere permitting the designers to think and act as freely as possible.

Subjects: 10 experienced designers were selected. They were 26-30 years old, with at least 3 years experience in product design.

Tasks: The subjects were asked to design a media player for University students. During the process, the designers were asked to dictate what they were thinking. Their deliberations were recorded for analysis purposes.

Initial findings: Reports are summarized in 5 aspects: shape, color, texture, usage and emotion, see Table 1.

Table 1. Designers' image perception

	Description	η/%
Shape	small	20
	unique	20
	pretty	90
	harmonious□without over-decoration	20
	simple and geometric form	60
	surface with some small corners	40
	plump	40
	regular layout	50
	forms not too grotesque (odd)	20
	echo design, biomorphic form	40
	futuristic form	10
Color	silver color, without pure color	20
	light color, pink	10
	black and white	30
	orange or blue, with black, white, or gray	50

	bright-colored	60
	silver gray with black and red	30
	green-blue	20
	saturated-color, low contrast, simple	20
Texture	metal and frosted	80
	plastic	20
	combined with metal, plastic and ceramic	40
	semi-opacity	80
	metal, high glisten	70
	soft surface	20
Usage	with clips	80
	with new fittings, could be worn on neck or wrist, etc.	90
Emotion	sentient, abstract, ornamental, delicate, splendid, bright, unique	/

Note: η/% denotes the percentage of designers having proposed an idea.

3.1.2 The Study of Users' Perceptual Image

Ethnographic method was, when possible, adopted to acquire and represent the users' perceptual image of the selection of media players.

Subjects: In this procedure, we interviewed and observed 24 industrial design students, as the users of media players. The age range of the participants was 16-24 years.

Samples: 4 media players from 6 companies. In sum 24 samples.

Tasks: They were asked to operate the real products for a total of 4 hours, in order to reveal possible deficiencies in current modes of operations, and suggest improvements of the products operations reliability. While operating, they were asked to consider a question: "What kind of media player would you prefer, disregarding the price?". The experiment was conducted in a natural environment with no interference with users the operating and reflecting. The scribes concentrated on viewing the users operating the products, observed their activities, and wrote down what the candidate did and said for later analysis.

Initial findings: The users' perception from the verbal reports could also be classified in 5 aspects, as illustrated in Table 2.

Table 2. Users' perception of the products

	Description	η/%
Shape	pretty	91.7
	symmetrical	25.0
	mainly cuboids with some round corner	41.6
	forms like animals and plants	16.7
	thin, with big screen	12.5
	light and handy	29.1
	streamline	33.3
	heart-like form	8.3
	simple	58.6
Color	single color	12.5
	yellow, green-blue	4.2
	black	25.0
	silver-gray	58.3

	pink	8.3
	white and sky blue	29.2
	metal-color and sky blue	58.3
	bright color	75.0
Texture	metal, grinding	75.0
	dislike metal	12.5
	plastic	8.3
	ceramic	8.3
	semi-opacity	83.3
Usage	new usage mode	87.5
	chest hanging, could be matched to clothes, easy to take	66.7
	could be folded	12.5
	wireless	41.7
	disc-like, line can be stored	25.0
	simple to use, smart	91.7
	small and smooth, nice for handle	83.3
	could be wore on neck	75.0
	colored shell, could be replaced	33.3
Emotion /expression	fashion, soft, ornamental, lovely, active, lively, individuality, strong, beautiful	/

Note: η/% denotes the percent of users who have proposed the idea.

3.1.3 Discussion

Comparing table 1 and table 2, we found that: Designers paid more attention to the form of products, while users paid more attention to the usability of products.

(1) Comparison of the two tables shows that the users paid more attention to the usability of the product. They proposed nine usage methods. The most important suggestions of the users are “simple to use, smart”□91.7%□ “new usage mode” □87.5%□; “small and smooth, nice to handle”□83.3%□; “easy to take hold of”□66.7%□. All these suggestions are related to usage. However, designers only proposed two suggestions of usage: “with clips”□80%□and “with new fittings, could be worn on neck or wrist”□90%□ □

(2) Users seem to think about the usage when they related to the products. An example: Some users wished the product could be “thin, with a big screen”, and some users wished the product could be “light and handy”, etc. while almost no designers proposed similar product properties on their own initiative.

(3) Designers preferred to propose ideas and concepts. They expressed their perceptual image using abstract words, such as “soft, curve, echo design, simple, geometric, regular”, while users considered it in a detailed and concrete way. They expressed their feelings in material meanings, such as “symmetrical, forms like an animal or plant, streamlined, heart-like”, etc.

3.2 Study of Designers and Users’ Preference of Product’s Form

3.2.1 Experiments

In this procedure, the 9 point Likert Scale method and conjoint analysis method were used to analyze the relationship between a product’s form and subjects’ perceptual image acquired and represented in the experiment.

Subjects: 2 groups of subjects, same as 3.1.1 and 3.1.2

Samples: 24 pictures were selected from 103 product pictures as experiment samples. These samples were numbered randomly. To avoid a possible influence of color in this experiment, all samples were shown in gray tones as seen in figure 1.

Procedure: In this study, a 9 point mental measurement scale was applied to evaluate the subjects' preference degree of product. From the left (point 1) to the right (point 9) of the scale, the point was labeled as "dislike extremely", "dislike very much", "quite dislike", "dislike a bit", "normal", "like a bit", "quite like", "like very much", "like extremely well" , in that order.

The aim of the experiment was introduced to the subjects. Then the samples were projected on the white wall one by one. The subjects were asked to evaluate the samples according to the mental measurement scale. This experiment was conducted in a quiet room, and each candidate was asked to complete it on their own.

Figure 1. Media player samples

3.2.2 Initial results:

The data was collected and calculated. The T-Test method [11] was applied to compare the two groups of data (users' preference degree and designers' preference degree). We got P=0.002, which mean there was a notable preference difference between designers and users with some items. The average scores of the samples are illustrated in figure 2.

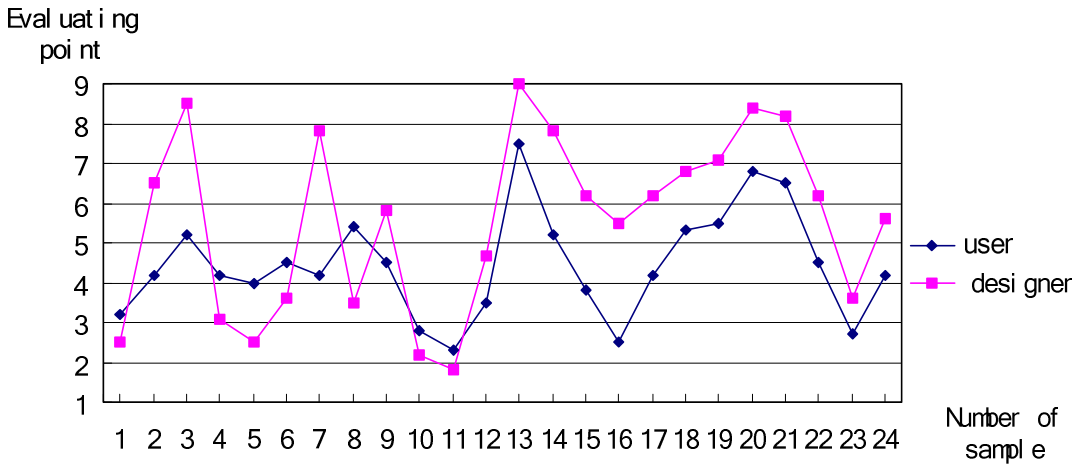

Figure 2. The product preference of users and designers

4 Form Factors of Product

Human's perception is a complex psychology process, influenced by many factors. From the aspect of product semantics and gestalt theory [12], the perception is partly caused by the integration of the product's form factors partly by proximity, similarity and continuity.

4.1 The hierarchical structure of media player

According to the product form structure, a product could be layered into 3 levels: product level, component level and feature level. The logical hierarchical structure of a media player is shown in figure 3:

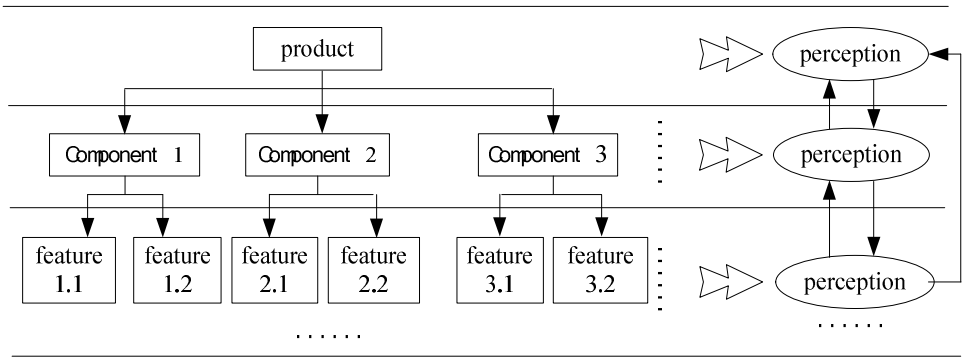

Figure 3. The form structure of product

The media player's form in this study is seen as composed of four main factors: body, screen, buttons, and decorations; the possible features of each factor could be classified into some types, shown in table 3.

Table 3. The form factors of the portable media players

Main factors	Sub factors			
A main body	a1 square	a2 organic form	a3 circle	a4 geometric form
B screen	b1 square	b2 arc	b3 organic form	
C buttons	c1 square	c2 ellipse	c3 organic form	c3 round corner
D decorations	d1 with screen	d2 with button	d3 with body	

4.2 Conjoint Analysis

Conjoint Analysis assumes that a product can be "broken down" into its component attributes. For example, a car has attributes such as color, price, size, miles-per-gallon, and model style. Using Conjoint Analysis, the value that individuals place on any product is equivalent to the sum of the utility they derive from all the attributes making up a product.

Taking preference value of users and designers as the dependent variable□the weight of form factor as the independent variable□and applying conjoint analysis□the weight of product form factor could be achieved, as shown in table 4.

A respondent's utility is a measurement of his or her relative degree of preference for each feature of the form factor of each level.

Table 4. The Weight of Form Factors

	User		Designer	
	Weight of main factor	Utility analysis	Weight of main factor	Utility analysis
a1 square	body	-0.6163	body	-1.3965
a2 organic form	30.07□	-0.4692	31.21□	0.0735
a3 circle		-0.0373		-0.0505
a4 geometric form		1.1227		1.3735
b1 square	screen	0.6753	screen	0.9007
b2 arc	21.65□	-0.0987	20.73□	0.0387
b3 organic form		-0.5767		-0.9393
c1 square	button	0.5338	button	0.1035
c2 ellipse	32.56%	-0.0673	28.62□	0.6335
c3 organic form		-0.1473		0.2295
c4 round corner		-0.3192		-0.9665
d1 with screen	decoration	0.1800	decoration	0.4947
d2 with button	15.73□	0.3650	19.43□	0.6147
d3 with body		-0.5450		-1.1093

4.3 Discussion

In table 4□the higher the percentage is, the more important the factor influence perception. To users□the form of button□32.56%□is the most important factor influencing their perception of a media player. The weight of the button plus screen equaled 54.21%. However, to designers, the form of the body□31.21□ □was the most important factor influencing their perception of media players. Since user's perception was influenced by the operation process, they focused on the factors related to usability more than designers.

5 Conclusions:

In this study, we have focused on the relation between a product's usability and perception, tried to learn the perceptional differences of designers and users occurring in the process of creating and using a product. Researching on users' and designers' perception and product's usability, may help us create tools to design products that will meet the user needs better.

(1) The usage of ethnography to design research constituted many challenges with the product design process. Using ethnographic methods to study the perception of users and designers showed how users actively participate in the product design process. If the design process

incorporates the user-participant perspective into new product creation, then it will be able to support both form design and product usability design better. Especially if a new usage method of a product is developed, user-participant design method will be more beneficial for both designers and users to learn and adapt to.

(2) Users' perception of product form image has particular characteristics, and there are marked perceptional differences in some cases between designers and users. To reduce the differences, user-centered design methods are essential. Designers should understand what users think about and desire. In order to develop a user-centered design system, a good understanding of how users recognize and experience a product must be achieved.

(3) The next step is to conduct experiments and prolonged observation of common users rather than industrial design students and to study the rules of cognition more deeply and broadly, for further researching and developing knowledge-based product design methods.

Acknowledgments:
This work has been financially supported by Chinese national Natural Science Foundation, Grant number: 60503068 and Zhejiang Natural Science Foundation (China), Grant number: M603059 and Y104256.

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