KEER2010, PARIS | MARCH 2-4 2010
INTERNATIONAL CONFERENCE ON KANSEI ENGINEERING AND EMOTION RESEARCH 2010

THE INVESTIGATION FOR CONCEPT DESIGN ON RANDOM ALGORITHM

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ABSTRACT

Intend to find a KE process for easily create ideas for concept design, select the front handle cover which is the most distinctive feature of motorscooter. Although this process could be more complicated than hand drawing, but it can immediately start and provide many ideas. And we can operate uncounted times to produce totally different ideas.

The process can be concluded to 6 steps: 1) collect samples: took 80 samples from market, 2) define parameter: The forms of collected samples have to categorize in the Bezier curve which is composed of 8 coordinate points and 14 control points. 3) define dimension of parameter: all dimensions of parameters are defined in maximum boundary from 80 samples, 4) random selection: a set of parameter selects from randomizing data of parameter 5) rebuild concept design model: use VB 2006 to rebuild models from randomizing data. 6) Evaluation: evaluate rebuild models to judge for further process from professional designers. Therefore, we found out some concept designs beyond imagination, and can easily redesign for further one. From this method, we could develop originality design, and it is possible to develop a universal program to fit for any one after modulate dimension of parameters.

Keywords: *Motorscooter, Random number routing, Conceptual design*

1. INTRODUCTION

The industrial design is to draw idea sketch manually on different material in order to launch creative thinking, and to select one or many appropriate idea sketch to be developed

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into mature concepts by utilizing hand drawing or CAID. A number of designers think hand drawing is the main medium for design thinking because hand drawing is not limited by equipment and can develop creativity freely. However, hand drawing sometimes is unable to obtain breakthrough development because it sometimes is influenced by some factors such as life experience and emotion of designers. Idea sketch made by computer tools are thought to fail to increase creativity while designing concepts (Elsas, Vergeest, 1998). If the designer can look for connection or characteristic of the existing figure through pondering on image and vision during the process of idea sketch, it can stimulate the imagination in the heart and initiate creative association (Goldschmidt, 1991). However, the creative design still remains at the stage of the black box (Jones, 1992). It is suggested to use scientific methods to collect, analyze, and synthesize data, and to come up with systematic method in searching creative conceptual design to design activity. Designers can use a large amount of obtained idea sketch as the starting point of design.

Although, idea sketch is necessary at the stage of creativity (Lawson, 1994; Pipe, 1990), it will be restricted because of designer's mood and experience if the human brain is the only source of creativity. If there is a method to find a large number of concept ideas and then select some concepts as the foundation of design, designer will be able to hand drawing idea sketch at the creativity stage in order to present idea concepts at the beginning of design (Jenkins, Martin, 1993). That is to say that it utilizes the operational method which designers can understand to produce concept map to replace the efforts in searching creative ideas which are unable to think or image at the stage of idea sketch.

Motorscooter has been developed as the popular tool of transportation in Taiwan. Due to its shaping plasticity and high competitive industry, it needs new design to stimulate the market. The important consideration for consumers in purchasing Motorscooter is its front handle cover. Front handle cover is like a face of the expression (Fig. 1) which is the focus of motorcyclists while they are riding and looking at each other and thus it becomes the important part of motorscooter design. Due to high competition, there are many kinds of shape design. There are two main design: integrative type (Fig. 1) and separated type (Fig. 2). Integrative type has become the most popular design and its process of development is shown in Figure 3. Up-look and side-look have clear developing directions, but the front-look seems to be changed following the pop trend and thus is the main focus of the vision of motorscooter.

Fig 1: Single light slide Motorscooter **Fig 2:** Dual lights Motorscooter

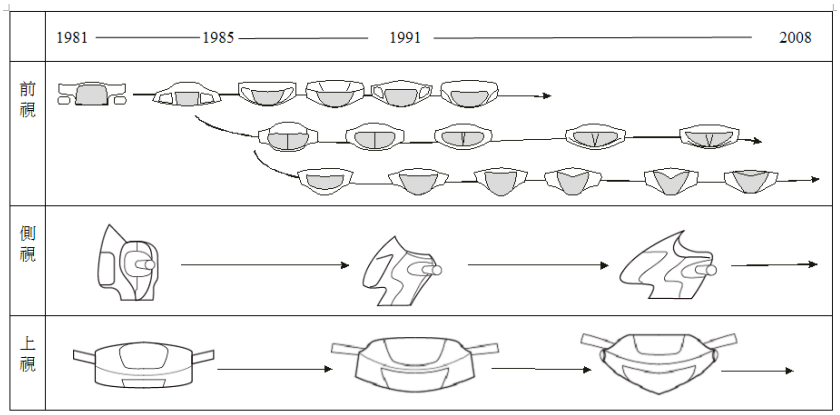


Fig 3: Development of the front handle cover

2. METHODS

There are three stages of this study (Figure 4). The first stage is preparation which includes collecting samples, defining parameter and dimension of parameter. The second stage is to conceptualize creativity including adjusting range of parameter, defining final range of parameter, and random number routing to create idea design. The final stage is the evaluation.

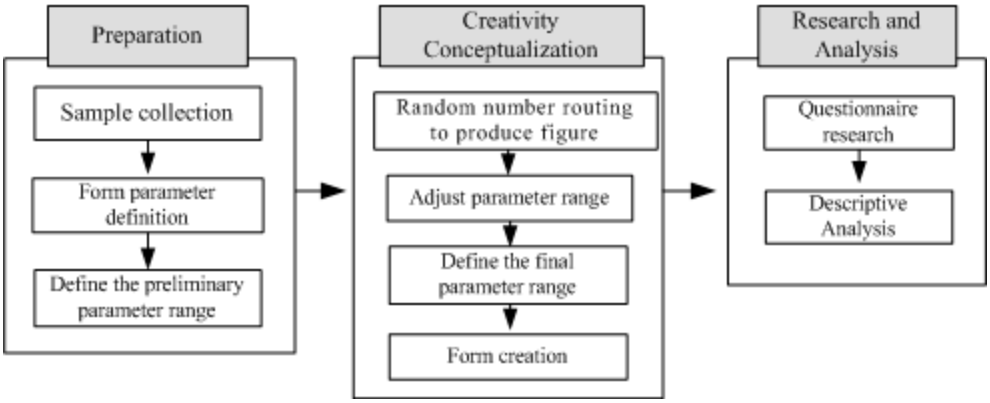


Fig 4: Process of research

2.PREPARATION STAGE

This stage is divided into three steps, from the sample collection of the market, products shaping parameter, defining the preliminary parameter range, that is to say to examine with the quantity of the existing sample, analyze distribution range of the important parts of its shaping in order to define reasonable range of points which produce rational conceptual design.

2.1. Sample collection

We took 150 pictures of front handle cover of Motorscooter parked in the parking lot. After deleting seperated headlights and similar ones, there were only 76 pictures kept. In

order to manage all data of control point of the shaping, each picture of front handle cover was depicted into Bezier curve by using the drawing function of the software CorelDraw12 (Fig. 5). Figure 6 shows all 76 pictures of front handle cover.

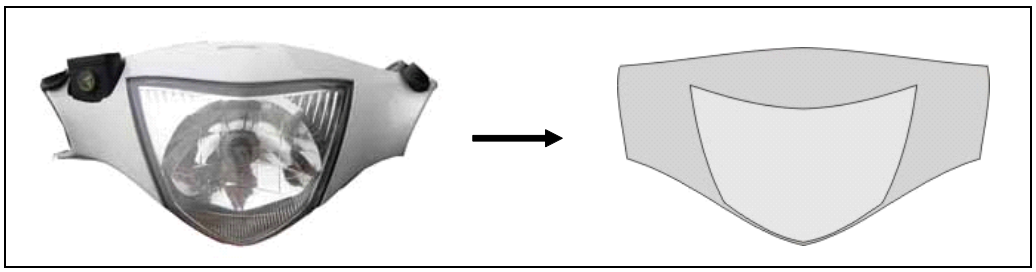


Fig 5: The entity depicts as the line chart

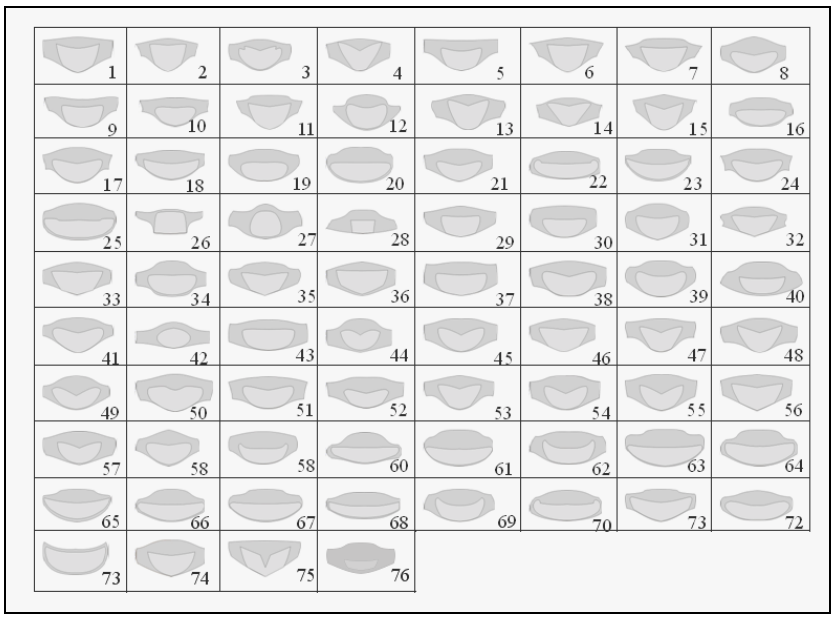
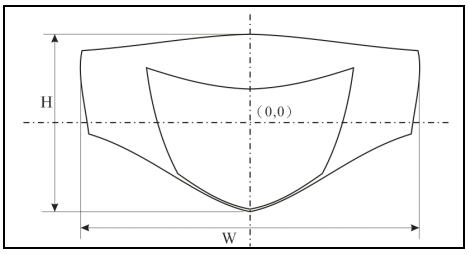


Fig 6: Products sample outline picture of the market

2.2. Form parameter definition

In order to make all samples into parameters, all samples were enlarged or reduced into 10 centimeters wide based on the same rate, and utilized the center of sample to be the starting point to record the Bezier curve's nodes and both ends of control points (X,Y) as parameter to define all samples (Fig. 7).

The symmetrical characteristic left half of data was used to reduce the number of parameters in calculation including outer outline of appearance and interior outline of head light. (A) The line of outer outline: There are four nodes: A, B, C, D and six control points: A2s, B1, B2, C1, C2, D1. (B) The line of interior outline: There are four nodes: E, F, G, H, and six control points: E2, F1, F2, G1, G2, H1, H2 (Fig. 8). Thus, there are a total of 20 coordinates and 40 parameters to form all sample shaping.



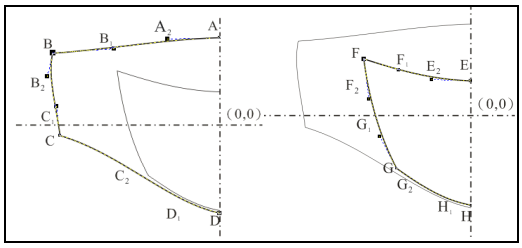
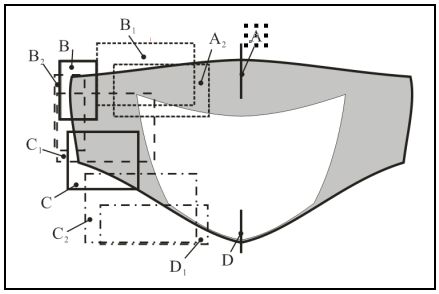


Fig 7: Composition of the coordinate

Fig 8: (left) It is a line of other outline, (right) It is nodes and control points of the line of interior outline

2.3. Define the preliminary parameter range

In order to rationalize the calculated design, the distribution range of 20 coordinates (Xn, Yn) of outer and interior outlines was sorted to control the design drawing of the concept (Fig. 9 and 10).



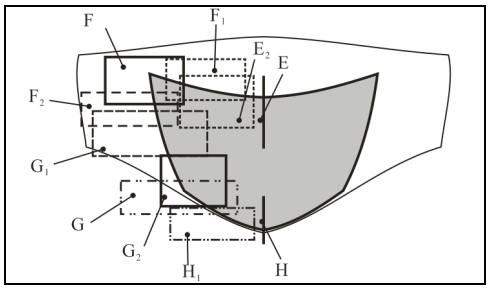


Fig 9: Range of outer outline **Fig 10:** Range of interior outline

3. CREATIVITY CONCEPTUALIZATION STAGE

3.1. Preliminary random number routing to produce figure

Bezier curve drawing function of Microsoft visual studio 2005 software was utilized. The range of inputting outside, inner circle every seat punctuation mark was controlled and randomly selecting any points within the range to draw the half of pictures of two curves separately, and then utilizing the mirror to penetrate and finish the whole idea.

The interface of mathematical calculations and 60 concept design drawings produced (Fig. 11) was conducted for five times continuously before adjusting the range. It is found that majority of concept desing drawings did not meet desingers' criterial of selection. It is because the range of points was not restricted conscientiously and carefully enough. Internal and external outlines cross each other and the figure was twisted due to the range overlaps.

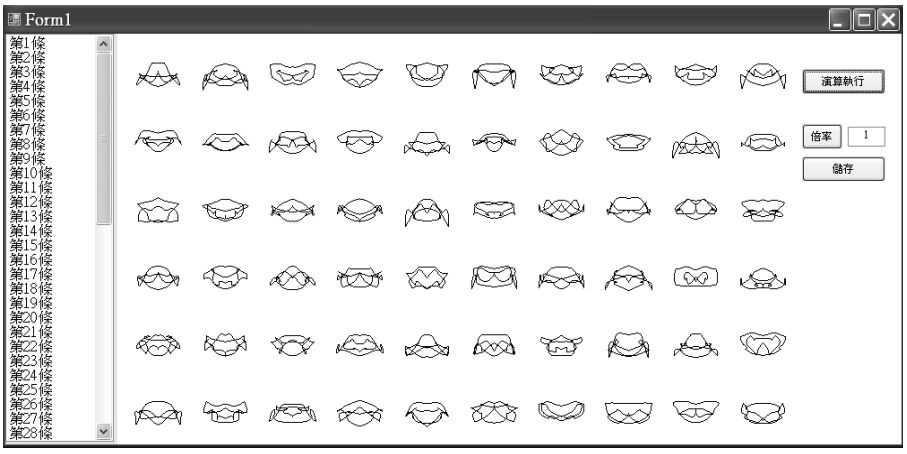


Fig 11: The interface of mathematical calculations and preliminary concept design drawing

3.2. Adjust parameter range

After the discussion between three designers on the concept design drawings produced before adjusting, the preliminary concept design drawing was thought to be not good enough. The rate of selection was below 25% (Table 3). Therefore, the range of every control points was adjusted and the second concept design drawing was produced (Fig. 12). The selection rate of the second calculated concept design drawing was increased to 50%. After another adjustment, the third drawing was produced (Fig. 13) and the selection rate of the third concept design drawing was reached 95% (Table 3). Utilize the designers' judgment, as the reference of adjusting the parameter range, could find the concept design drawing with common understanding.

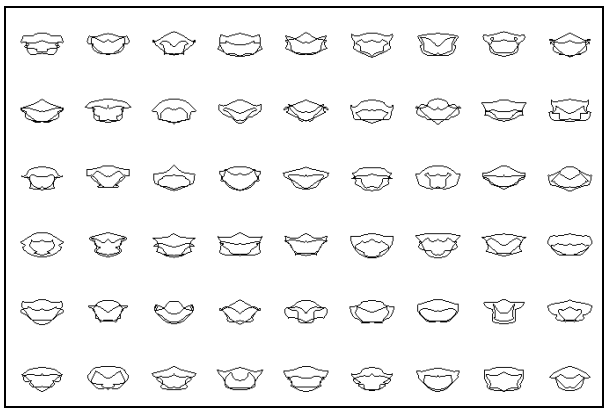


Fig 12: The second concept design drawings

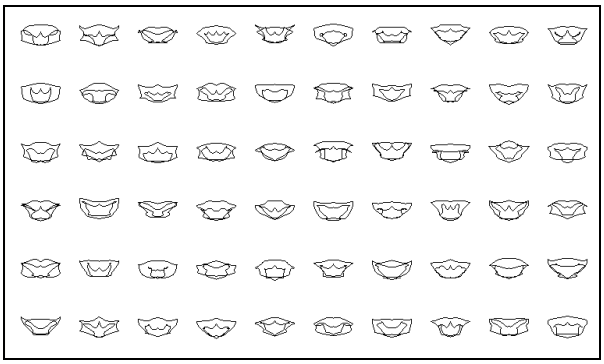


Fig 13: The third concept design drawings

3.3. Define the final parameter range

Following the above two steps, it was able to define the range of X(1-20) and Y(1-2), 20 parameters of the outer outlines (Table 1) and 20 parameters interior outlines (Table 2). The selecting rate was from below 25% to over 85% (Table 3).

Table 1: Outer outline parameter range

No.	1	2	3	4	5
code	A	A_2	B_1	B	B_2
coordinates	X_1 [0, 0]	X_2 [-51, -14]	X_3 [-37, -8.9]	X_4 [-52, -41.7]	X_5 [-54.2, -45.5]
dimension	Y_1 [14.5, 29.5]	Y_2 [12.9, 31]	Y_3 [9.4, 24.6]	Y_4 [2.3, 25.5]	Y_5 [-4.5, 21.1]
No.	6	7	8	9	10
code	C_1	C	C_2	D_1	D
coordinates	X_6 [-53.5, -25.2]	X_7 [-50.2, -24.5]	X_8 [-45.3, -13]	X_9 [-40.9, -9.7]	X_{10} [0, 0]
dimension	Y_6 [-3, 16.3]	Y_7 [-14.8, 7.8]	Y_8 [-26.5, -7]	Y_9 [-27, -15.8]	Y_{10} [-29.7,-17.1]

Table 2: Interior outline parameter range

No	11	12	13	14	15
code	E	E_2	F_1	F	F_2
coordinates	X_{11} [0, 0]	X_{12} [-24.0, -4.4]	X_{13} [-42.5, -4.9]	X_{14} [-48, -21]	X_{15} [-52.6, -15.0]
dimension	Y_{11}[-4, 15.5]	Y_{12} [-3.6, 15]	Y_{13} [9, 24]	Y_{14} [-2.8, 20.5]	Y_{15} [-6.0, 8.0]
No	16	17	18	19	20
code	G_1	G	G_2’	H_1	H
coordinates	X_{16} [-61, -15.6]	X_{17} [-30, -10]	X_{18} [-39.2, -7]	X_{19} [-24.0, 0.0]	X_{20} [0, 0]
dimension	Y_{16} [-11.0, 11]	Y_{17} [-22.5, -2.5]	Y_{18} [-24.6, -14]	Y_{19} [-28.4, 15.3]	Y_{20} [-28.9, -16.7]

Table 3: Selecting rate at three stages

1st	Selected	Total	Rate	2nd	Selected	Total	Rate	3th	Selected	Total	Rate
1	10	60	16.7%	1	29	60	48.3%	1	51	60	85%
2	12	60	20%	2	28	60	46.7%	2	53	60	88.3%
3	14	60	23.3%	3	30	60	50%	3	52	60	86.7%
4	15	60	25%	4	35	60	58.3%	4	52	60	86.7%
5	15	60	25%	5	33	60	55%	5	57	60	95%

3.4. Form creation

In order to investigate the relation between concept design drawing and existing products produced, 30 concept design drawing were randomly chosen to be the sample of this study namely R1 to R30 (Fig. 14).

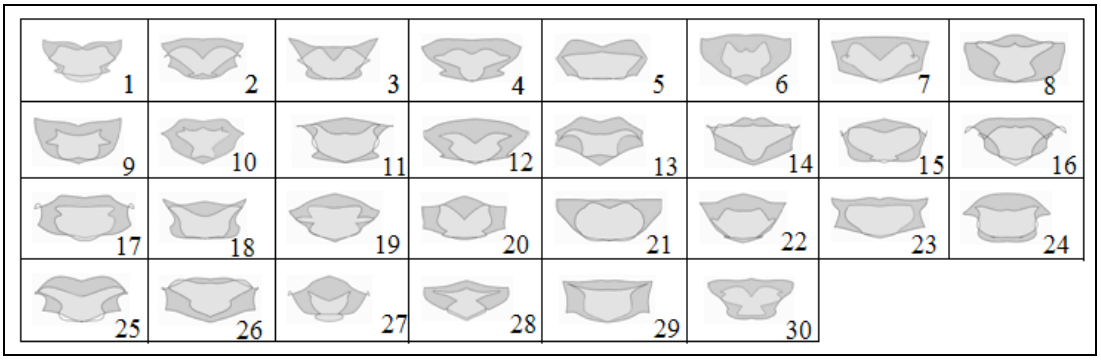


Fig 14: Concept design drawing produced arbitrarily (R1~R30)

4. RESEARCH AND ANALYSIS

4.1. Questionnaire research

A total of 106 samples was produced which consists of 30 concept design drawings and 76 pictures collected. In order to investigate the relation between the products image and concept design drawing, we collected 191 advertising wordings used to describe motorscooter from motorcycle magazines and brand catalogs. These wordings were categorized into seven product image words by the use of KJ law's vocabulary classification and only four vocabularies related to image were selected which are scientific and technological sense (scientific), popular sense (fashionable), innovative sense (innovative), and streamline sense (streamline). At the end, the questionnaire consists of 106 samples and four vocabulary using Likert 10 points scale for evaluation. Questionnaires were sent to 130 students studying in product design and understanding concept design drawing. Finally, there were 112 valid questionnaire received.

4.2. Descriptive Analysis

SPSS12.1 was used to conduct descriptive analysis. The broken line picture of the average of appraises on four vocabularies of 76 products shows that the score of "streamline" is higher than the other three (Fig. 15). In addition, the broken line picture of the average of appraises on 30 concept design drawings indicates that the score of "innovative" is higher than the others (Fig. 16). The averages of vocabularies used to describe all figures are all positively between four and six. The comparison of these two finds it is obviously that the concept design drawing is thought to be more innovative than market products (Fig. 17). Moreover, market products are thought to be more streamline than concept design drawings. The reason might be because market products are carefully designed by designers. The appraisement of the other two vocabularies is quite close. It is surprising that the concept design drawing which produced after three adjustments receive the same appraisement with market products. This indicates that this kind of method is worth continuing making great efforts.

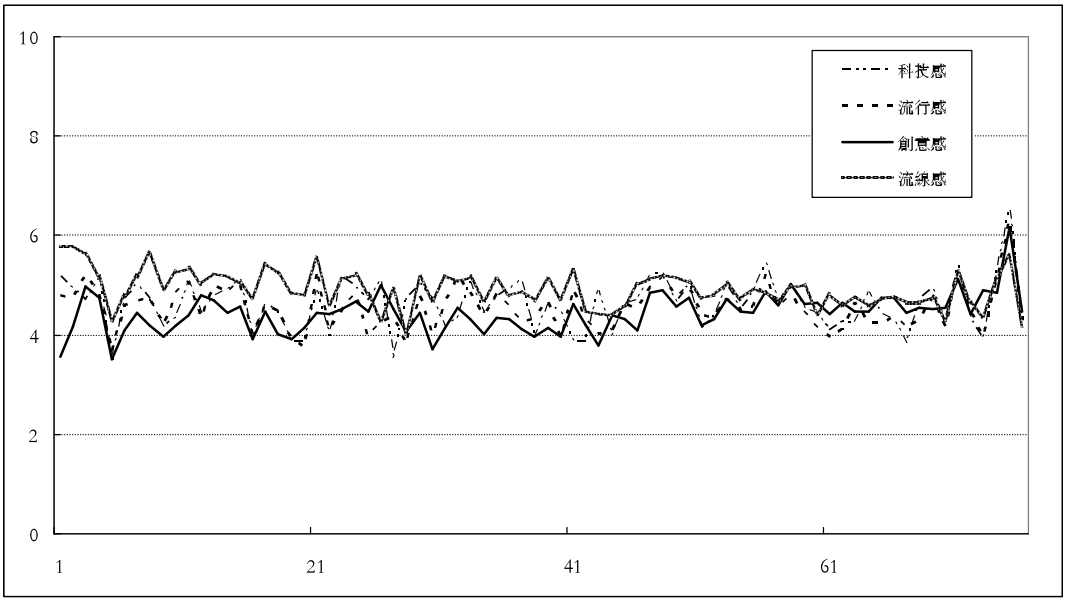


Fig 15: Results of Market Products

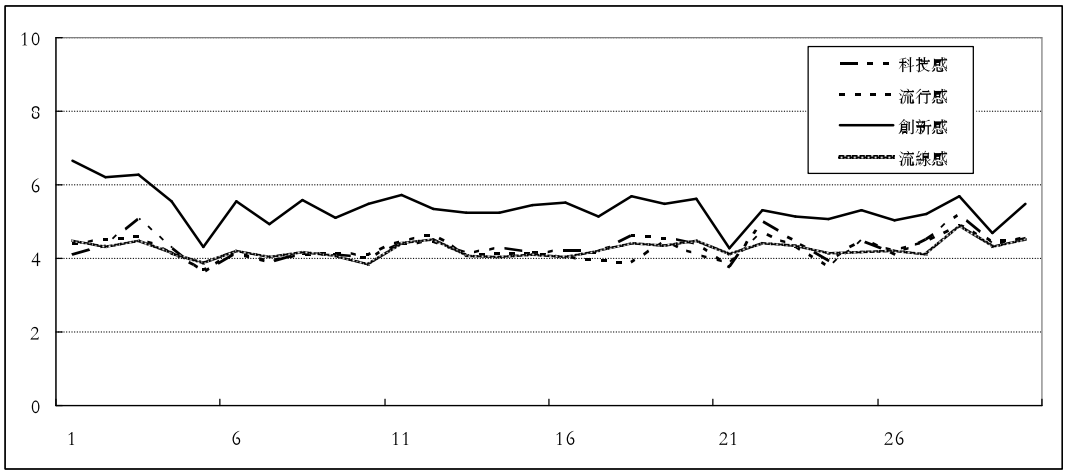


Fig 16: Results of Concept Design Drawings

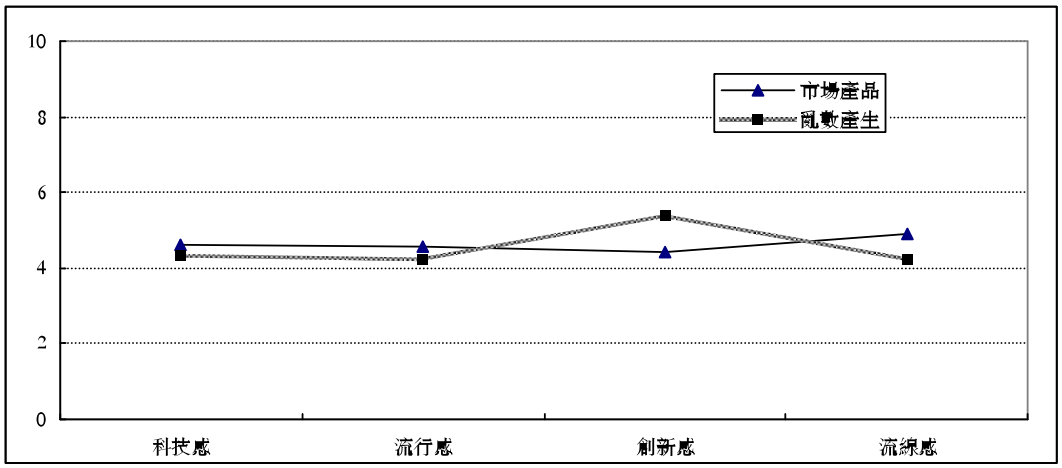


Fig 17: Comparison of Market Products and Concept Design Drawings

5. DISCUSSION AND CONCLUSION

While working on concept design, designers usually browse various relevant books, catalogue, to irritate own thinking, and to transform and simulate into their own ideas. However, sometimes it results in the risk and misunderstanding of plagiarism. This study collected and demonstrated samples and development of front handle cover of motorscooter which suggested the need to understand the development of product while conducting product design. It is the direction of future research on the creativity of concept design in the field of design which is to investigate the width of design concept through simple random number routing. Although it might be unable to obtain the most complete range through a few times of data adjustment, such method make designers do not need to fear the lack of inspiration and provide professional designers of motorscooter with a different source of creative design.

There is no conflict between this process and traditional method. Furthermore, it helps to improve the idea sketch drawing and avoid the helplessness during the black box of drawing idea sketch. The results show that the concept design drawing which produced after three adjustments receives the same appraisement with market products. Thus, this finding suggests that this kind of method is able to provide lots of ideas. Designers can select and adjust these ideas, and come up with good creative design.

Many kinds of mathematical calculations used for figures have been developed into different fields which require experts to understand the process of implementation. This study demonstrates a process for easily create ideas for concept design beyond imagination. From this method, we could develop originality design, and it is possible to develop a universal program to fit for any one after modulate dimension of parameters.

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