產品造形視覺複雜度與情感性回饋

Visual Complexity and Emotional Response for Product Form

許言

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摘要

產品視覺複雜度是指設計師在設計產品外觀時，賦予產品在視覺上呈現的複雜程度。設計師可透過操弄不同的造形元素來控制視覺複雜度。本研究以問卷調查的方式，收集 2001~2004 年間的消費性電子產品，包括行動電話、CD 隨身聽及手提音響等三類共 180 件樣本。樣本經五位資深設計師段篩選為 36 件測試樣本，並探討年輕及中年 2 種年齡受測群之情感性偏好與視覺複雜度關係。研究主要發現為：(1)年輕與中年群對於產品視覺複雜度的認知差異不大。(2)受測者對於產品的偏好和視覺複雜度呈現反向的關係，即受測者對於產品的偏好會隨著視覺複雜度的增加而降低。(3)中年群較年輕群偏好低視覺複雜度之產品。

關鍵詞：視覺複雜度、消費性電子產品、情感性偏好

ABSTRACT

Product visual complexity refers to the degree of complexity the designer endows with the product form. Through the manipulation of different design elements, designers can bring the visual complexity under control. Through questionnaire survey, the authors collected 180 consumer electronic products, including 2001-2004 mobile phones, CD players, and hi-fi sets to explore the relationship between product visual complexity and user preferences in two subject groups. Five designers with at least 3 years in practical design experience were invited to classify the 180 product samples in terms of visual complexity. In three rounds, 36 representative samples. From the comparisons of the distribution patterns of the visual complexity and user preferences, the authors reached the following major conclusions: (1) there is no big difference between visual complexity perceptions between young generation and middle age groups; (2) there exist negative relationships between product visual complexity and user preferences; namely, the user preferences tend to reduce when the visual complexity of product forms is higher; (3) the middle age consumer prefers products of lower visual complexity.

Keywords： Visual complexity, product form, user preferences

1. Introduction

The control of product form design trend is one of the key issues designers care about (Hubel and Lussow, 1984). Looking at the development of product form, we can find that the appearance of earlier products features high degree of visual complexity whereas modern products tend to have simpler product form (Baxter, 1995). Figure 1 illustrates such diversion in typewriters of which the product form is gradually transformed from high complexity to simple geometric styles (Beeching, 1974).

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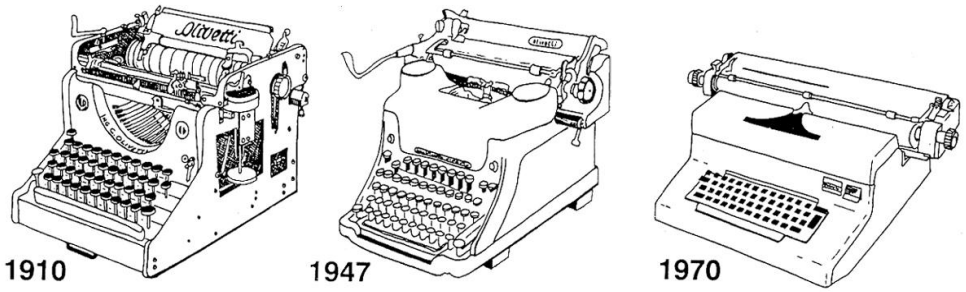

Figure 1: The change of product form of typewriter design

The tendency of simple product form can be found in many modern products. For instance, most popular products of Apple (2006) boast of simple images (Figure 2). In addition, the layout of product form elements will influence the visual complexity of products. More product form elements will make a product more complex while fewer elements may make a product look simpler in visual perception (Baxter, 1995). Generally, according to the design conditions, designers will manipulate such product form elements to make a product look simple or complex (Roozenburg and Eekels, 1995).

Furthermore, different degrees of visual complexity will give consumers more choices to select products. However, it is not known whether the degree of visual complexity of product form will cast impacts upon user's preferences, especially for the perception of consumers of different age groups.

Figure 2: Some popular products of Apple

In this study, the author explored user's perceptions towards products of varying visual complexity. The result can serve as designers' references in product design and furthermore, as basis for the universal design of products so as to create products that not only meet the consumer's preferences but also keep pace with the popular trends.

2. Visual complexity of product form

In general, every product form will have the characteristics of "unity" and "variety"to some extent. The concept of unity signifies order while variety implies complexity. Therefore, product form can be defined as the final result of order and complexity (Bense, 1954; Bud and Ruth, 1980; Crozier, 1994). Bürdek (1996) also indicated that the activity of product form design is usually undertaken through the inter-connection between order and complexity; that is to say, product form can be defined as a mathematical function of order and complexity.

Hsiao (2001) explored the recognition and memory

of product form complexity from the visual cognition point of view. Hsiao pointed out that complexity is an important factor designers use to manipulate the product form. Moreover, in addition to visual perception, other factors like the subject's cultural background and life experience will influence the degree of visual complexity. Berlyne (1974) argued that the perception of visual complexity will be affected by individual differences, life experience, and culture. Upon the basis of visual features, Berlyne (1974) proposed the preference curve of visual complexity (Figure 3) and found that products of too simple or too complex appearances will be less attractive to people but products of medium degree of visual complexity will catch more eyes.

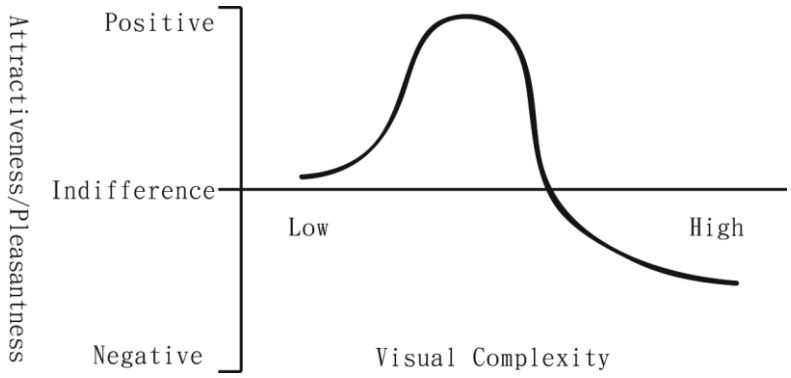

Figure 3: The relationship between visual complexity and attractiveness

Hsiao and Chen (2003) emphasized the important role visual complexity plays in consumer's image perceptions of product form and pinpointed that people's image perceptions toward products are made up of four potential influence factors (PIFS): complexity factor, trend factor, emotion factor, and potency factor. Among them, the complexity factor is the most important, including complex and simple axes. Products of low visual complexity are different from those of high visual complexity in total image perceptions. Therefore, if designers can subtly control design elements to reach the expected visual complexity, more varieties of product forms can be generated.

3. Method

In this study, questionnaire survey was used to investigate the relationships between user's preferences and the visual complexity of product form. Differences between different age groups in the perception of visual complexity are explored.

The questionnaire survey is composed of the following four stages:

(1) Select product samples and subjects: In selecting samples for the subjective evaluation, the types of products that are for professional usage or that the subjects are not familiar with were avoided. As a result, popular consumer electronic products of different volumes were chosen, mobile phones, CD Players and portable hi-fi sets included. For the subjects, the convenient sampling was adopted from which 100 young generation (22-28 years) and 100 middle age (42-48 years) consumers living in Taipei area were chosen as subject samples. The subject profile is shown in Table 1.

Table 1: The profile of the subjects

Item	Young generation (n=100)	Middle age generation (n=100)
Male (%)	50.0	50.0
More than junior college (%)	100.0	100.0
Age (M)	24.5	45.0
Age (years)	22-28	42-48

(2) Collect product samples: Photographic images of consumer electronic products in 2000~2004 were collected from different sources, including design magazines, books, and web sites. More importantly, the products were from different brands as much as possible. For the same category of products, the same perspective view was used as a criterion to pick the samples. Finally, 180 high quality product samples, 60 for each category, were gathered. For each sample image, the texts on the screen and trademark were deleted. They were turned into gray scale images and of the same resolution, and printed on a A4 size paper.

(3) Select representative product samples: Five designers with at least 3 years in practical design experience were invited to classify the 180 product samples in terms of visual complexity. In three rounds, 36 representative samples, 12 for each category of products, were picked as shown in Table 2.

Table 2: The product samples used in the test

A01	A02	A03	A04	A05	A06
					
A07	A08	A09	A10	A11	A12
					
B01	B02	B03	B04	B05	B06
					
B07	B08	B09	B10	B11	B12
					
C01	C02	C03	C04	C05	C06
					
C07	C08	C09	C10	C11	C12
					

(4) Conduct the questionnaire survey: The questionnaire consists of two parts: one for the basic data of the subjects and the other for the 7-point semantic questions. Three categories of products (A for mobile phones, B for CD plays, and C for portable hi-fi sets), totally 36 samples are covered for the subjects to evaluate their preferences and visual complexity perceptions.

4. The differences of the subject's visual complexity perception

The subject's perceptions of visual complexity to product samples are shown in Table 3. The results of t-test indicate that there do not exist significant differences between subjects of two age groups in the perception of visual complexity. Significant differences can only be found in Sample B7 ($p = 0.017$; difference of means = 0.56) and Sample C10 ($p = 0.017$; difference of means = 0.66). This demonstrates that there is a high degree of consistency between these two age subject groups in their perceptions of visual complexity towards product samples.

Table 3: The subject's perceptions of visual complexity to product samples

	Young generation (n=100)		Middle age generation (n=100)				
Sample	M_y	sd	M_m	sd	M_y - M_m	t	P value
A1	4.78	1.27	5.22	1.06	-0.44	-1.89	0.062
A2	3.54	1.18	3.80	1.09	-0.26	-1.14	0.255
A3	2.64	1.12	3.02	1.10	-0.38	-1.71	0.090
A4	4.62	1.09	4.22	1.11	0.40	1.82	0.072
A5	2.78	1.09	3.00	1.03	-0.22	-1.04	0.303
A6	3.20	1.03	3.46	1.23	-0.26	-1.14	0.255
A7	5.80	0.83	5.58	1.01	0.22	1.19	0.238
A8	1.78	0.68	1.90	0.86	-0.12	-0.77	0.442
A9	5.88	0.92	5.64	1.27	0.24	1.08	0.282
A10	2.56	1.13	2.90	0.99	-0.34	-1.60	0.113
A11	4.44	1.31	4.58	1.25	-0.14	-0.55	0.586
A12	5.40	1.43	5.52	1.34	-0.12	-0.43	0.666
B1	2.60	1.14	2.98	1.20	-0.38	-1.62	0.109
B2	4.32	1.33	4.08	1.12	0.24	0.97	0.332
B3	5.88	1.21	6.14	1.03	-0.26	-1.16	0.249
B4	3.84	1.45	4.34	1.08	-0.50	-1.96	0.053
B5	1.80	0.76	1.72	0.64	0.08	0.57	0.569
B6	5.66	1.22	5.22	1.01	0.44	1.88	0.063
B7	2.42	1.20	2.98	1.10	-0.56	-2.44	0.017*
B8	6.10	0.79	5.88	0.96	0.22	1.25	0.214
B9	2.44	1.01	2.82	1.00	-0.38	-1.88	0.063
B10	4.86	1.43	4.38	1.23	0.48	1.80	0.075
B11	2.38	0.97	2.54	0.89	-0.16	-0.86	0.390
B12	2.46	0.84	2.62	1.10	-0.16	-0.82	0.416
C1	3.98	1.55	3.54	1.09	0.44	1.64	0.103
C2	3.08	1.12	2.80	0.88	0.28	1.39	0.168
C3	5.64	1.03	5.32	0.91	0.32	1.65	0.103
C4	4.04	1.40	4.22	1.27	-0.18	-0.67	0.502
C5	2.74	1.05	2.94	0.96	-0.20	-1.00	0.321
C6	5.86	0.99	5.50	0.97	0.36	1.83	0.070
C7	5.22	1.25	4.84	1.18	0.38	1.56	0.122
C8	2.86	1.43	3.32	1.30	-0.46	-3.79	0.095
C9	5.36	1.27	5.20	0.97	0.16	0.71	0.481
C10	4.10	1.61	3.44	1.05	0.66	4.56	0.017*
C11	4.36	1.34	4.38	1.12	-0.02	-0.08	0.936
C12	5.48	0.86	5.10	1.11	0.38	1.91	0.059

Note: * $p < 0.05$

5. The relationship between user's preferences and product visual complexity

In order to explore the relationship between user's preferences and product visual complexity, a regression analysis was conducted. The result in Table 4 demonstrates a high correlation between user's preferences and visual complexity in both young generation and middle age groups, -0.811, -0.870 for total product samples in young and middle age groups respectively. Moreover, the relationship between user's preference and visual complexity is negative; meaning that consumers will prefer product forms of lower visual complexity when there are more choices to select. When the degree of visual complexity of a product form is higher, the degree of user's preference will be reduced accordingly. Besides, the Pearson correlation coefficient of user's preference and visual complexity of the middle age group is higher than that of the young generation, indicating that consumers of middle ages will have a higher tendency to like products of low visual complexity.

Table 4: The Person correlation coefficients of the subject in three categories of samples

User preference	Complexity	Total	A1-A12	B1-B12	C1-C12
Young generation	Person Correlation	-0.811**	-0.851**	-0.838**	-0.684**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	100	100	100	100
Middle age group	Person Correlation	-0.870**	-0.902**	-0.908**	-0.892**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	100	100	100	100

A close look at the relationships between user preferences and visual complexity in different kinds of product samples indicates that both subject groups have a higher negative relationship in mobile phones (Sample A) and CD players (Sample B). However, the correlation coefficient of young generation in portable hi-fi sets (Sample C) reaches only -0.684, a medium correlated. This might be partly due to the fact that young generation consumers have a bigger divergence in the preferences towards hi-fi set or that some of the young generation consumers prefer a hi-fi set that features a powerful image.

Furthermore, the distribution patterns of the preferences and visual complexities of two subject groups (Figure 4) also demonstrate such a negative relationships. X axis indicates the average degrees of visual complexity in an increasing order from left to right and Y axis represents the degrees of user preferences towards product sample images. The distribution patterns in Figure 4 reveal the above mentioned negative relationship; that is, the more to the right (the higher visual complexity), the lower the user preferences. Moreover, the tendency of the curves also indicates the similarity of the relationships between user preferences and visual complexities in young generation and middle age subject groups. The results from this study conforms the results from Belyne (1974). For the product form of consumer electronic products, lower complexity will be more preferred.

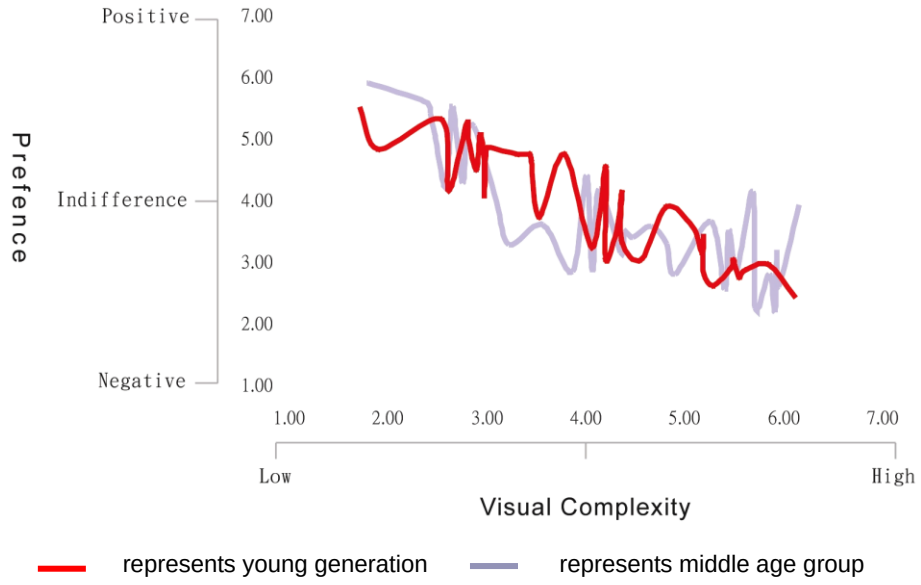

Figure 4: The distribution patterns between visual complexity and user preferences

6. Discussions

(1) Subjects in young generation and middle age groups are similar in their perception of visual complexity of product form. This demonstrates that there is a certain degree of consistency in human beings' visual perceptions (Norman, 1998).

(2) The relationship between user preference and visual complexity is negative, meaning that user's preferences towards product form will be reduced when the visual complexities increase. For both two subject groups, simple product samples (products of lower visual complexities) will be more preferred. This result matches the main stream design trends of consumer product design at present days.

(3) Subjects in the middle age group will have a lower preference towards products of high visual complexity than the young generation subject group. In the light of this, in designing electronic products for middle age group consumers, the total visual complexity should be carefully controlled so as to correspond to the preferences of the target population. Products whose visual complexities are too high will not be accepted in the market.

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