

Nov 17th, 12:00 AM

A Study of Consumer Perception in Innovative Product.

Rungtai Lin
National Taiwan University of Arts

Chia-Ling Chang
National Cheng Kung University

Yen-Yu Kang
Mingchi Institute of Technology

Follow this and additional works at: <https://dl.designresearchsociety.org/drs-conference-papers>

Citation

Lin, R., Chang, C., and Kang, Y. (2004) A Study of Consumer Perception in Innovative Product., in Redmond, J., Durling, D. and de Bono, A (eds.), *Futureground - DRS International Conference 2004*, 17-21 November, Melbourne, Australia. <https://dl.designresearchsociety.org/drs-conference-papers/drs2004/researchpapers/52>

This Research Paper is brought to you for free and open access by the Conference Proceedings at DRS Digital Library. It has been accepted for inclusion in DRS Biennial Conference Series by an authorized administrator of DRS Digital Library. For more information, please contact DL@designresearchsociety.org.

A Study of Consumer Perception in Innovative Product.

Rungtai Lin

National Taiwan University of Arts

Chia-Ling Chang

National Cheng Kung University

Yen-Yu Kang

Mingchi Institute of Technology

With increasing global competition, innovative products are not merely desirable for a company; rather, they are mandatory. In today's intensely competitive business climate, innovation becomes central in product development. To be successful, innovative products must have a clear, significant, point of difference that is related to a need in the market place. Furthermore, changes in consumer perception regarding innovation are also important in product design. The main purpose of this work is to study factors affecting designers' and users' perception in innovation; these factors are discussed in order to eliminate differences between designers' and users' perception of innovative products. Subjects are sampled from students with different backgrounds. Multidimensional scaling analysis is performed to transform subjects' preference evaluations into geometric distance for a multidimensional configuration for studying the subjects' perception of innovation.

The results are summarized as follows:

- 1** Specific training in design has an influence on the innovative product form.
- 2** In all innovative product categories, only the category of "me-too" can be distinguished from other innovative product categories by all subjects whether they have a design background or not.

A study of Consumer Perception in Innovative Product

Rungtai Lin*, and Chia-Ling Chang **

* Department of Crafts and Design, National Taiwan University of Arts, Taiwan.

** Department of Industrial Design, National Cheng Kung University, Taiwan.

ABSTRACT

With increasing global competition, innovative products are not merely desirable for a company; rather, they are mandatory. In today's intensely competitive business climate, innovation becomes central in product development. To be successful, innovative products must have a clear, significant, point of difference that is related to a need in the market place. Furthermore, changes in consumer perception regarding innovation are also important in product design. The main purpose of this work is to study factors affecting designers' and users' perception in innovation; these factors are discussed in order to eliminate differences between designers' and users' perception of innovative products. Subjects are sampled from students with different backgrounds. Multidimensional scaling analysis is performed to transform subjects' preference evaluations into geometric distance for a multidimensional configuration for studying the subjects' perception of innovation. The results are summarized as follows: (1) Specific training in design has an influence on the innovative product form. (2) In all innovative product categories, only the category of "me-too" can be distinguished from other innovative product categories by all subjects whether they have a design background or not.

Keywords: creativity perception, innovative product, product design, human factor, design management

1. INTRODUCTION

In today's competitive environment, "innovation" serves as a competitive advantage that allows companies to dominate particular market segments. With respect to corporate strategy, innovation is not only the key to extended market share, but also the key to increased commercial gains [1]. For product design, an innovative product must be designed without violating the company strategy. According to Norman's mental model [7], the innovation of a new product must be appreciated and recognized by the users. Yet, users form a total image of a product instantly from its appearance (form), without pondering deeply over it [2]. The formation of a product's image is heavily tied to its perceived form, thus product form is a significant factor that draw people's attention. As a result, form is the key factor for the innovative products.

In other words, the product form must be endowed with an immediate attraction, which renders user's perception of innovative product form an important issue for study.

Moreover, concerning corporate product strategy, designers must select an innovative category from the product strategy when designing products. Recently, some researchers proposed different opinions about innovative product categories. For example, in 1991, Crawford [5] introduced the five definitions of new products, based on the product itself and how the product was received. In addition, Veryzer [10] identified different innovative categories according to the dimensions of both product and technology. He divided the innovative categories into four kinds, from the lowest to the highest. Earlier, Roberson [8] mentioned three categories of consumer adoption of innovations. Finally, from the viewpoint of companies, Motokazu & Chihiro [6] divided the driving forces of innovation into four categories based on the previous studies as illustrated in table 1.

Table1. Conceptual framework of innovative product (Motokazu & Chihiro, 2000)

4 driven of innovative product	Explanation
(1) Market-DrivenProduct	develops new group of consumers.
(2) Technology-Driven	Product scores a great success with innovative technology.
(3) Me-too	Product gets ahead in technology and market. It imitates competitive product and divvy to the market.
(4) Conception-Driven	Product has potential and high acceptability in the market, and the concept of product is the leader of market and technology innovation.

Based on a user-centered viewpoint, this study attempts to uncover the attributes that impact innovative products by studying consumer perception of product form and innovative categories. The purpose of this work is intended to provide designers with an idea of how to concentrate their efforts when designing innovative products in the early design stages.

2. METHOD

This study involved using preference evaluations and MultiDimensional Scaling (MDS) analysis to analyze the cognitive factors affecting consumer perception of innovative products. The work consisted of two different sessions including pilot study and preference evaluations. First, the pilot study was intended to select stimulus samples and attributes of innovative form and category for subjects' evaluation. Second, the preference evaluations were composed of evaluating attributes that affect innovative form and category. Finally, the MDS was used for analysis of preferences to construct

a subjects' preference space of "perception of innovative form" and "perception of innovative categories". From this, it is possible to discuss the factors affecting innovative form and category.

2.1 Pilot study

(1) Stimulus samples: Mobile phones were chosen as the stimulus samples because the product is popular and well-developed in the market. Fifty samples were selected from the web sites of the leading mobile phone makers in the third quarter of 2003. 14 product designer and 21 college students served as the subjects for rating and ranking the most characteristic and representative from the 50 samples. With statistical analysis, 14 samples were chosen as the stimuli samples in preference evaluations, as shown in figure 1.



Figure1. The final 14 mobile phone samples

(2) Selecting attributes of innovative form: Ninety bipolar adjectives related to attributes of form were collected from the previous studies [3, 4, 9]. Subjects, which included fifteen product designers and seventeen college students, were asked to rate and rank the importance of 15-20 groups of attributes that would influence the innovative form. Based on these importance ratings, the top 13 attributes (F1~F13) were selected as the bipolar adjectives in the preference evaluations, as shown in the table 2.

Table2. 13 attributes of innovative form

F1. geometric vs. streamlined	F8. ordinary vs. unique
F2. conservative vs. progressive	F9. classical vs. fashion
F3. complicated vs. concise	F10. static vs. dynamic
F4. ancient vs. hi-tech	F11. invaluable vs. valuable
F5. tendency vs. alternative	F12. abstract vs. concrete
F6. un-design vs. designed	F13. unnoticeable vs. attractive
F7. decorative vs. functional	

(3) Selecting attributes of innovative categories: The four innovative categories

proposed by Motokazu & Chihiro (Table 1) were adopted as the base to study the difference of innovative categories. For our study, the relationship between the innovative form and innovative category “product-driven” was added as the fifth category. The 13 attributes of the innovative categories (C1~C13) are shown in [table 3](#).

Table3. 13 attributes of five innovative categories

Five categories of innovation	13 attributes of innovation	
(1) Market-Driven	C1. market-leading	C6. market segment
(2) Technology-Driven	C2. technology-leading	C7. re-design
(3) Me-too	C3. function extensity	C8. imitation
(4) Concept-Driven	C4. creativity	C9. value-up
	C11. international style	
(5) Product-Driven	C5. stylish	C10. ergonomic
	C12. user friendly	C13. texture-unique

2.2 Preference evaluations

Preference evaluations were conducted to evaluate the 14 stimuli samples (Figure 1) with the 13 attributes of innovative forms (Table 2) and innovative categories (Table 3). A total of 168 students served as the subjects, and were divided into two groups: with and without a design background, as shown in [Table 4](#).

Table4. The subjects in the experiment

Group	Design Background	Subjects	Sex	Subjects	Age	Subjects
	Design	74	Female	30	Under 19	6
	Non-design	94	Male	138	20~30	146
					Above 31	16
Total		168		168		168

Subjects were told the purpose of the study; and then were asked to evaluate each stimulus sample with the attributes of the innovative forms or the innovative categories based on a nine-point Likter scale. For evaluation of the innovative forms, each stimulus sample, the 13 attributes, and the rating scale were listed together on a single piece of paper. While subjects were evaluating the stimuli, pictures of all the mobile phones were shown in a PowerPoint slide for subjects’ reference. For the evaluation of innovative categories, the questionnaire was arranged in a similar way; expect in addition, the selling points and function features of each sample were also provided for reference.

The preference and evaluation data were subjected to the MultiDimensional Preference analysis (MDPREF). The analysis is usually conducted on a matrix of averaged preference evaluations, and converts the data into a visual perception preference space. Using the perceptual space, the factors that affect consumer perception in innovative products can be studied, and the differences in consumers

with or without design backgrounds in innovative products can be identified [11]. MDPREF is a vector model whose purpose is to identify a perceptual space displaying attribute vectors. Like factors analysis, MDPREF analysis decides the number of dimensions by referring to the relationship between the cumulative proportion of variance and the number of dimensions. Based on MDPREF analysis, the perception of innovative forms and innovative categories were separated by the design background of the different subject groups.

3. RESULTS and DISCUSSIONS

3.1 Preference of Innovative Product Form

(1) Preference of subjects with design background: The cumulative proportion of variance for two dimensions is 89.9%, which indicates that two dimensions were sufficient to construct a preference space. To demonstrate the attribute vectors and stimulus points visually, Figure 2 shows the two dimensional configuration in which streamlined (F1) and alternative (F5) are drawn as the primary dimensions (factors). The stimulus points (products) are also plotted in Figure 2. Accordingly, the 14 mobile phones can be classified into 4 groups based on preference space, as shown in Table 5.

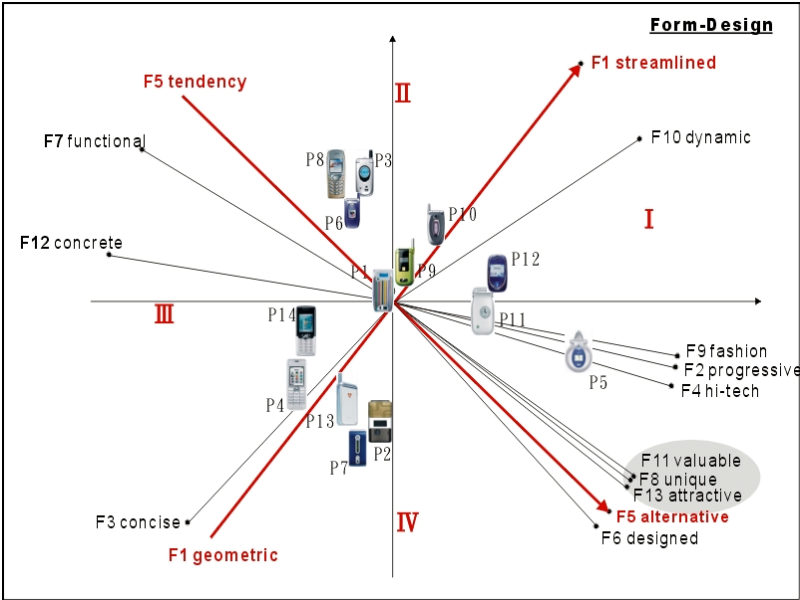


Figure 2. Preference space of innovative form with design background

Table 5. The distribution of each quadrant with design background

I streamline-alternative	P5、 P11、 P12
II streamline-tendency	P1、 P3、 P6、 P8、 P9、 P10
III geometric-tendency	P4、 P14
IV geometric-alternative	P2、 P7、 P13

Each stimulus point can be projected onto every attribute vector. Based on the output of the MDPREF program, a second score matrix file provides the values of projections from each stimulus to each attribute in preference space: these projections show the average subject's preference of each stimulus product with respect to the attribute vectors. Those attributes that have a similar order of stimulus products appear to have common factors and can be grouped together. For example, stimulus products P8, P3, P6 and P5, P11, P12 are the same order in bipolar attributes including: ordinary-unique (F8), invaluable-valuable (F11) and unnoticeable-attractive (F13) as shown in [table 6](#). In figure 2, the attribute vectors F8, F11, and F13 are grouped together. This confirms that these three attributes are identified by subjects with design background.

Table 6. Projection order of form attributes of mobile phone with design background

	1st	2nd	3rd	...	3rd	2nd	1st	
F8 ordinary	P8	P3	P6	...	P12	P11	P5	F8 unique
F11 invaluable	P8	P3	P6	...	P12	P11	P5	F11 valuable
F13 unnoticeable	P8	P3	P6	...	P12	P11	P5	F13 attractive

(2) Preference of subjects with non-design background : The cumulative proportion of variance for two dimensions is 95.2%, which indicates that two dimensions were sufficient to construct a preference space. The preference space of subjects with non-design background is similar to that of subjects with design background. [Figure 3](#) shows the two dimensional configuration in which streamlined (F1) and alternative (F5) are drawn as the primary vectors, with the stimulus points (products) plotted.

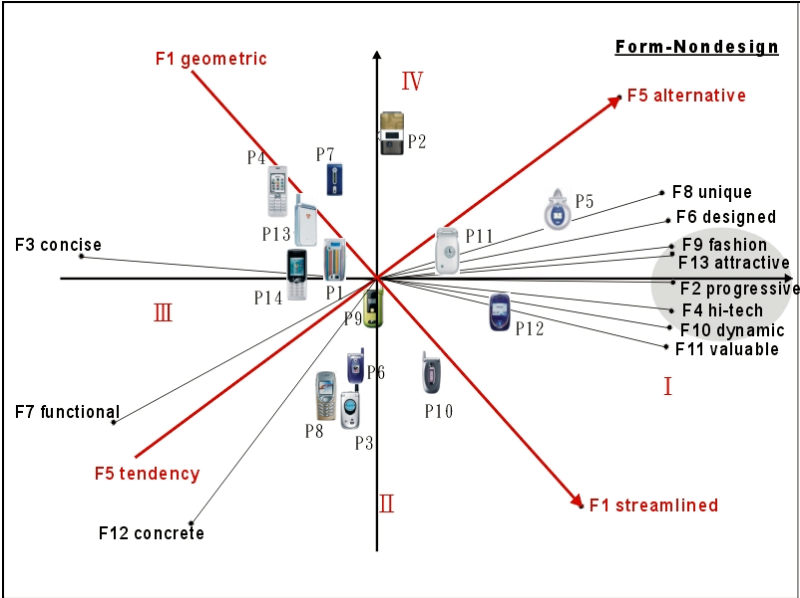


Figure 3. Preference space of innovative form with non-design background

Based on Figure 3, the preference space was constructed by the bipolar attributes streamlined (F1) and alternative (F5), which divided the 14 stimulus samples into four groups as shown in Table 7. Concerning the projection order, the stimulus products P4, P14, P13 and P2, P12, P11 are completely identical in the bipolar attributes conservative-progressive (F2), ancient- hi-tech (F4), classic-fashion (F9), static-dynamic (F10) and unnoticeable-attractive (F13), as shown in Table 8. The projections of the mobile phone stimuli on each form attribute are shown sorted in Table 6. Based on the preference space in Figure 3, the attribute vectors F2, F4, F9, F10, and F13 can be grouped together; these five attributes have been identified by subjects without a design background.

Table 7. The distribution of each quadrant of mobile phone with non-design background

I streamline-alternative	P5、 P11、 P12
II streamline-tendency	P3、 P6、 P8、 P9、 P10
III geometric-tendency	P1、 P4、 P13、 P14
IV geometric-alternative	P2、 P7

Table 8. Projection order of form attributes with non-design background

	1st	2nd	3rd	...	3rd	2nd	1st	
F2 conservative	P4	P14	P13	...	P11	P12	P2	F2 progressive
F4 ancient	P4	P14	P13	...	P11	P12	P2	F4 hi-tech
F9 classic	P4	P14	P13	...	P11	P12	P2	F9 fashion
F10 static	P4	P14	P13	...	P11	P12	P2	F10 dynamic
F13 unnoticeable	P4	P14	P13	...	P11	P12	P2	F13 attractive

From Figures 2 and 3, the main factors affecting subjects' preference evaluation of innovative forms can be identified as streamlined (F1) and alternative (F5). Table 6 and 8 show that there exist differences between subjects with and without background in the preference evaluation of individual mobile phone and form attributes.

3.2 Preference of Innovative Product Category

(1) Preference of subjects with design background : Based on the preference analysis, the cumulative proportion of variance for two-dimension is 85.1%, which indicates that two dimensions were sufficient to construct a preference space. After correlation analysis, technology-leading (C2) and imitations (C8) was selected as two main dimensions to construct the preference space, as shown in Figure 4.

Based on Figure 4, the preference space was constructed by the attribute vectors of technology-leading (C2) and imitations (C8) divided the 14 stimulus samples into four groups, as shown in Table 9.

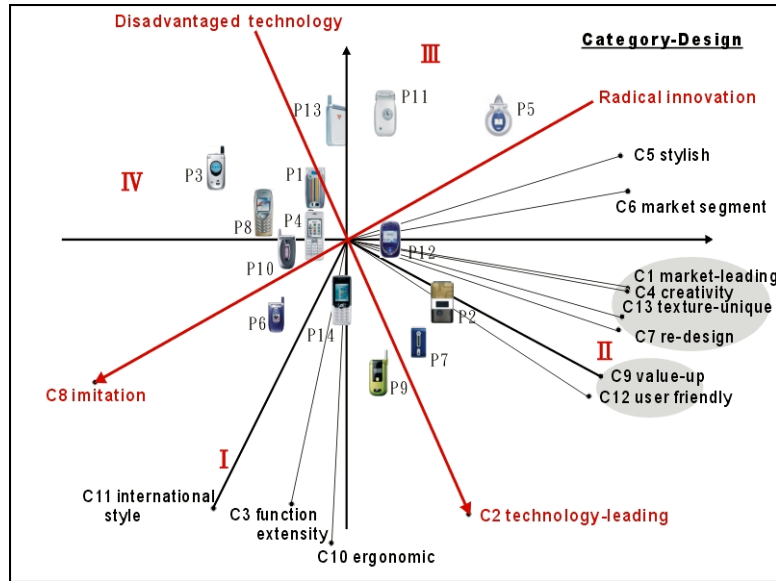


Figure 4. Preference space of innovative category with design background

There are two groups of attribute vectors in figure 4. One group is the attributes of market-leading (C1), creativity (C4), re-design (C7), and texture-unique (C13); the other group is the attributes of value-up (C9) and user friendly (C12). Table 10 shows the projection order of stimulus products in these two groups of attribute vectors. The stimulus products P3, P8, P10 and P5, P2, P7 are completely identical in the attribute vectors market-leading (C1), creativity (C4), re-design (C7), and texture-unique (C13). The other stimulus products P3, P8, P13 and P6, P7, P5 are completely identical in attribute vectors which are value-up (C9) and user friendly (C12). The results show that subjects with design background have consistent perception in these two attribute groups. In Table 3, C1, C4, C7 and C13 belong to different innovative product categories except “me-too”. This indicates the meaning of “me-too” is most explicit among all innovative product categories and this one is the easiest to be distinguished.

Table 9. The distribution of each quadrant of mobile phone with design background

I technology leading-imitations	P6、P9、P14
II technology leading-radical innovation	P2、P7、P12
III disadvantaged technology -imitations	P5、P11、P13
IV disadvantaged technology - radical innovation	P1、P3、P4、P8、P10

Table10. Projection order of categories attributes of mobile phone with design background

	1st	2nd	3rd	...	3rd	2nd	1st
C1 market-leading	P3	P8	P10	...	P7	P2	P5
C4 creativity	P3	P8	P10	...	P7	P2	P5
C7 re-design	P3	P8	P10	...	P7	P2	P5
C13 texture-unique	P3	P8	P10	...	P7	P2	P5
C9 value-up	P3	P8	P13	...	P6	P7	P5
C12 user friendly	P3	P8	P13	...	P6	P7	P5

(2) Preference of subjects with non-design background : The cumulative proportions of variance for one to three dimensions are 63.6%, 87.8%, and 93.1%, respectively. Two dimensions were sufficient to construct a preference space. Figure 5 shows the two dimensional configuration in which technology-leading (C2) and imitation (C8) are drawn as the primary vectors. The preference space of subjects with non-design background is similar to subject with design background. Based on Figure 5, the attribute vectors of technology-leading (C2) and imitation (C8) divide the 14 stimulus samples into four groups, as shown in Table 11.

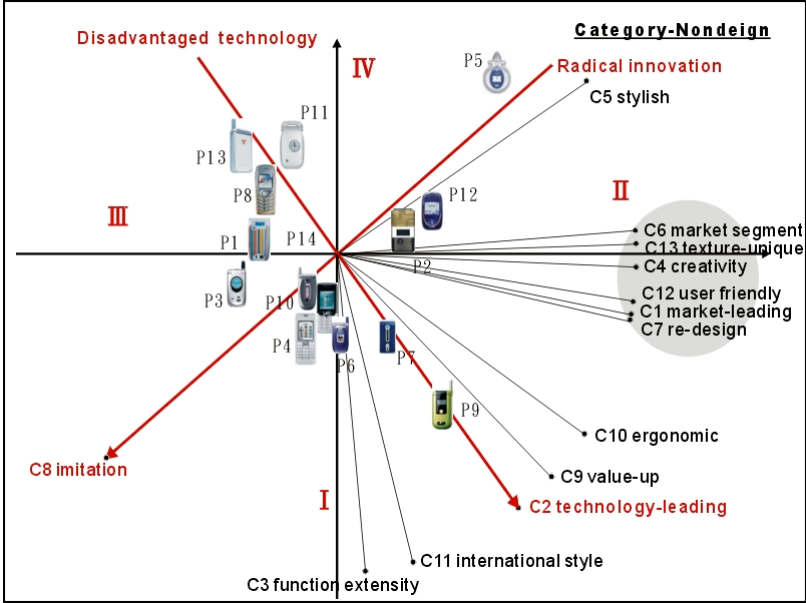


Figure 5. Preference space of innovative category with non-design background

Table 11. The distribution of each quadrant of mobile phone with non-design background

I technology leading-imitations	P4、 P6、 P7、 P9、 P10、 P14
II technology leading-radical innovation	P2、 P12
III disadvantaged technology -imitations	P1、 P3、 P8、 P13
IV disadvantaged technology - radical innovation	P5、 P11

Table 12 shows the projection order of stimulus products in these four groups of attribute vectors. There are four groups of stimulus products identical in four groups of attribute vectors which are market-leading (C1) and re-design (C7), technology-leading (C2) and value-up (C9), market segment (C6) and texture-unique (C13), and creativity (C4) and user friendly (C12). This indicates that these four groups of innovative product categories can be grouped together. The results show that subjects with non-design backgrounds have consistent perception in these four attribute groups. In Table 3, C1, C4, C6, C7, C12 and C13 belong to different innovative product categories, except “me-too”. This indicates the meaning of “me-too” is most explicit among all innovative product categories and is the easiest to

distinguish, just as for subjects with design background.

Table 12. Projection order of categories attributes of mobile phone with non-design background

	1st	2nd	3rd	...	3rd	2nd	1st
C1 market-leading	P13	P3	P8	...	P12	P5	P9
C7 re-design	P13	P3	P8	...	P12	P5	P9
C2 technology-leading	P13	P11	P8	...	P6	P7	P9
C9 value-up	P13	P11	P8	...	P6	P7	P9
C4 creativity	P13	P3	P10	...	P12	P9	P5
C12 user friendly	P13	P3	P10	...	P12	P9	P5
C6 market segment	P3	P13	P10	...	P12	P9	P5
C13 texture-unique	P3	P13	P10	...	P12	P9	P5

3.3 DISCUSSION

(1) Preference of innovative product form between the two groups : Comparing the preference spaces of the two subject groups (Figure 2 and Figure 3), it is found that attributes F9, F13, F2, F4, and F10 can be grouped together for subjects without design background, and the attributes F8, F11, and F13 can be grouped together for subjects with design background. These results indicate that subjects without design background have difficulty to distinguish the differences of attributes of innovative product forms comparatively. Among all the attributes of innovative product form, all subjects consider attractive (F13) ambiguous and difficult to identify. Furthermore, comparing the Table 5 with Table 7, it can be seen that the two subject groups have the same cognitive preference toward mobile phone samples, except samples P1 and P13, which have little difference. Subjects tend to consider P1 in an innovative product category; however, for the innovative product form, subjects with design background think of P1 as geometric form, while subjects without design background consider it a streamlined form. All subjects agree that P13 is geometric form, but they have different perceptions with regards to whether it is alternative or tendency in the innovative product category. The results described above show that there is not only a common understanding but also a different interpretation of form attributes by subjects with or without design background. Further exploration and discussion is warranted.

(2) Preference of innovative product category between two groups : Comparing the preference space in Figure 4 and Figure 5, the results showed that the attribute group of C1, C4, C7, C13, C9, and C12 for subjects with design background is similar to the attribute group of C1, C6, C4, C7, C12, and C13 for subjects without design background. When comparing the five innovative product categories in Table 3, it can be inferred that only the innovative product category of “me-too” is explicit and is easily distinguishable from the other four categories and thus no confusion will occur

between the two subject groups. This demonstrates that customers' perception of "me-too" is explicit; thus, it is obviously necessary to remind mobile phone manufacturers the significance of innovative products. From the view of mobile phone samples in Tables 9 and 11, the two subject groups have almost the same perception of the innovative product attributes except P4, P7, P10 and P13. All subject groups hold different perceptions to the stimulus products P4, P7, P10, and P1. These issues are worthy of further study to provide a reference for manufacturers and designers.

4. CONCLUSIONS

The power of innovation forces designers and managers to develop successful new products and services. For the designers, the product is the most direct medium that connects the designer and the consumer, and designer's creativity must be transferred through product design to consumers. For the managers, successful innovative products should have clear and definite properties and target markets, and an innovative product is commercial successful only when the product is accepted by consumers. The main purpose of this paper is to explore the influence of subjects with and without design background to the perception of innovative products so that the differences between designers and customers can be reduced. Both the innovative product forms and innovative product categories are discussed, based on subjects with and without design background. The result of this study can be summarized as follows:

- (1) In attributes of innovative product forms, subjects with design background are more capable than those without design background in distinguishing the differences from attributes connotations.
- (2) With regard to stimulus samples of innovative productive forms, the two subject groups have similar perceptions except for mobile phones P1 and P13.
- (3) With regard to innovative product categories, only the category of "me-too" has intensive reactions that can distinguish by the two groups consistently. This means that it is not easy for both groups to identify the differences regarding the other four innovative categories.
- (4) Regardless of innovative product forms or categories, mobile phone P13 is the most disputable sample between the two groups.

There are some tendencies for subjective interpretation in the foregoing context, so it is expected that more specific and rigid methodology will be conducted to verify these results in the future.

Reference

1. Bain, S. R., 1999, Remodeling industrial design, Chaw, Taipei, Taiwan. pp. 13-16.
2. Baxter M., 1995, Product Design: a Practical Guide to Systematic Methods of New Product Development. Chapman & Hall, London, UK. pp. 39-45.
3. Chang, C. C., 1999, Perceptual Factors Underlying Users' Image Perception toward Product Form, PhD Thesis, Department of industrial engineering and management, National Chiao Tung University, Taiwan.
4. Chuang, M. C., Ma, Y. C., 1999, Expressing the expected product images in product design of micro-electronic products, *Industrial Ergonomics* 27, pp. 233-245.
5. Crawford, C. Merle. 1991, *New Product Management*, 3rd ed. New Richard D. Irwin, Inc.
6. Motokazu O., Chihiro W., 2000, The interaction between product concept and institutional inducement: a new driver of product innovation, *Technovation*, 20, pp. 11-23.
7. Norman D.A., 2000, *The Psychology of Everyday Things*, Yuan Liou, Taipei, pp. 40-45.
8. Robertson, T. S., 1976, The Process of Innovation and the Diffusion of Innovation. *Journal of Marketing*, 31, pp. 14-19.
9. Tsang, H. T., 2003, Application of Morphing in Multidimensional Perceptual Space – Using Chairs as Examples, Master Thesis, Department of industrial & commercial design, Taiwan University of Science and Technology, Taiwan.
10. Veryzer, R. W., 1998, Discontinuous Innovation and the New Product Development Process, *Journal Product Innovation Management*, 15, pp. 304-321.
11. Yang, H. E., 1996, *Multidimensional Scaling-Theory, Method and Application*, National Institute for Complication and Translation, Taipei, Taiwan, pp. 3-18.