Innovation Design Method for Electronic Consuming Products Figures Based on TRIZ*

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Abstract This Paper presents a valid innovation design method for electronic consuming products figures. Using the technology evaluation principle in TRIZ (theory of inventive problem solving) theory as a powerful tool, combined with consumer psychology and relevant knowledge on products modeling methodology, evolution patterns and evolution paths of electronic consuming products figures have been explored. Moreover a set of regulations working for figures innovation design is established.

Key words TRIZ; innovation design; technology evaluation principle; regulations set

Many studies about innovation design have been done in China and the world recently, but these studies are mostly centralized on the innovation for design theory and function of product. Besides functions of the product, figure is another critical factor which determines competitiveness for a rapidly updating electronic consuming product. How to develop products which will lead trend of the times and attract customers rapidly? It’s a problem that all product designers want to solve. Thus this paper is aimed at researching the innovation design of electronic consuming products figures based on TRIZ. Using the technical evolution principle, combining consumer psychology and some relevant knowledge on product modeling methodology, the evolution patterns and evolution paths for innovation figures design of electronic consuming products have been put forward [1].

TRIZ was firstly developed by a former Soviet Union engineer in late 1940’s. It’s a comprehensive and sophisticated theoretical system which comprises of all kinds of methods and algorithms used in technical problems or innovative design. Through the development of more than 60 years, TRIZ has become a powerful method for problems and solutions come across in industrial and scientific fields, for the evolution trends in these fields. Researchers can apply these principles to predict the trend of the product development and steer the striving direction [2].

The heuristic method in TRIZ faces to designers, instead of machine. Computer software based on TRIZ is just playing an aided role, rather than replacing designer completely. It is the combination of methods and tools which has been offered to designers for deal with random problems [3-4].

Plenty of studies about product design principle and function on TRIZ theory have obtained considerable achievements. For example, the “Goldfire Innovation” developed by Invention Machine Corporation; the “Pro/Innovator” developed by IWINT, Inc; and in China, the “InventionTool2.0” which has been developed by Hebei University of technology [5]. However, studies on product figure innovation design are quite few.

1 Basic Classification and Figure Analysis

1.1 Basic Classifications

There are various electronic consuming products in the present market. The basic classification was given, according to their use, shown as Tab.1.

As can be seen from Tab.1, some products are traditional and have existed for tens of years, some are novel, developed only few years age. For reflecting the development of products figures all-round, some traditional products were selected by author to research.

1.2 Figure Analysis

By analyzing traditional products figure, it can be found that the volume of some products are more and more little, the figure becomes gentle and colorful, and the design is increasingly to satisfy the demand of person. Mobile phone is a good example. Some pictures of mobile phone were shown in Fig.1, whose figures giganticly changed during recent 20 years.
The first picture was the primary mobile phone in 1983. It had a big volume, wooden figure, monotonous color, and heavy to carry out. The second picture is the style in the end of 1980s. It's the first folder-type mobile phone, so the danger of accidentally dialing can be avoided. The third picture is the product style in the mid-1990s, which has been adopted by many mobile phone manufacturers in that period for little volume and richer color. Since then, the figure design of mobile phone is classified more clearly. On one hand, it could be divided into fold-type and unfold-type; on the other hand, divided into internal antenna and external antenna. In one word, not only color and figure of mobile phone but also the feel and quality sense have become increasingly harmonious and cordial.

The development of mobile phones has gone through simulated times, GSM times, 2.5G times and 3G times. These could not be well-behaved without technical advance. The figures are also improved alone with the technical advance.

For common products, such as washer or radio, their figures have been changed revolutionarily with the technical improvement too. Their figures are never single straight lines. Their forms are also gradually diversified.

The different figure evolution period of washer and radio, in recent 20 years, was shown as Fig.2 and Fig.3.

Besides the three kinds of products mentioned above, tens kinds of electronic consuming products contour have been studied. The details will not be introduced in this paper.

Tab. 1 Basic Classifications of consumer electronic products

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Products</th>
</tr>
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<tbody>
<tr>
<td>Home audio and video</td>
<td>TV set, home theatre, DVD, video, radio etc.</td>
</tr>
<tr>
<td>Household products</td>
<td>Air-conditioner, refrigerator, washer, iron, vacuum cleaner, electric fan etc.</td>
</tr>
<tr>
<td>Portable entertainment</td>
<td>Mp3 player, CD player, DC etc.</td>
</tr>
<tr>
<td>Kitchen appliances</td>
<td>Blender, juice extractor, coffee kettle, rice cooker, hand mixer, fryer etc.</td>
</tr>
<tr>
<td>Personal information products</td>
<td>PDA, electric dictionary, U-disk etc.</td>
</tr>
<tr>
<td>Information terminal</td>
<td>Telephone, mobile phone, cordless phone etc.</td>
</tr>
<tr>
<td>Personal care</td>
<td>Lady shave, razor, hire care, electric toothbrush etc.</td>
</tr>
</tbody>
</table>

Fig.1 Contour evolution of mobile phone

Fig.2 Figure evolution of washer

Fig.3 Figure evolution of radio

2 Evolution Patterns and Evolution Paths

Products figures has two aspects, one aspect is artistic that belongs to psychology category. The other is scientific that changes continuously with technical innovation. So, technical evolution principle in TRIZ theory is introduced to discuss the evolution patterns and evolution paths of the products figures. Then some principles should be followed, and some patterns should be applied mechanically in the products figures innovation design. This method is very helpful for designers to find the design thinking of the new generations products contour as soon as possible.

2.1 Evolution Patterns of Product Contour

From the figure analysis above all, similar patterns and regulars which existed in the developments and changes of different electronic consuming products could be found.

Given an example with washer, the stiff lines of washer are replaced gradually by curves. Increasing the degree of curve of product contour has been embodied. The forms of washer also developed from single to diversity step by step, some washers suited the masses, and some suited the children such as the
washer like egg or bell pepper shown in Fig.2. Increasing the degree of diversity of product figures has been reflected. At the same time, the figures of washer have been also developed from rigid machine to artistic work with cordial and satisfying the demand of customer's visual appreciation. Increasing the degree of humanity and harmony of product figure has been adequately embodied.

Then the seven evolution patterns of products figures have been summed up, shown in Fig.4.

<table>
<thead>
<tr>
<th>Evolution patterns of product figures</th>
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<tr>
<td>Increase the degree of harmony</td>
</tr>
<tr>
<td>Increase the degree of curve</td>
</tr>
<tr>
<td>Increase the degree of whole</td>
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<tr>
<td>Increase the degree of multi-channel</td>
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<tr>
<td>Increase the degree of fine</td>
</tr>
<tr>
<td>Increase the degree of humanity</td>
</tr>
<tr>
<td>Increase the degree of diversify</td>
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Fig.4 Evolution patterns of product contour

Pattern 1: Increase the degree of harmony
This evolution pattern is the most basic one. Both the harmony of product itself and the harmony of product between user and environment are important for product figure development.

Pattern 2: Increase the degree of curve
This pattern indicated that straight line has been changed to curve, plane has been changed to curved surface, and cubic has been changed to cylinder and so on.

Pattern 3: Increase the degree of whole
It means that many different parts of product figure are combined together overall gradually.

Pattern 4: Increase the degree of humanity
The big bulk of products can achieve their function by only passing through the operation of users. Therefore, products design must focus on the operation and the aesthetic interest of consumer. When using some product, if it goes beyond this scope that the physiological condition of user himself and the control ability for product, user would feel uncomfortable or could not reach the use efficiency. For example, when designed some electronic consuming products which operated by hands, the scope and the manner of operation with hand must be considered to alleviate exhausting hand as far as possible. Then the optimum effect and psychological feelings could be gained. All these would be embodied in this pattern.

Pattern 5: Increase the degree of multi-channel
The means of this pattern was that the concept and style of other fields, such as city, building, automobile and dress etc, were fused in the figure design of consumer electronic products.

For example, when explained the figure concept of C45 one of the most succeed mobile phones, the total designer Ulrich Skrypolle of Siemens mobile phone said he has referred to the color of Paris, the dress design of London, the building design of Milan and the automobile modeling in German, after digested all of this information, blended in C45 completely.

Pattern 6: Increase the degree of fine
It means that the figure of product has become lighter, thinner, and smaller.

Pattern 7: Increase the degree of diversify
Because of the difference in customer’s sex, age, healthy condition, educational level, appreciation and nature, as well as the region environment of living, customs and habits etc. some discrepancy have appeared about the aesthetic feelings for figures. Culture and status or nature and characteristics would be embodied in the product shape. This pattern would become the one of important tools that solved the above mentioned discrepancy.

2.2 Evolution Paths of Product Contour
After summarizing the seven evolution patterns, some evolution paths adhering to these patterns have been summed up. Some paths would be introduced simply in this paper.

1) Path 2-1: The geometry evolution of line (It’s a path in pattern 2)
   Straight line → 2D curve → 3D curve → compound 3D curve

2) Path 2-2: The geometry evolution of surface
   Plane ↦ curved surface ↦ hyperboloid ↦ compound curved surface

3) Path 2-3: The geometry evolution of body
   Cubic ↦ cylinder ↦ sphere ↦ compound body

4) Path 3-1: Leave out the supplementary part
   (It’s a path in pattern 3.)
   Leave out the rectify part → leave out the prepare part → leave out the protect part → leave out the external husk → leave out the other supplementary part

5) Path 4-1: The demand of person (It’s a path in pattern 4)
   The demand of physiology → the demand of psychology → the demand of intelligence

6) Path 4-2: The adaptability of product
   The design about dimension of person → the design about
vision of person

7) Path 7-1: Diversify on sex (It’s a path in pattern 7)
   Be suitable for masses → be suitable for male or female

8) Path 7-2: Diversify on age
   Be suitable for masses → be suitable for old age people, middle age people, young people or children

2.3 The Searching Tactics Based on the Evolution of Product Figure

Evolution patterns and paths have been given, then how to solve problems occurred in figure innovation design with these patterns and paths? The searching tactics are put forward in this paper, shown as Fig. 5.

After design problem being defined, according to Fig. 5, first of all, designers can select one or more evolution patterns about the design problem. The next step, selected evolution paths in those patterns, and then searched the state of product now in those paths and the new state that the product could move to. After that, the new state of the product could be defined and the problem could be solved.

So, the problem about the future shapes of new generation products can be solved. Such as what shape of new generations of mobile phone should be?

Firstly, pattern 7 (Increase the degree of diversify) can be tried to adopt to solve this problem. Secondly, the path 7-1 (Diversify on sex) was selected. After analysis the present market state, the male and female mobile phone had been on the market visibly. Following, the path 7-2 (Diversify on age) was selected, it maybe a more feasible path. In the next future, children phone, girl phone, lady phone, old man phone could be emerged on the market.

Certainly, it’s not the only path. In the future, mobile phone may be not only a telephone, but also a kind of varied audiovisual ware. The personal appliances that could be imagined, such as a camera, a pair of glasses, a watch, a earplug, or a pair of gloves, a surgical mask, a billfold, a brooch and so on, became new generations of mobile phone possibly, and also might be hided in person’s body as a conceal device.

3 Conclusions

The evolution patterns and paths of electronic consuming products are described in this paper. This method could break the traditional thinking form, widen the thought of designers, and help them to find the design train of thought easily. An effective figure innovation method leading trends of times is established. In the future, the figure innovation research will become a hot spot in innovation research domain, and will become riper step by step.

References


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