

A STUDY ON AN ANALYZED METHOD OF THE EMOTIONAL IMAGES OF PRODUCTS

Toshiki Yamaoka

Wakayama University, Japan

ABSTRACT

An analyzed method of emotional images of products was proposed. The correspondence / cluster analysis and the Formal Concept Analysis were used for the purpose. After the correspondence/cluster analysis and the Formal Concept Analysis were summarized, the procedure and characteristics of the proposed method were explained using examples of alarm clocks. The following turned out. The correspondence / cluster analysis restricts and narrows down the image of products. Formal concept analysis clarifies the relation and structure among images and products.

Keywords: *formal concept analysis, correspondence analysis, cluster analysis*

1. BACKGROUND AND THE PROPOSED METHOD

Usually emotional images of products were always not analyzed in design process quantitatively. Sometimes a factor analysis and so on was done in order to know the emotional structure of products. However these methods need statistical knowledge and are difficult to grasp the meaning of results [1][2].

The proposed method is easy to grasp the meaning of results and users such as designer, planner and so on can recognize the structure and meaning of results at a glance [3].

The proposed method's procedure is as follows.

- (1) A questionnaire survey is done by participants
- (2) The data of questionnaire survey are analyzed by the correspondence analysis.
- (3) The data are grouped by the cluster analysis.
- (4) The data of questionnaire survey are changed into the binary data.

The binary data are analyzed by formal concept analysis.

- (5) The relationships between emotional items, users and products turn out and are useful for designing.

The method is described in detail using an example from the second chapter to the third chapter. Products, participants and question items for the example are as follows.

1.1. Products

5 alarm clock: 4 analog type(a, b, c, e) and 1 digital type (d)



(a)



(b)



(c)



(d)



(e)

1.2. Participants

19 Wakayama University students (sophomore, M:11,F:8)

1.3. Question items

Participants were asked question items for each product.

- (1) look simple, (2) look classic, (3) look harmony, (4) want to purchase,
- (5) look modern, (6) look adorable, (7) look cool, (8) look accurate,
- (9) look easy to use, (10) look warm, (11) look colorful, (12) look like loud sound
- (13) look calm

5 point likert scale was done for the question items.

2. THE CORRESPONDENCE ANALYSIS + THE CLUSTER ANALYSIS

The data of questionnaire survey (Table1) are analyzed by the correspondence analysis. The correspondence analysis visualizes the associations between the rows and columns of a contingency table. In this case participants and question items were inputted into the rows and columns of a contingency table.

The participant's subjective data were analyzed by the correspondence analysis (Fig.1) and also classified into 4 groups by the cluster analysis (Fig1). The question items (emotional items) are classified for 5 alarm clocks.

(1) Alarm clock (a)

* Simple, cool

*modern, easy to use

*classic, calm, accurate, loud sound

- *harmony, warm, purchase, adorable, colorful
- (2) Alarm clock (b)
 - * Simple, modern, calm *classic, accurate, harmony, purchase
 - *easy to use, cool, loud sound * adorable, warm, colorful
- (3) Alarm clock (c)
 - *Simple, easy to use *cool
 - *classic, harmony, purchase, adorable, calm
 - *modern, loud sound, accurate, warm, colorful
- (4) Alarm clock (d)
 - *Simple, accurate, cool *classic, harmony, purchase, easy to use, calm
 - *modern, adorable *warm, loud sound, colorful
- (5) Alarm clock (e)
 - *Simple, classic, loud sound *harmony, easy to use, cool, calm
 - *purchase, adorable, accurate, modern *warm, colorful

Table1: The results of alarm clock (a)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AV.
simple	2	3	2	4	3	1	3	2	2	2	2	4	2	2	3	2	2	2	1	2.32
classic	4	2	4	2	4	2	4	2	2	2	2	3	3	3	2	2	1	3	1	2.53
harmony	3	3	3	2	2	2	2	2	1	3	2	4	3	3	2	3	2	4	1	2.47
purchase	2	1	2	1	3	1	1	1	1	1	3	4	2	2	2	2	2	2	1	1.79
modern	2	4	3	3	2	2	2	3	4	2	1	5	4	3	2	3	4	3	1	2.79
adorable	3	2	2	1	1	1	2	1	2	3	3	3	1	4	3	2	3	4	1	2.21
cool	2	4	4	4	4	2	4	5	4	5	4	4	4	3	2	2	3	3	2	3.42
accurate	3	4	3	2	4	3	3	3	3	4	3	3	3	3	3	3	2	3	3	3.05
easy to use	3	3	3	3	3	3	2	3	4	3	2	3	3	3	2	4	2	4	2	2.89
warm	2	2	3	2	2	2	2	1	1	2	2	2	2	3	2	2	2	4	2	2.11
colorful	4	2	3	3	2	2	2	1	3	4	4	4	4	3	4	3	4	4	2	3.05
loud sound	5	4	4	5	5	5	5	3	5	5	3	3	5	4	4	4	5	5	4	4.37
calm	4	2	2	2	3	2	3	2	2	3	2	2	2	2	2	2	1	2	1	2.16

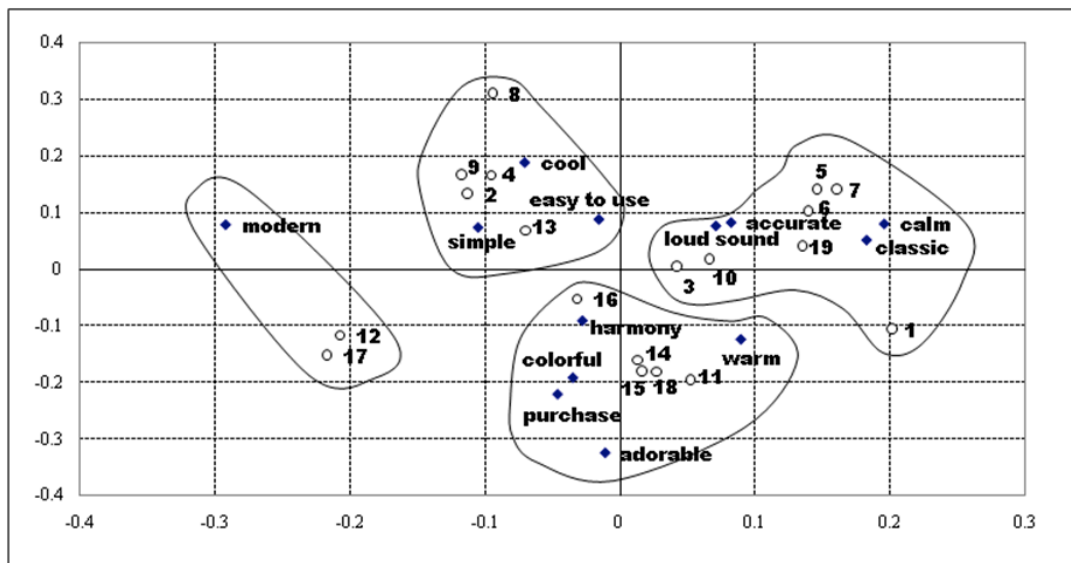


Figure1: The results of the correspondence analysis and cluster analysis of alarm clock (a)

According to Fig.1, the alarm clock(a) can be analyzed as mentioned below.

(1) The emotional items and participants are classified by the correspondence analysis and cluster analysis.

(2) The classified items and participants are as follows.

*classic, accurate, loud sound, calm, 1, 3, 5, 6, 7, 10, 19 (participants)

*harmony, purchase, adorable, warm, colorful, 11, 14, 15, 15, 18 (participants)

*simple, cool, easy to use, 2, 4, 8, 9, 13 (participants)

*modern, 12, 17 (participants)

Most participants (1, 3, 5, 6, 7, 10, 19: 37%) judged the image of product (a) to be classic, accurate, loud sound and calm. The main image of product (a) is “loud sound”, as the average score of 2loud sound” is very high (Table1).

Then we can understand the main image of product (a) is classic, accurate, loud sound and calm.

3. THE FORMAL CONCEPT ANALYSIS

3.1. FCA for the emotional items and participants

The participant’s subjective data were changed into binary data (1,2 point:0, 3,4,5 point:1) in order to do the Formal Concept Analysis(FCA). FCA creates a lattice based on relationship among objects and their attribute on a matrix. The objects are the emotional items (question items) and their attributes are the participants’ data. Fig 2 and 3 show the lattice that characterizes the relationship among the emotional items (without “purchase”) and the participants’ data.

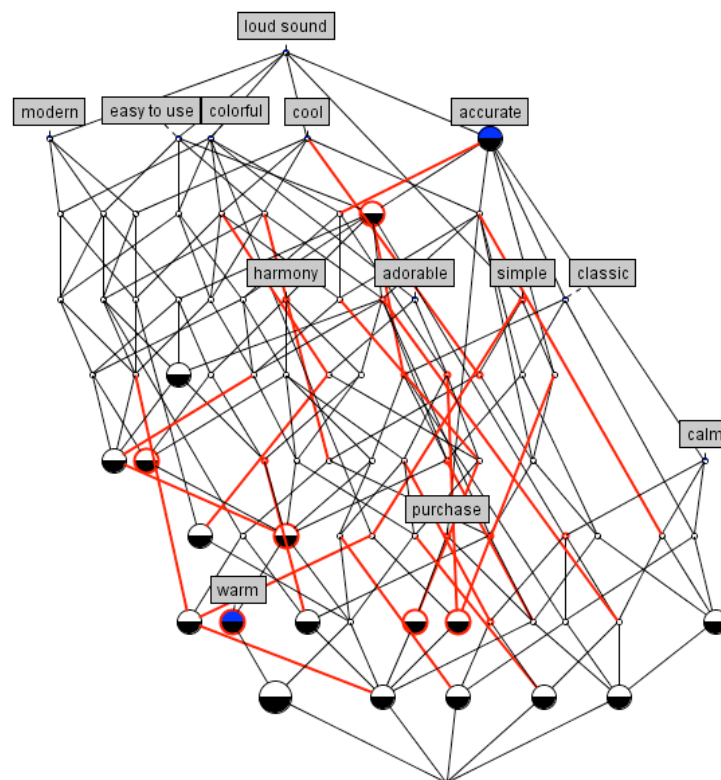


Figure2: The results of the formal concept analysis of alarm clock (a)

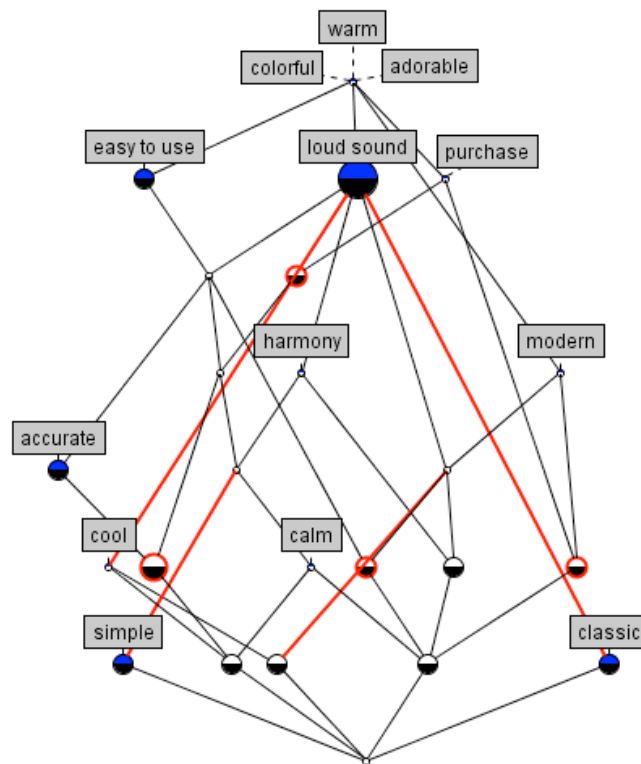


Figure 3: The results of the formal concept analysis of alarm clock (e)

High-ranking items in the lattice include low-ranking items linked to high-ranking items. For an example, if A include B linked to A, product Z mean not only A mainly, but also B. The data of participants in the lattice are not shown in order to watch the lattice easily.

The following relation among the emotional items turned out.

(1) alarm clock (a)

The main image of the alarm clock (a) is “loud sound”. And 5 subordinate and the classified images are “modern”, “easy to use”, “colorful”, “cool” and “accurate”.

- Loud sound > modern
- Loud sound > easy to use
- Loud sound > colorful
- Loud sound > cool
- Loud sound > accurate

(2) alarm clock (b)

The main image of the alarm clock (b) is “harmony”, “calm”, “accurate”, “classic” and “simple”. And 4 subordinate and the classified images are “cool”, “easy to use”, “modern”, and “purchase”.

- Harmony, calm, accurate, classic and simple > cool
- Harmony, calm, accurate, classic and simple > easy to use
- Harmony, calm, accurate, classic and simple > modern
- Harmony, calm, accurate, classic and simple > purchase

(3) alarm clock (c)

The main image of the alarm clock (c) is “calm” and “simple”. And 4 subordinate and the classified images are “accurate”, “cool”, “easy to use”, and “harmony”.

- Calm and simple > accurate
- Calm and simple > cool
- Calm and simple > easy to use
- Calm and simple > harmony

(4) alarm clock (d)

The main image of the alarm clock (d) is “cool”. And 3 subordinate and the classified images are “calm”, “accurate” and “purchase”.

- Cool > calm Cool > accurate
- Cool > purchase

(5) alarm clock (e)

The main image of the alarm clock (e) is “colorful”, “warm” and “adorable”. And 3 subordinate and the classified images are “easy to use”, “loud sound” and “purchase”.

- Colorful, warm and adorable > easy to use
- Colorful, warm and adorable > loud sound
- Colorful, warm and adorable > purchase

3.2. FCA for products and emotional items

The table2 shows the relation between products and emotional items based on the binary data which are changed the average data. The binary data were analyzed by the correspondence analysis and cluster analysis. The following is the results (Fig.4).

- (1) Product(a) : loud sound
- (2) Product(b),(c): classic, calm, harmony, purchase, simple
- (3) Product(d): accurate, cool, easy to use, modern
- (4) Product(e): adorable, colorful, warm

The fig.5 shows the relation between the emotional items and the alarm clocks. According to the results, the following turned out.

- (1) Loud sound ---> product(a), product(d)
- (2) Accurate, cool---> product(a), product(b), product(c), product(d)

Table2: The data of alarm clock and emotional items

	A	B	C	D	E
simple	0	1	1	1	0
classic	0	1	1	0	0
harmony	0	1	1	1	0
purchase	0	1	0	1	0
modern	0	1	0	1	0
adorable	0	1	0	0	1
cool	1	1	1	1	0
accurate	1	1	1	1	0
easy to use	0	1	1	1	0
warm	0	0	0	0	1
colorful	1	0	0	0	1
loud sound	1	0	0	1	1
calm	0	1	1	1	0

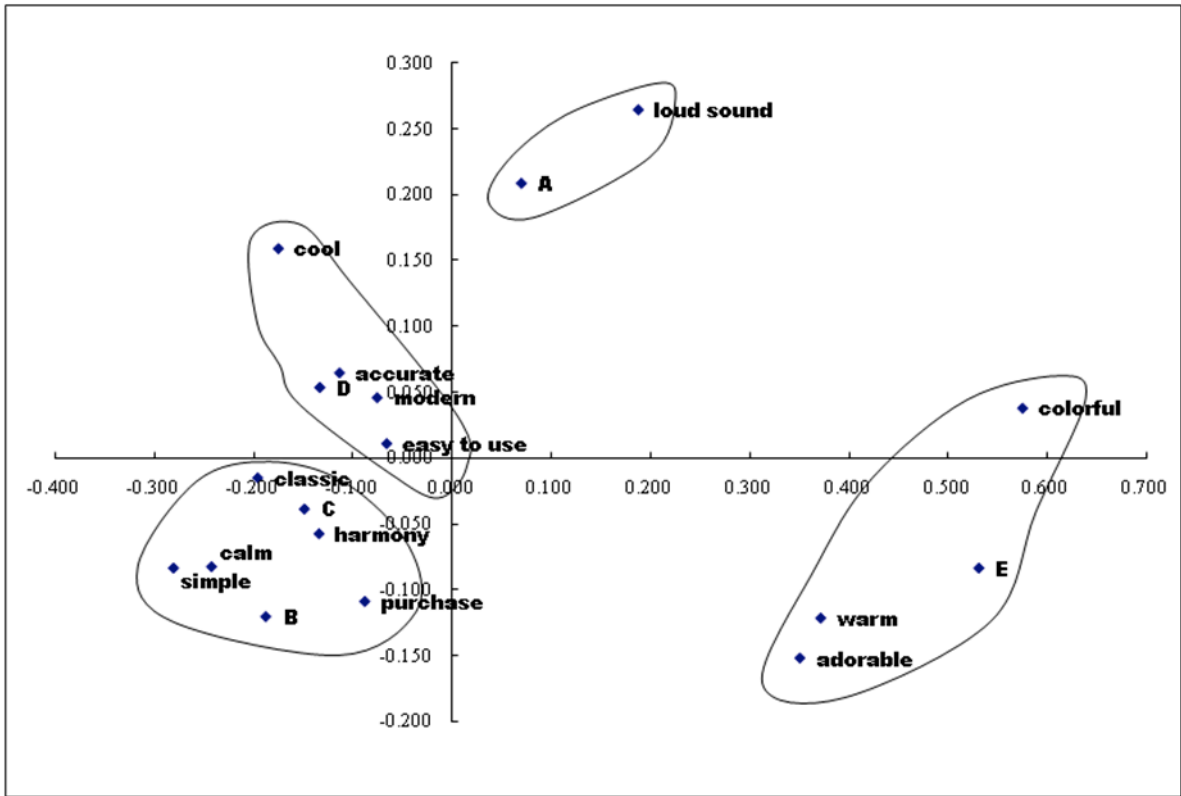


Figure4: The results of the correspondence/ cluster analysis of the five alarm clocks and the emotional items

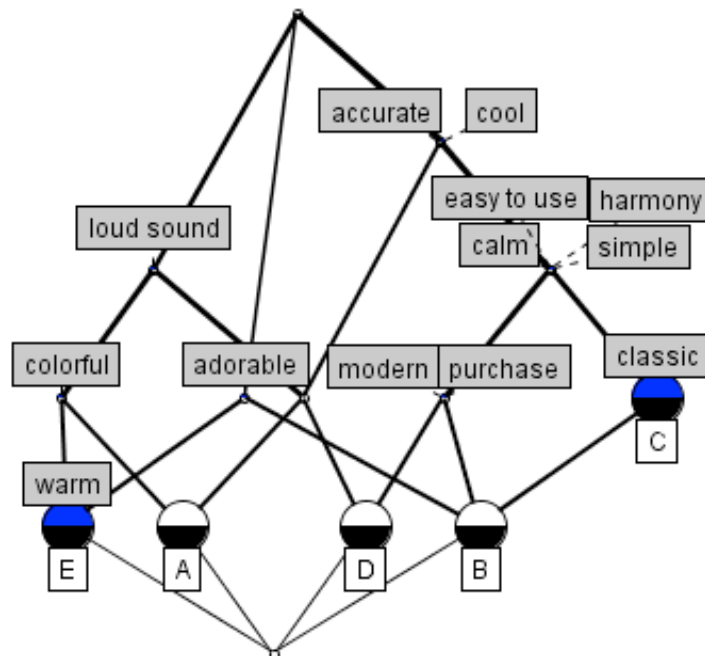


Figure5: The results of FCA of the five alarm clocks and the emotional items

(3) Adorable---> product(b), product(e)

The images of each product are as follows.

Product(a) : “loud sound, colorful” and “accurate, cool”

Product(b) : “accurate, cool”, “easy to use, harmony, calm simple” , “modern, purchase” and “adorable”

Product(c) : “accurate, cool”, “easy to use, harmony, calm simple” and “classic”

Product(d) : “loud sound” , “accurate, cool”, “easy to use, harmony, calm simple” , “modern, purchase”

Product(e) : “loud sound, colorful, warm”

For the results mentioned above, the output of the correspondence analysis / cluster analysis and FCA are not different a little. However, the former restricts and narrow down images and the latter clarifies the relation and structure among images.

4. SUMMARY

Designers can understand the image of product, interior and so on intuitively. However ,as designers and planners and so on cannot estimate the image or liking of target users, they can grasp them employing the proposed method. The proposed method consists of two analysis. The one is the correspondence analysis and the cluster analysis. The other is the formal concept analysis.

The following is the characteristic and procedure of the method.

(1) Participants thirty and below

The correspondence / cluster analysis and FCA are done separately. The results of each analysis are analyzed separately and used together for examining and identifying the image of products

(2) Participants thirty one and over

When a lot of participants is needed, the correspondence / cluster analysis are done in order to classify participants at first. Next, FCA is done for the grouped participants. If FCA is done with participants thirty one and over, it's very difficult to check the relation between items and products.

The characteristics of the correspondence / cluster analysis and FCA are as follows.

(1)The correspondence / cluster analysis restricts and narrow down the image of products.

The characteristics and image of group are clarified by this method .

(2) FCA clarifies the relation among images and products.

FCA clarifies the relation and structure among images using lattice.

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