From Design to Humanity - A Case Study of Costumer Value Toward Dechnology Products

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Abstract. This study explores customer value using 13 dechnology products, and discusses differences in customers' preferences with regard to use of advanced technology, display of design aesthetics, and expression of human care. The experiment comprises two parts, elementary school students and netizens, in each group subjects are asked about their preference for and evaluation of product design attributes. Results show that the two independent samples were consistent when choosing the product they liked most, and that the only significant difference was their evaluation of the product's concern for humanity. This study uses a means-end chain to construct a customer value model for dechnology products, and further analyzes their attitude towards and preference for the products, thereby providing a basis for enterprises to evaluate the value they deliver to target customers.

Keywords: Dechnology · Aesthetic perception · Customer value · Means-end chain model

1 Introduction

All products and services in the market must contain customer value, to what extent, however, is an important consideration of consumers when deciding whether or not purchase it at the price it is offered. Hence, it is important to consider customer value when designing products or developing services. Although enterprises can use mature technologies, such as surveys or product trials, to test the market's reaction and reduce the risk of failure, in a competitive market where information is easily accessible, new products and services are constantly emerging, and there are diverse channels for advertisement, the ability to seek out customer value and make breakthroughs in value-added designs are keys to maintain a competitive advantage. How to customers perceive these products? What are the attributes of these products? How do these products deliver value to customers? These are important issues that this study will explore.

2   Communication and Customer Value

Based on previous studies (Lin 2007; Lin and Kreifeldt 2014), a three-level design model was proposed as shown in Fig. 1. A successful communication must satisfy three aspects: the first is a technical aspect that must allow the person receiving a message to see, hear, touch, and even feel; it involves precisely conveying a message. The second is a semantic aspect that must allow the person receiving a message to understand its meaning; it involves precisely conveying the original intention of the message without causing any misunderstanding. The third aspect is the effect of a message, how to let the person receiving the message take the correct course of action; it involves how to effectively influence expected behavior. This study divides design attributes based on this concept of communication into use of advanced technology, display of design aesthetics, and expression of human care (Hsu et al. 2011, 2013, 2014).
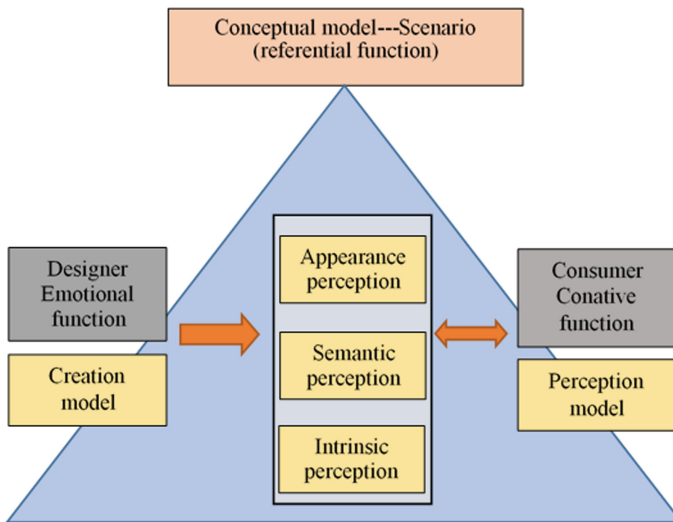

Fig. 1.   Three levels of a design model

Use of advanced technology refers to the systematic evaluation of techno-logical development trends that may influence competition in the industry, wealth creation, and quality of life. Advanced technology originates from anticipations of future technology, but emphasizes an open attitude using conscientious and creative approaches of science for predictions, hoping to explore long-term development opportunities and feedback future vision to current objectives and topics (Ko 2011). Product design is founded on the use of advanced technology, which can increase the product's value-added or create an excellent user experience. It is an effective competition strategy for developing market demand and increasing customer value.

Aesthetics is a set of principles for perceiving or appreciating beauty, and is the science of perceiving things with our senses. In traditional fields of design,

e.g. architectural design, product design, graphic design, and fashion design, aesthetics has long been an important subject. Even though the interactive aesthetics conveyed by industrial designers in the form of products is somewhat different from other fields, aesthetic elements that are explored are all based on the con-tent and form of interaction between people and things (Ma 2012). Hence, integrating aesthetic designs into technology products, so that the products may con-vey aesthetics and further interact with people is an important task of product designers.

Humanity is what drives design, if we use Maslow's hierarchy of needs: (1) physiological needs, (2) safety needs, (3) social needs, (4) esteem needs and (5) self-actualization needs in the technology aspect of product design, as well as the historical development of aesthetics, it corresponds to the functionality, friendliness, fun, uniqueness, and experience of perceptual technology (Lin and Kreifeldt 2014). When people satisfy high level needs, they begin to enrich their lives through experiences. This explains why the design of any product should be based on human care.

2.1 Customer Value

Studies on customer value adopt two main perspectives, one is the traditional rational perspective and the other is an experiential perspective. The experiential perspective evaluates the intrinsic pleasure symbols of a product, as well as the customer value of an aesthetic and enjoyable experience. Woodruff (1997) defined customer value as a customer perceived preference for and evaluation of those products attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situations. Product attributes can by a symbolic meaning, hedonic response, or aesthetic standard. On the other hand, the rational perspective evaluates products based on their utility or effectiveness, which is also referred to as rational consumption value. Kotler (2003) defined it as an offering, including combinations of options, and evaluated the potential difference between overall customer benefits and cost, e.g. problem solving and satisfying demand. Hence, Huang (2001) believed that scholars who define value by its effectiveness, cost-benefit ratio or difference take on a rational perspective, while scholars who emphasize emotions and preferences take on an experiential perspective.

Holbrook (1994) further divided customer value into three aspects, namely extrinsic value and intrinsic value, self-oriented value and other-oriented value, and active value and reactive value. The categories of customer value, namely efficiency, excellence, status, esteem, play, aesthetics, ethics and spirituality, based on these three aspects are shown in Table 1 (Holbrook 1999) quoted from (Yao 2009).

Table 1. Categories of customer value

		Extrinsic	Intrinsic
Self-oriented	Active	Efficiency (O/I, Convenience)	Play(Fun)
	Reactive	Excellence(Quality)	Aesthetics(Beauty)
Other-oriented	Active	Status(Success, Impression Management)	Ethics(Virtue, Justice, Morality)
	Reactive	Esteem (Reputation, Materialism, Possessions)	Spirituality (Faith, Magic, Ecstasy)

2.2 Means-End Chain Model

The basic concept of the means-end chain model can be traced back to an approach proposed by psychology researchers in studies on human behavior in the 1930s. This model believes that customers' purchase motivation is not for the object itself, but a connection with the object created through a series of value evaluations and choices. This connection is meaningful and is an exploration of the relationship between the object and customers' abstract values. Ladder analysis is employed to analyze how customers form meaningful connections between product attributes, results and goals, and further explain the hierarchical relationship between value perception and customer behavior (Yang 2012). In short, the means-end chain model is used to explore how customers choose products, and which results serve the purpose of which values held by consumers.

Hence, the main purpose of the means-end chain model is to construct and explain the connection made by customers between product attributes, results and values (Gutman 1982). Figure 2 shows that attributes-results and results-values form a two stage means-end chain, in which results are a means and also an end. Olson (1983) (quoted from Huang (2001)) derived six levels from this model (see Fig. 2), in which products have concrete and abstract attributes, customers that purchase the products gain functional or social results, at which time results transforms from an end to a means to satisfy customers' goals, and further realizes utility and the ultimate value. This is how the attribute-results-values chain operates.
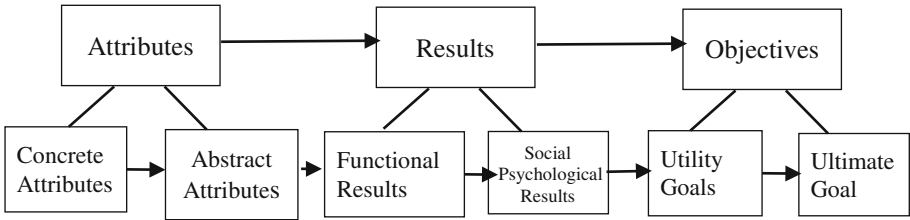

Fig. 2. Means-end chain model

3   Research Methodology

Based on the exploration of design attributes and customer value in chapter two, the three levels of the means-end chain model can be used. Content analysis showed that in the three levels of the design model, appearance perception corresponds to attributes, semantic perception corresponds to results, and intrinsic perception corresponds to goals. Hence, this study divides customer value of dechnology into three stages: stage one is the literature review and theoretical foundation above; stage two uses a sample of dechnology products and designs a questionnaire survey based on three categories of design attributes; stage three comprises data organization, statistical analysis, research on customer value theories and perception, explores research results, constructs a new design model for dechnology products, and obtains possible conclusions and recommendations.

Technology is rational while aesthetics is perceptual. The two are like two sides of a scale, but if they can be combined, the results will be worth looking further into. Dechnology is one approach to finding a solution.

Dechnology stands for Design + Technology. Its main purpose is to channel Taiwan's rich design energy into value-added aesthetic design of technology products, hoping to combine the ration left brain of scientists with the sensitive right brain of designers, allow technology to breakthrough its constraints, and transform technology into moving products in the market (Zhang 2012). This study uses the innovative products of Dechnology 2014 New Collection shown in Table 2 as the research sample, and explores the relationship between design attributes and customer value from the perspective of customers Hung and Huang (2013).

Table 2. Products in the sample

1(A)	2(B)	3(C)	4(D)	5(E)	6(F)	7(G)
Sheathing Fabric Pot	Cake Steamer	Low Temp.	Portal	Purification Bag	Beauty Mirror	Sit Properly

8(H)	9(I)	10(J)	11(K)	12(L)	13(M)
Flip IRB	Water 911	Health Travel	Ultrasound Monitor	Medical HMD	Touch Handlebar

Based on the discussion on communication and customer value in chapter two, a questionnaire survey consisting of two parts is conducted. Subjects of the first group are 72 elementary school students (41 boys and 31 girls, ages 10–11) of grade 5 and

products shown in Table 2 are printed out on the questionnaire. Subjects of the second group are netizens of a model making blog and an online questionnaire survey is conducted; 120 effective samples were collected, the majority are in the ages 21 ~ 25 (31 %), followed by 20 years and younger (24 %). The items are measured on a 5 point Likert scale, in which 1 indicates strongly disagree and 5 indicates strongly agree. The questionnaire displays images of the products, and subjects are asked to choose their preference with regard to use of advanced technology, display of design aesthetics, and expression of human care. This is used to analyze whether if the value conveyed by the designer and the product is significantly correlated with customer value. It is also used to verify the hypothesis that design attributes are intrinsic customer values, and that customers use the perception model to determine their preference for a product.

4   Results and Discussion

4.1   Experiment Results

Table 3 shows test one and test two subjects' preference and compatibility with the three design attributes, in which the average preference was 3.6 in test one and 3.7 in test two. Subjects of test one and two both preferred products (E) and (I) the most with an average score of 4; their scores for the three design attributes were also above 4. This shows that subjects' preference is in direct ratio to the three design attributes. Products (E) and (I) have bright colors, vanguard design, and their use satisfy human needs, which makes them the most popular among different groups.

Table 3. Average scores for compatibility with product attributes in tests one and two

Test 1: Evaluation by elementary school students					Test 2: Evaluation by Netizen				
Attribute Product	Preference	Technology	Design Aesthetic	Human Care	Attribute Product	Preference	Technology	Design Aesthetic	Human Care
1(A)	3.2	3.4	3.2	3.3	1(A)	3.3	3.7	3.3	3.6
2(B)	3.8	3.9	3.5	3.4	2(B)	3.3	3.7	3.8	3.3
3(C)	3.5	3.7	3.4	3.3	3(C)	3.7	3.8	3.7	3.6
4(D)	3.9	4.0	3.9	3.7	4(D)	3.8	4.0	4.0	4.0
5(E)	3.9	4.2	3.9	3.9	5(E)	4.0	4.1	3.9	4.2
6(F)	3.3	3.5	3.6	3.5	6(F)	3.5	4.1	3.3	4.1
7(G)	3.8	3.8	3.7	3.7	7(G)	4.0	3.9	3.9	4.3
8(H)	3.7	4.1	3.8	3.9	8(H)	3.5	3.9	3.3	3.9
9(I)	4.1	4.3	4.1	4.0	9(I)	4.0	4.1	4.0	4.1
10(J)	3.9	4.1	3.9	4.0	10(J)	3.8	4.0	3.7	4.3
11(K)	3.4	3.8	3.6	3.9	11(K)	3.6	4.1	3.6	4.1
12(L)	3.3	3.7	3.4	3.9	12(L)	3.7	4.2	3.4	4.1
13(M)	3.8	4.2	3.9	4.1	13(M)	3.6	3.9	3.3	4.1

4.2   Elementary School Students

Correlation analysis of the preference, technology, design aesthetics, and human care scores of elementary school students are shown in Table 4. All four are significantly positively related (p < 0.001), and the correlation coefficient all reached a certain level. Preference is then used as the dependent variable and technology, design aesthetics, and human care are used as independent variables in multiple regression analysis. The regression model constructed is shown below:

$$\text{Product preference} = 0.08 + 0.65(\text{Technology}) + 0.67(\text{Design aesthetics}) - 0.39(\text{Human care})$$
$$\text{Adj.}R^2 = 0.92, P < 0.01$$

The model shows that product preference is affected by technology, design aesthetics, and human care with standardized regression coefficients of 0.65, 0.67 and -0.39, respectively. This shows that use of advanced technology and display of aesthetic design have a relatively strong influence on elementary school students' preference for products, while human care does not. We can reason that elementary school students gain a more direct perception from the appearance and symbols of products, or the utility and aesthetics of products, but gain less from intrinsic emotions of human care. This is possibly related to their incomplete socialization and education.

Table 4. Correlation analysis results for elementary school students

	Preference	Technology	Design aesthetics	Human care
Preference	1			
Technology	0.91***	1		
Design aesthetics	0.92***	0.89***	1	
Human care	0.71***	0.85***	0.81***	1

***p<0.001

4.3   Netizens

Correlation analysis of the preference, technology, design aesthetics, and human care scores of netizens are shown in Table 5. All four are significantly positively correlated (p < 0.001) and their correlation coefficient reach a certain level. The model generated from multiple regression analysis is shown below:

$$\text{Product preference} = -.15 + 0.46(\text{Design aesthetics}) + 0.54(\text{Human care})$$
$$\text{Adj.}R^2 = 0.90 \ P < 0.01$$

The standardized regression coefficients of design aesthetics and human care are 0.46 and 0.54, respectively, showing that the influence of human care on preference is

higher than design aesthetics. Technology did not have a significant effect on the preference of Netizens, which may be due to subjects frequently receiving technology related information and are more exact when evaluating products' use of advanced technology. This result indicates that online consumers not only require dechnology products have an aesthetic appearance, but also offer intrinsic values as well.

Table 5. Correlation analysis results for Netizenss

	Preference	Technology	Design aesthetics	Human care
Preference	1			
Technology	0.63***	1		
Design aesthetics	0.65***	0.17***	1	
Human care	0.77***	0.77***	0.2***	1

***p<0.001

4.4 Comparison of Elementary School Students and Netizens

Independent t-test is employed to evaluate the influence of elementary school students and netizens' preference on the three design attributes. A significant difference was found between the opinions of elementary school students and netizens regarding products' human care (t = 3.21, p < 0.05), but there was no significant difference in terms of preference, technology, and design aesthetics. This shows that age will affect subjects' intrinsic perception of products, and further result in different evaluations of the expression of human care.

4.5 Customer Value Design Model for Dechnology Products

The statistical analysis above shows that customers' perception of product attributes will influence their preference for products, and we can further infer that design attributes are highly correlated with customer value. Therefore, after combining the pyramid-shaped perception model of design communication with the means-end chain model and customer values table, the resulting customer value design model for dechnology products is shown in Fig. 3.

Figure 3 shows that the values delivered by design attributes are closely related to customer values. The relationship between different design elements used by designers and the values desired by target customers are a crucial factor in the design process Chen (2012). Although the entire design process is strongly subjective, the customer

value table can be used to analyze and evaluate if customers know the design elements that deliver value, and allow developers to find a balance between design elements and customer value, making products closer to customers' expectations and deliver values desired by customers.
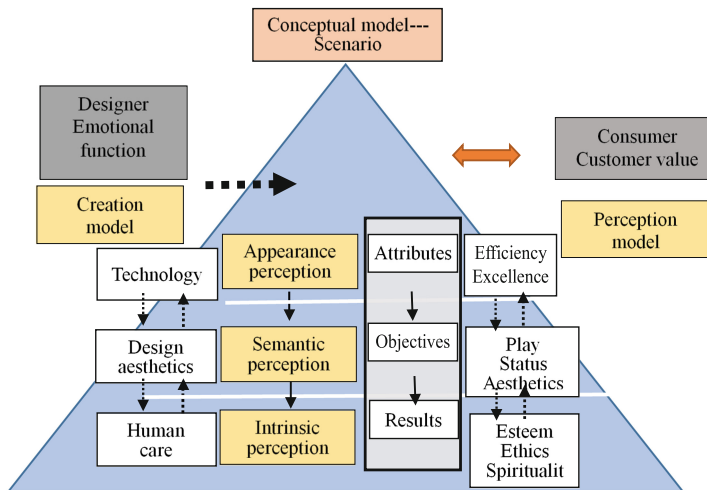

Fig. 3. Customer value design model for dechnology products

Design communication of dechnology involves a vast scope. Besides the efficiency offered by the technology, it also includes rational values such as utility, price, taste and status, and experiential values such as profound aesthetic content and symbols and spiritual value. Based on the model displayed in Fig. 3, this study uses content analysis on the customer values in the sample and combines it with the customer value table of Huang (2001) into Table 6.

Based on the model in Fig. 3 and analysis in Table 6, products in the sample of this study, whether it may be for living, sports, travel, medical devices, multimedia, home appliances, or lighting, the main characteristic is they are used by customers as a habit, hobby or interest, and most importantly they satisfy customers' intrinsic needs. This study found that every product contains the eight customer values of Holbrook (1999), only that the ratio of each customer value varies with the product's purpose. This is consistent with the fact that age or other factors of the two groups will result in significant correlation with the design attributes, especially the expression of human care.

Table 6. Customer values for dechnology products

MEC	Attributes	Results	Objectives	Sample
Design modal *Customer Value*	**Appearance**	**Semantic**	**Intrinsic**	
Efficiency	Easy to use Simple Search Physiological Price utility	Save time Comfortable Save/Health	Free Pleasure Meet Achievement	
Excellence	Achieve Professional Specific store	Worth it Taste Satisfactory service	Comfortable life Security Achievement	
Status	Luxury Impression Management	Status upgrade Confidence Success Interpersonal	Recognition Belonging Achievement	
Esteem	Brand owners Particular type Service Wearing appropriate	Reputation Self-expression Position Affirmative	Get respect Achievement Strengthen self-esteem Pleasure	
Play	With Diversity Voluntary Creative	Growing up Importance Relief Save	Meet/Free Accomplishment Pleasure	
Aesthetics	Color Pattern Modeling Cultural Fashion	Pleasing Craving Confidence Popular	Pleasure Achievement Comfortable life	
Ethics	Boycott Expose Charitable	Justice Ethics Virtue	Responsibility Helping sense of achievement	
Spirituality	Style Gregarious Divine Faithful	Identity Fascinated Magic Safe	Spiritual freedom Heaven Pleasure	

5   Conclusion

Customers receive information of design attributes conveyed by the product using their perception model, generate a connection with the product, and further develop a subjective evaluation of the product. This study found that elementary school students and Netizens both preferred the same products. A good product must be able to continuously past the tests of its customers, and the products that were preferred contained customer values that satisfied the needs of most people. There are eight customer values that form the core values of customers, and products that deliver these values will gain unmatched competitiveness.

This study also found that there was no significant difference between scores given by the two groups for technology and design aesthetics, but there was a significant difference in human care. Observing based on the customer value theory, the former are rational perspectives that emphasize effectiveness and utility, and thus generally result in the same opinions between groups. The latter is an experiential perspective that emphasizes intrinsic pleasure, emotions and preference, and there are thus greater differences between age groups and individuals. Hence, product design can target the needs of different groups to find a niche market.

Therefore, whether enterprises embrace several customer values or focus on a single customer value, communicating through products and satisfying customers' needs is the one and only way to run a business. Before beginning the design of a new product, studying the connection between design attributes and customer value in the planning process, and understanding values of target customers will increase the product's success rate. Future studies may look into different products or groups to strengthen the theoretical foundation, or develop a more exact means-end chain model for design communication, and help evaluate customer value before products enter the market.

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