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Research Paper

Establishing picture database for images board- An example for lifestyles of health and sustainability (LOHAS) image

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ABSTRACT

Recently, great importance has been attached to consumers' emotional feeling in the course of product design. Designers must convey positive emotions such as surprise and affection, to consumers through their designs. For this purpose, image boards have been frequently used in design to position product emotional feeling and stimulate design ideas. A large number of pictures are often needed for constructing an image board. However, it is time consuming and labor intensive, to find appropriate pictures, and the pictures that are finally collected may not reflect the expected image of consumers. Therefore, this research aims to establish a user-driven picture database for image boards to express the expected emotion by taking the Lifestyles of Health and Sustainability (LOHAS) as an example. In the research, 16 LOHAS representatives were identified and recruited by using a lifestyle questionnaire to collect and then screen out 50 proposed pictures relevant to the image of the LOHAS. As the image board is usually used by designers, to include their ideas, another16 pictures were selected by the invited experienced product designers to obtain the comprehensive pool of 66 proposed pictures. Design experts were asked to screen out six key image adjectives including healthy, environmentally friendly, sustainable, natural, simple and ecological for description of image of the LOHAS from the vocabulary pool collected by ordinary people, LOHAS representatives and designers. Next, 219 LOHAS subjects were required to carry out the semantic differential assessment for each of the 66 proposed pictures on the six key images. Two types of analyses on the collected data from the semantic differential assessment: the mean analysis and the grey relational analysis, were adopted to screen out the recommended pictures for representation of the images of LOHAS or of the six key adjectives, respectively. Three modes of applying the database picture based on the above result were also proposed. The result of this study is expected to be used by designers, users, manufacturers and the education circle to help improve product design efficiency in the future.

Key words: Picture database, image board, lifestyles of health and sustainability (LOHAS), semantic differential scale, grey relational analysis.

INTRODUCTION

One of the goals that designers strive to achieve is integration of positive emotion into product design, because it can stimulate consumers' motivation to purchase. Roy et al. (2009) pointed out that positive and joyous emotions are

one of the key points for product design. Lauer and Pentak (2011) claimed that in the design process, implementing proper method or tool helps in creating successful design. Green and Bonllo (2002) also stressed that proper design process and method can well help define ideas and make decisions. To import method in the course of design can stimulate design thinking and obtain diversified design inspirations and available design elements. Among available design methods and tools, image board is one of the commonly used tools by designers to realize and achieve emotional requirements of users.

Image board was first proposed in 1995 by Baxter, who pointed out that designers could work out empathy effect by making image board to fully understand users' feeling and experience on design (Baxter, 1995). Image board is a kind of design tool using intuitional judgment to let designers directly put themselves in the shoes of users to experience design problem and avoid design fixation (Jansson and Smith, 1991). Image board is also a strong tool for users to express their emotion, expectation and points of view (McDonagh al., 2002). Brown (2009) pointed out that users could obtain more positive emotion on products by purchasing the products designed with image board.

While designing image board, most of the designers exert their imagination ability through search and retrieval visual data. Graphic data are beneficial to the design transformation. In the process of design transformation, designers can generate image associations through the visual stimulation of pictures before further converting them into a design concept (Menezes and Lawson, 2006). Therefore, it is necessary to obtain huge amount of image pictures, then identify the characteristics of them, sort them into categories accordingly and provide appropriate names for each category before using them to make an image board. Picture collection is time consuming and labor intensive. Furthermore, mostly, the pictures are subjectively collected, analyzed, sorted and named by designers based on their personal experience and feelings without verifying their conformation to the image that users pursue. Most of the pictures collected are paper-based, which not only occupy a lot of space, but also make it difficult to replace the old ones. Although, now designers can scan the pictures and create folders for them to electronically collect data, it still consumes a lot of time and energy. In addition, the image database created by the designers themselves may have cognitive differences with users in terms of image integration, which is not conductive to the participatory design among users or trans-disciplinary design among people in various fields.

To help designers construct an appropriate image board effectively and quickly for designing products closer to users' positive emotion requirement, this research aimed to establish a user-driven database of image board with positive emotion. In the preliminary stage, the user group of Lifestyles of Health and Sustainability (LOHAS) was selected as the target; a database of image pictures specifically aimed for them was to be established.

Literature review

Image is the mental imaginary of integrating internal subjective emotion and external physical image. Image can be generated under two ways: to be specific, the first way is that image can be directly obtained from people's own culture, including life experience, social norms, life background, etc.; the other way is the cognition conveyed to the brain through sensory stimulation indirectly, such as the imagination after reading or the feeling after appreciating artistic work. Most scholars in different fields believe that image is composed of cognitive image and affective image (Dobni and Zinkhan, 1990).Cognitive image refers to personal attitude and perception; affective image refers to personal understanding on image attributes and characteristics (Martin and Del Bosque, 2008). Nagamachi (1989) also proposed that image is abstract and non-specific, and its imagination is related to users' life experience and cultural background. He regarded image as an equivalent term to Japanese 'kansei' (emotion), although asserted the meaning 'kansei' is more sophisticate than emotion, to propose and develop a new ergonomic approach of Kansei Engineering.

Image boards could provide an environment that stimulates designers' ideas in product development and design (Baxter, 1995). There are 4 stages in the design process where image boards can be used, these include:

(1) Exploratory stage: It is used in the stage prior to product design or preliminary design stage with the main purpose of understanding and communicating with users on their perception on the products available in the market at present.
(2) Design stage: It is used in the design conception process to obtain the ideal product concept in the users' mind and stimulate design ideas.
(3) Assessment stage: It is used to assess developed design concepts to ensure the user-oriented design.
(4) Presentation stage: It is used to express the image that the completed design is aimed for and is usually used in advertising or marketing.

The three general ways to prepare relevant pictures for image board (McDonagh et. al., 2002) are as follows:

(1) By designers: Designers collect pictures relevant to target consumers or planned product theme mainly from the Internet, newspapers and magazines, advertisements, etc. They collect pictures mainly based on the subjective awareness of designers such as their personal life experience, cultural background, etc., then position and group the pictures based on their subjective judgment.
(2) By panel discussion: Firstly, pictures are extensively

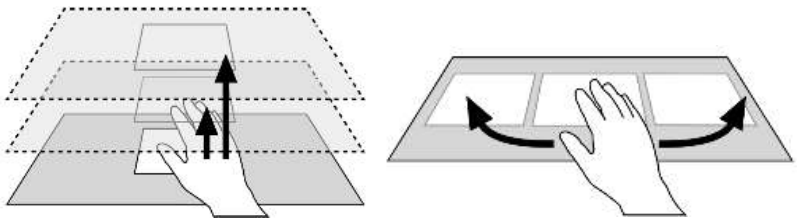

Figure 1: Electronic interactive mode of operation proposed by Lucero and Dima (Lucero, 2007).

collected by designers according to lifestyle of target consumers, expected personality of product or planned design theme, then they are positioned, grouped and named by panel discussion with expert members.
(3) By both designers and users: Relevant pictures are extensively collected by designers according to lifestyle of target consumers, expected personality of product or planned design theme, also, then they are positioned, grouped and named by target users based on the same principles.

Among the above three methods, preparing relevant pictures by designers is the most common one. However, it is always too subjective and the expressed image is always too superficial or limited, making it difficult to meet users' real needs. Preparing relevant pictures by panel discussion is more objective than the former, but most of the panel experts are either designers or manufacturers, making it hard to get close to the image that users pursue. Moreover, in this way, picture image needs to be discussed in depth and compared repetitively, which is absolutely time consuming and labor intensive. In the last method of preparing pictures by both designers and users, although users are responsible for picture positioning and grouping, pictures are collected by designers, making the integration of opinions very difficult due to the perception difference on pictures between users and designers. In contrast, the establishment of picture database proposed in this study entails the joint efforts of designers and users, from picture collection to image board production.

The advancement of science and technology gave birth to some tools for making image board, which give priority to replacement of traditional manual image board production by e-webpage platform. For example, Lucero and Dima (2006) proposed the image board developing approach by using MR system which provides the required technology and system concepts to construct a tailored image browser, and it also provides designers with an interaction platform for making image board. To use this system, designers must collect many image pictures by themselves first. This system provides the functions of downloading pictures from the Internet and scanning paper pictures to assist in building designers' personal picture database. Designers can use their hands comfortably and flexibly to grab physical images (Figure 1) to make image boards in the design studio environment. This e-webpage platform mainly solves the problem of office chaos caused by hand-made image boards, and provides an electronic picture database to reduce the problem of taking up a lot of space by paper pictures (Lucero, 2007). However, the picture collection, positioning, grouping, naming and image board construction in this e-webpage platform are still by designers according to their personal views. Its objectiveness is not verified, and the collected pictures may not necessarily meet the users' need. At the same time, the platform is only suitable for single user instead of trans-disciplinary joint design team.

SmpleBorad Lab is an e-webpage platform that can be used for constructing image boards for the following four categories of industry: interior design, landscape, wedding, clothing and textile. The platform allows users and designers to construct the personal image boards for stimulating design ideas or communication ideas with others. The picture database of the platform contains about 30,000 to 50,000 pictures, which are classified according to type of products and industries. The platform software can assist designers to retrieve relevant pictures from the picture database according to the mode of cloth pattern, texture, color pallet and so on, for conveying the design conception (Figure 2). The completed image boards can be stored based on the four categories above. The method of classifying pictures according to type of products and industries are weakly associated with aimed images, so platform users generally cannot obtain appropriate pictures to construct their image boards. In addition, they are designed only for four categories of industry, which means a failure of comprehensive coverage for the product design that is closely related to varied aspects of people's lives.

The MoodShare image board Internet platform is fitted with drawing function such as Picasa, and search engine linking sources of pictures and video films of such websites as Twitter, Google, Bing, Flickr, Picasa, Bigstock, Shutterstock, Youtube, Vimeo and ColourLovers, etc. Pictures are mainly obtained by entering key words of nouns or pronouns. For example, by entering the key word 'wave', a user can find pictures and videos related to wave, and then he can quickly drag images, videos, sounds, color palettes within a few seconds to create an image board (Figure 3). The picture collection of this platform is based on the picture classification of the major websites by themselves

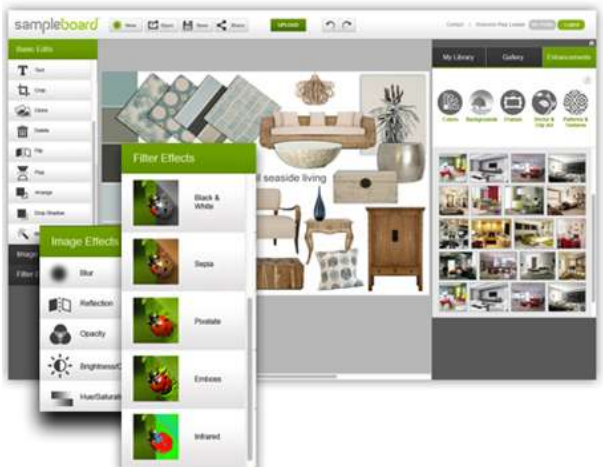

Figure 2: Smple Borad laboratory e-platform.

Figure 3: Image board production process by using Moodshare.

(mostly by keywords), but users have no idea about how pictures are classified; thus, have difficulty in obtaining pictures relevant to ideal image of target users. Moreover, the way to retrieve pictures in this system is by entering a noun or pronoun, not by entering the relevant adjective of expected image, the obtained pictures are multifarious and messy. If these pictures are directly used to make an image board, it is impossible to determine whether it meets the image that users pursue. Although, we can position and group these pictures before using them to make an image board, it is still time consuming and labor intensive just like using the traditional image board method.

The key to operate image board lies in the appropriateness and objectivity of picture collection, the simplicity and convenience of the production process, the ability to ensurethe participation of multiple people from picture collection to image board production and no restrictions by the region and language. In view of this, the research aims to establish an image picture database and construct an e-webpage platform, both of which involve users' participation to ensure that the obtained pictures areable to better reflect LOHAS, so that it can be effectively used by designers and relevant industries.

LOHAS was first proposed by Ray and Anderson (2000) in the book of 'The Culture Creatives: How 50 Million People are changing the World.' He proposed that 1 out of 4 in the United States and about 1 out of 3 in Europe are LOHAS and predicted that almost half of the total population in the US would be LOHAS in the future. One of three people in Taiwan is pan-LOHAS, as pointed out by the Eastern Integrated Consumer Profile (E-ICP, 2019), which did survey on the consumption behaviors and life style of the consumers in Taiwan per year since 1998. Pícha and Navrátil (2019) pointed out that LOHAS consumers can be identified as a group with specific purchase behavior. As estimated by Australia's LOHAS Consumer Trends Report, the global value of the LOHAS market would exceed AUD 500 billion. Products whose main targeted consumer group is LOHAS, such as products of Japanese MUJI and Daiso are also very popular in Australia. With the consumers of LOHAS spread around the world, the new and giant business opportunities for LOHAS are created, as reflected by data, reports, research and market trend. Therefore, the LOHAS is taken as the research object in this study.

Semantic Differential Scale was first introduced by Osgood in 1957 to explore the semantic connotative meanings of some abstract concepts (Osgood et al., 1957). It requires the respondents to self-report their feelings on a concept based on a set of opposite semantic adjective pairs. This method has been widely used in various related fields at present, especially in the field of design, it is frequently applied to explore the image or emotional feeling of design (Liu and Chuang, 2016; Chen and Chuang, 2014; Chuang and Ma, 2001; Tu et al., 2019; Belboula et al., 2019; Nakada, 1997).Thus, the SD scale was also used to explore the image feelings of pictures collected in this study.

To statistical analyze data in some systems, which are composed of many variables with very complex interrelationships, the existing randomness in data may confuse researchers' intuition and cover up the essence of things easily, making it uneasy to form a clear concept. In view of the above, Deng (1982, 1988) proposed Grey Relational Analysis (GRA)to clarify the main relationships among various factors in the system through a certain method, find out the most influential factors, and check the relevance of two systems. Different from regression analysis which has more data and fewer variables, GRA has a very simple and clear calculation process, needs only a little amount of data and is more flexible in terms of condition limitation than traditional methods. The obtained quantitative results will not produce the conclusions in conflict with qualitative analysis. The model assumed is a non-functional sequence model, which can effectively handle discrete data. The analysis steps of GRA include: (1) determine analysis sequence; (2) data standardization; (3) calculation of grey relational coefficients; (4) calculation of grey relational grade (5) ranking of grey relational grade. In the field of design, GRA is also always used for multi-criteria analysis to compare the comprehensive performance among different designs or design concepts. For example, Chen and Chuang (2008) applied GRA to explore the aesthetic quality of mobile phones on archiving a higher customer satisfaction and showed that GRA is suitable for the research of abstract concepts such as society and economic system.

MATERIALS AND METHODS

By taking the image of LOHAS as the research object, the research includes the following steps: (1)asking representatives of LOHAS and designers to extensively collect pictures and image adjectives relevant to LOHAS image; (2) inviting experts with design experience to choose pictures as stimuli and key adjectives as scales, which are more relevant to LOHAS image, form the above collection; (3) recruiting LOHAS subjects to conduct SD assessment on the selected stimuli with the selected scales; (4) finding out the suitable pictures for expressing image of LOHAS or of the key LOHAS adjectives based on the result of SD assessment.

Representatives of the LOHAS

This research focuses on LOHAS. The E-ICP Life Style Scale, which is a set of questionnaires developed by Dongfang Online in cooperation with the Institute of Business Administration of National Chengchi University, Taiwan, to classify the consumers' life style, was adopted to screen out representatives and subjects of LOHAS for this study. The volunteers wereinvited first on-line to complete the LOHAS questionnaire of the E-ICP Life Style Scale. From 68 volunteers, 52 persons belonging to LOHAS were screened out. Among them, 16 people (7 males and 9 females),with age mainly above 31-35 and education background of college/university or above, agreed to participate as representatives of LOHAS in this study.

Selected stimuli of pictures

The image pictures of LOHAS were collected by two ways. First, the 16 LOHAS representatives were asked to extensively collect pictures mainly on food, clothing, residence, travel, education and recreation related to LOHAS for one week. No limitation was set for the number of pictures and a total of 325 pictures were collected. Another 5 LOHAS representatives were invited to review and discuss together the relevance of these pictures to express LOHAS image via cloud video conference. Based on consensus, 50 pictures were selected for the database. In addition, as the image board are mostly built and used by designers, to include designers view in the picture database, 14 designers with more than 1 year of design experience were also invited to first collect many pictures relevant to LOHAS and product design. No limitation was set on the number of pictures collected. The collection lasted fora week with a total of 200 pictures collected. Another five designers with more than 5 years of design experience were invited to reduce the quantity of the pictures also via cloud video conference. Based on consensus, 16 pictures were finally selected. With these two ways, a total of 66 pictures, as shown in Figure 4, were proposed for the picture database and served as the stimuli for the following SD assessment.

Selected scales for SD assessment

To expand the range of assess scales for LOHAS image, three questionnaires weredistributed online to ask volunteers of different types of people providing relevant adjectives in2 weeks, as shown below:

1. Ask ordinary people to provide adjectives of expected

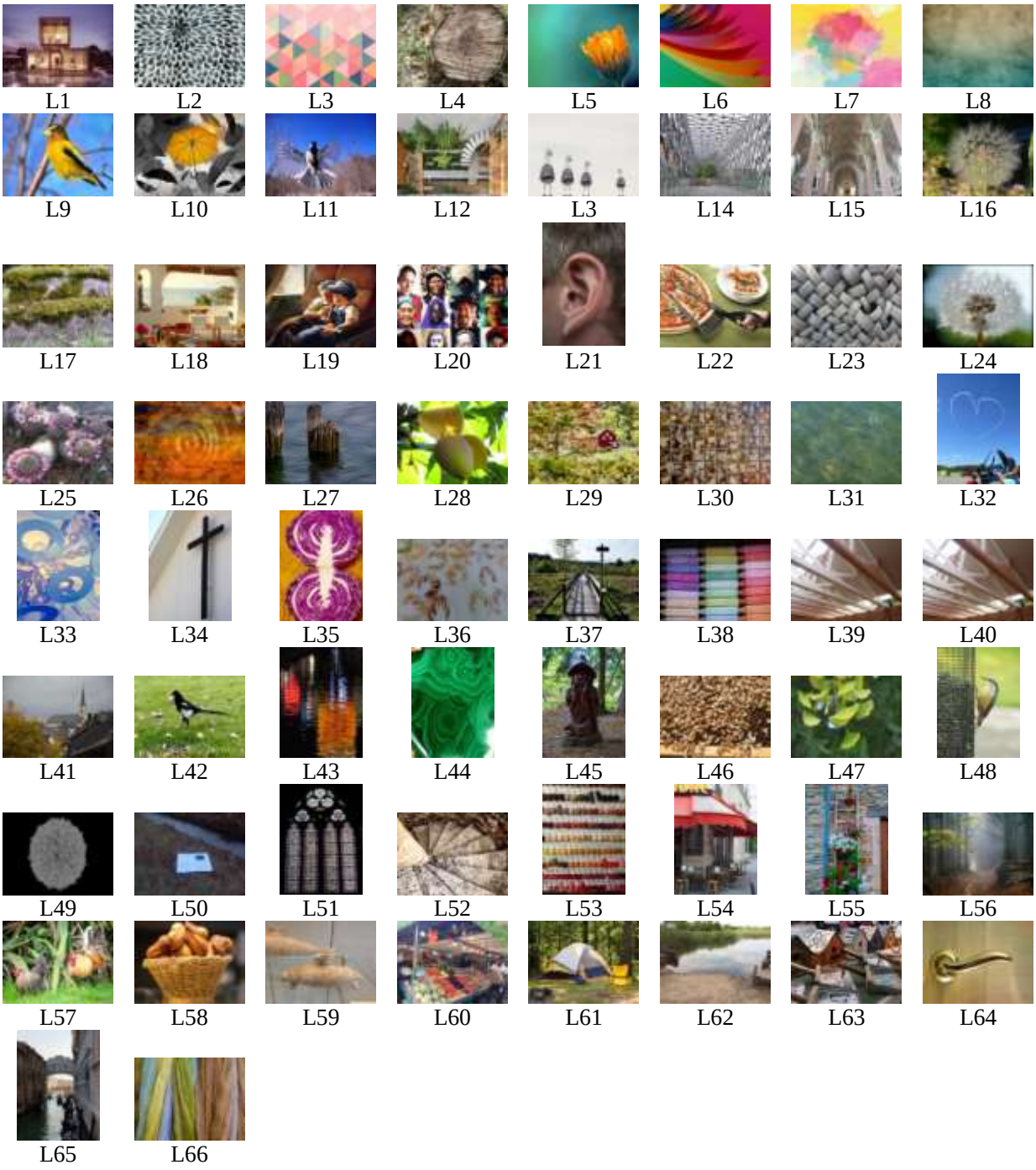

Figure 4: Stimuli of pictures for LOHAS image (L1-L16 were proposed by designer, L17-L66 by the representative of LOHAS).

images commonly desired on products: A total of 160 adjectives were obtained from 15general respondents.

2. Ask designers to provide adjectives of expected images commonly used by designers on product design: A total of 188 adjectives were obtained from 13 designer respondents.

3. Ask people belonging to LOHAS to provide adjectives of their expected images on products: A total of 188 adjectives were obtained from 22 LOHAS respondents.

The researchers compiled the adjectives obtained through the three ways by combining the ones with similar meaning, deleting repetitive ones or the ones with irrelevant connotation, to obtain a total of 148 adjectives which were close to LOHAS image. Then, five experts with more than five years of design experience were invited to further reduce the number of adjectives together. In

Figure 5: Most recommended pictures with the all adjective average values> 4.

consideration of the working load of responding to the questionnaire of SD assessment, the experts were instructed to screen out not more than 10 adjectives, and 6key image adjectives were finally determined, including healthy, environmentally friendly, sustainable, nature, simple and ecological. These 6 adjectives were adopted as the assess image scale with the form of 5-level degree of agreement Likert scale for the SD assessment.

SD assessment

Subjects of LOHAS were recruited to participate in the SD assessment in two stages; first stage to assess the 50 pictures determined by LOHAS representatives and the second stage to assess the 16 pictures determined by designers. The subjects were volunteers recruited on-line, through various APPs (WeChat, Line andWhat's up) and community websites (Facebook and Weibo), and screened by the LOHAS questionnaire of the E-ICP Life Style Scale. For these two stages: 101 and 118, valid subjects were recruited, respectively. The subjects were given the purpose and instruction of this SD assessment and asked to provide their demographic data. Then, they were asked to self-report their feeling on the six key image adjectives with 5-level degree of agreement Likert scale to each picture, until all pictures were assessed. The assessment was anonymously conducted in 3 months.

Data analysis

Based on the responses given by each subject, the comprehensive mean score of all respondents for each picture on each image adjective was calculated and ranked. The pictures with higher mean scores were believed to better comply with LOHAS image. Then, the correlation between pictures and LOHAS were calculated and ranked by grey relational analysis. Again, the pictures with higher grey relational grades were believed to better comply with the image of LOHAS. The results of the above two analyses were summarized to recommend suitable pictures for the database of LOHAS image.

RESULTS

Subject background

A total of 219valid subjects (101 subjects for assessing pictures by LOHAS representatives and 118 subjects for assessing pictures by designers) were recruited including 122 males and 97 females, mostly 25 to 45 years of age (59.82%). According to the provided demographic data, the subjects had independent economic ability, most of whom were service industries and with an educational background of college/junior college (including master's degree or above, 56.62%). In terms of age distribution and career, the group had a life attitude of continuous learning.

Semantic difference assessment result

The degree of agreement of each subject's SD assessment on each adjective with 5-level Likert scale to each picture was firstly converted into the score of 1-5; then, the average scores of the subjects for each picture on each of the 6 key adjectives were calculated, as shown in columns 3 to 8 of Table 1. Next, the grand average value of the 6 adjectives in each picture was calculated, as shown in columns 9 to 10 of Table 1.Ranking of relevance to LOHAS image of pictures(column 1 of Table 1) was made based on the grand average values.Finally, the number ofimage adjective with an average value greater than 4(corresponding to the degree level of 'agree' or above on the 5-level degree of agreement Likert scale) of each picture was counted and shown in column 10 of Table 1.

Two criteria were adopted for recommendation of relevant pictures based on the above result. The first criterion is the grand average value (columns 9 in Table 1) of a picture higher than 4 and there are 16 pictures that met the criterion including L12, L11, L56, L28, L46, L47, L29, L55, L31, L4, L16, L62, L1, L27, L35 andL60 in order of grand average values, as shown in Figures 5 and 6. The second criterion is pictures with the total number of adjectives with average value higher than 4 (columns 10in Table 1) equal to 6 (all adjective average values>4) and there are 12 pictures that met the criterion including L12,

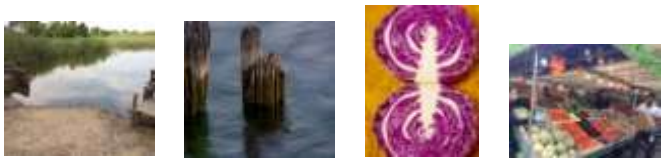

Figure 6: Recommended pictures with grand average value >4, but not all adjective average values>4.

Table 1: Pictures with the total number of adjectives with average value higher than 4 and equal to 6 that met the second criterion.

Rank	Picture number	Healthy	Environment ally friendly	Sustainable	Nature	Simple	Ecological	Grand average	Adjectives average number of 4 or more
1	L12	4.75	4.64	4.73	4.60	4.81	4.47	4.67	6
2	L11	4.55	4.61	4.63	4.60	4.64	4.70	4.62	6
3	L56	4.49	4.63	4.58	4.66	4.65	4.57	4.60	6
4	L28	4.63	4.65	4.52	4.62	4.51	4.60	4.59	6
5	L46	4.63	4.53	4.53	4.59	4.62	4.62	4.59	6
6	L47	4.63	4.59	4.55	4.59	4.55	4.56	4.58	6
7	L29	4.54	4.56	4.58	4.51	4.54	4.64	4.56	6
8	L55	4.60	4.53	4.51	4.55	4.58	4.53	4.55	6
9	L31	4.51	4.55	4.45	4.41	4.56	4.46	4.49	6
10	L4	4.23	4.25	4.36	4.68	4.34	4.26	4.35	6
11	L16	4.35	4.43	4.50	4.06	4.26	4.48	4.35	6
12	L62	4.60	2.89	4.63	4.65	4.57	4.69	4.34	5
13	L1	4.10	4.39	4.11	4.15	4.75	4.09	4.27	6
14	L27	3.84	4.05	4.65	4.47	4.08	4.51	4.27	5
15	L35	3.89	3.78	4.95	4.90	3.75	4.06	4.22	4
16	L60	4.67	3.95	4.69	3.99	3.89	3.92	4.19	3
17	L49	4.17	3.93	4.04	3.87	3.79	3.93	3.96	2
18	L40	3.99	3.83	4.24	3.82	3.84	3.93	3.94	1
19	L53	3.87	4.01	3.88	3.91	4.00	3.89	3.93	2
20	L43	4.67	3.92	3.99	4.06	4.08	2.80	3.92	2
21	L38	3.93	3.96	3.88	3.94	3.98	3.79	3.91	0
22	L54	4.74	3.90	3.90	3.86	3.91	2.95	3.88	1
23	L41	3.86	3.79	3.90	3.97	3.82	3.92	3.88	0
24	L64	2.92	3.91	3.95	4.01	3.88	3.96	3.77	1
25	L36	3.98	3.85	3.91	3.98	3.89	2.88	3.75	0
26	L45	3.86	2.79	3.92	3.94	3.83	3.88	3.70	0
27	L58	3.66	3.74	3.76	3.62	3.68	3.62	3.68	0
28	L32	4.54	3.13	4.17	2.76	4.60	2.83	3.67	2
29	L61	3.78	2.95	3.88	2.90	4.59	3.80	3.65	0
30	L26	3.92	3.82	3.00	3.97	3.79	3.19	3.62	0
31	L42	2.8	3.97	3.91	2.93	2.84	4.62	3.51	0
32	L24	2.98	2.92	3.08	4.37	3.85	3.83	3.51	0
33	L-6	2.95	4.17	3.97	4.00	2.91	2.96	3.49	1
34	L34	4.52	2.90	2.93	2.96	3.04	4.60	3.49	1
35	L25	2.88	2.96	3.03	4.28	3.86	3.85	3.48	0
36	L15	2.73	3.58	4.82	2.92	3.59	3.19	3.47	1
37	L44	4.04	4.07	2.87	2.85	2.77	4.18	3.46	3
38	L57	3.26	2.88	2.94	2.93	3.29	3.43	3.46	0

Table 1: Conts

Rank	Picture number	Healthy	Environmentally friendly	Sustainable	Nature	Simple	Ecological	Grand average	Adjectives average number of 4 or more
39	L0	3.91	2.94	3.98	2.99	2.90	4.04	3.46	1
40	L33	2.94	3.95	4.00	2.89	2.89	3.88	3.43	1
41	L17	3.54	3.06	3.02	3.93	2.96	3.90	3.40	0
42	L39	2.99	4.01	3.03	4.09	3.06	2.91	3.35	2
43	L18	2.91	3.08	2.98	3.88	3.93	2.88	3.28	0
44	L48	2.82	2.94	2.87	2.93	3.98	3.88	3.24	0
45	L65	2.89	2.81	3.05	2.81	3.88	3.95	3.23	0
46	L2	3.35	3.57	2.63	2.76	3.59	2.80	3.11	0
47	L63	3.01	3.02	3.04	2.96	2.99	3.06	3.01	0
48	L10	2.60	4.47	2.32	2.75	2.81	3.00	2.99	1
49	L52	2.96	2.94	3.13	2.97	2.98	2.90	2.98	0
50	L19	2.86	3.06	2.93	2.94	2.94	3.11	2.98	0
51	L21	2.97	2.96	2.96	3.20	2.78	2.95	2.97	0
52	L37	3.04	3.00	2.98	3.00	2.85	2.92	2.97	0
53	L59	2.77	2.93	3.09	2.88	2.92	3.09	2.95	0
54	L20	2.92	2.82	2.99	2.89	2.95	3.03	2.93	0
55	L3	2.77	2.77	2.83	2.88	3.59	2.69	2.92	0
56	L51	2.68	3.00	2.88	2.99	2.92	2.91	2.90	0
57	L4	2.56	2.84	3.39	2.50	3.27	2.66	2.87	0
58	L7	2.89	2.48	2.43	2.56	4.46	2.37	2.86	0
59	L8	2.80	2.89	2.60	3.38	2.51	2.61	2.80	0
60	L6	2.74	2.86	2.73	2.87	2.64	2.81	2.78	0
61	L5	2.83	2.69	2.85	2.89	2.88	2.37	2.75	0
62	L9	2.84	2.82	2.34	2.76	2.75	2.55	2.68	0
63	L30	2.79	2.65	2.05	3.00	3.22	2.13	2.64	0
64	L22	2.46	2.28	2.18	2.02	3.08	2.91	2.49	0
65	L23	2.15	2.04	2.25	1.99	3.06	2.84	2.39	0
66	L13	2.41	2.18	2.20	1.96	2.25	2.34	2.22	0

L11, L56, L28, L46, L47, L29, L55, L31, L4, L16 and L1in order of grand average values, as shown in Figure 5. These12 pictures screened using the second criterion certainly also met the first criterion; thus, they are regarded as the most recommended pictures for LOHAS image in this study. The other 4 pictures including L62, L27, L35 and L60 as shown in Figure 6, which only met the first criterion but not the second one, are regarded as recommended pictures for LOHAS image in this study.

Focusing on the individual image adjective, with the criterion of average value higher than 4, 20 pictures for healthy, 18 for environmentally friendly, 21 for sustainable, 21 for nature, 19 for simple and 19 for ecological are recommend as shown in Table 2.

Grey relational analysis

Grey relational analysis(GRA) can be used for assessing the correlation between two sets of serial data, which contain a reference series (also called parent series) for reflection of the characteristics of the system behavior, and a compared series which is a data sequence composed of system behavior factor. The calculation formula and steps are shown below:

Reference: $x_0(k)=(x_0(1),x_0(2), \ldots\ldots\ldots\ldots x_0(n))$, k=1,2,3, ..., n

Compared series: $x_i(k)=(x_i(1), xi(2), \ldots\ldots\ldots\ldots x_1(n))$ i = 1,2,3, ..., m,

If m series is compared with n attributes; m=66pictures, n=6adjectivesin this study.

Analysis Step 1: Select the appropriate reference series: In this research, the maximum value 5 of the SD assessment for the six image adjectives was taken as the reference series, here.

Analysis Step 2: Data normalization: Normalize the values

Table 2: Recommend pictures for individual image adjective.

Adjective	Picture number
Healthy	L12, L54,L60,L43,L28,L46,L47,L55,L62,L11, L29,L32,L34,L31,L56,L16, L4, L49,L1, L44 (Total 20).
Environmentally friendly	L28, L12, L56, L11, L47, L29, L31, L46, L55, L10, L16, L1, L4, L66, L44, L27, L53, L39 (Total 18).
Sustainable	L35, L12, L15, L60, L27, L11,L62, L56, L29, L47, L46, L28, L55, L16, L31, L4, L40, L32, L1, L49,L33 (Total 21).
Nature	L35, L4, L56, L62, L28, L12, L11, L46, L47, L55, L29, L27, L31, L24, L25, L1, L39, L16, L43, L64, L66 (Total 21).
Simple	L12, L1, L56, L11, L46, L32, L61, L55, L62, L31, L47, L29, L28,L7, L4, L16, L27,L43,L53 (Total19).
Ecological	L11, L62, L29, L46, L42, L28, L34, L56, L47, L55, L27, L16, L12, L31, L4, L44, L1, L35, L50 (Total 19).

Table 3: Result of GRA.

Rank	Picture Number	Healthy	Environmentally friendly	Sustainable	Nature	Simple	Ecological	Gray relational grade	The number of adjectives with an gray relational coefficient above 0.8
1	L12	0.92	0.89	0.91	0.88	0.94	0.84	0.8967	6
2	L11	0.89	0.89	0.89	0.88	0.90	0.91	0.8933	6
3	L56	0.85	0.89	0.88	0.90	0.90	0.88	0.8833	6
4	L46	0.89	0.87	0.87	0.88	0.88	0.89	0.8800	6
5	L28	0.89	0.89	0.86	0.89	0.86	0.88	0.8783	6
6	L47	0.89	0.88	0.87	0.88	0.86	0.87	0.8750	6
7	L29	0.87	0.87	0.88	0.86	0.87	0.89	0.8733	6
8	L31	0.87	0.88	0.86	0.85	0.89	0.87	0.8700	6
9	L55	0.88	0.86	0.86	0.87	0.88	0.86	0.8683	6
10	L62	0.88	0.54	0.89	0.89	0.87	0.99	0.8435	5
11	L16	0.82	0.82	0.85	0.73	0.76	0.85	0.8050	4
12	L4	0.77	0.77	0.80	0.90	0.80	0.77	0.8017	3
13	L27	0.70	0.74	0.9	0.85	0.75	0.86	0.8000	3
14	L1	0.73	0.84	0.77	0.78	0.92	0.74	0.7967	2
15	L35	0.71	0.68	0.98	0.97	0.68	0.75	0.7950	2
16	L60	0.90	0.73	0.91	0.74	0.71	0.72	0.7850	2
17	L43	0.91	0.72	0.73	0.75	0.75	0.52	0.7300	1
18	L40	0.73	0.69	0.83	0.70	0.70	0.72	0.7283	1
19	L49	0.78	0.72	0.74	0.71	0.71	0.71	0.7283	0
20	L54	0.92	0.71	0.72	0.7	0.71	0.53	0.7150	1

shown in Columns 3 to 8 of Table 1. The most common methods are min-max standardization and z-score standardization; there is no fixed used standard. The z-score standardization was adopted in the research to let the processed data conform to the standard normal distribution, which means the average value is 0 and the standard deviation is 1.

Analysis Step 3: Calculate grey relational coefficient as follows:

$$r(x_0(k), xi(k)) = \frac{\Delta min + \zeta \Delta max}{\Delta oi(k) + \zeta \Delta max}$$

$r(x_0(k),x_i(k))$ are the grey relational coefficient of the k^{th} attribute (adjective) and the i^{th}series (picture), and$\Delta_{0i}(k)=|x_0(k)-x_i(k)|$is the absolute difference between x_0 (k) and x_i (k). Δ_{min} and Δ_{max} are respectively the minimum and maximum values of the absolute difference from reference series of the compared series at each point. ζ is the distinguish coefficient between 0-1, for adjusting distinguish resolution. The value 0.5was adopted in this study as in general studies. The grey relational coefficient of each picture on each adjective was calculated according to the above formula and the result is shown in columns 3 to 8 of Table 3.

Analysis Step 4: Calculate grey relational grade from grey relational coefficients: The commonly used calculation methods of grey relational grade are average value method and weighted method. Average value method, assuming

Table 3 Conts: Result of GRA.

Rank	Picture Number	Healthy	Environmentally friendly	Sustainable	Nature	Simple	Ecological	Gray relational grade	The number of adjectives with an gray relational coefficient above 0.8
21	L53	0.70	0.74	0.70	0.72	0.72	0.70	0.7133	0
22	L38	0.71	0.72	0.71	0.71	0.73	0.68	0.7100	0
23	L41	0.71	0.69	0.72	0.73	0.7	0.71	0.7100	0
24	L36	0.72	0.71	0.72	0.72	0.72	0.53	0.6867	0
25	L64	0.54	0.70	0.72	0.73	0.71	0.72	0.6867	0
26	L32	0.87	0.57	0.77	0.51	0.88	0.51	0.6850	2
27	L45	0.70	0.51	0.72	0.72	0.70	0.72	0.6783	0
28	L61	0.69	0.54	0.71	0.53	0.88	0.70	0.6750	1
29	L26	0.71	0.70	0.55	0.72	0.69	0.57	0.6567	0
30	L42	0.53	0.72	0.72	0.54	0.52	0.89	0.6533	1
31	L34	0.88	0.53	0.53	0.54	0.55	0.88	0.6517	2
32	L24	0.54	0.55	0.56	0.85	0.70	0.70	0.6500	1
33	L5	0.48	0.68	0.94	0.55	0.67	0.53	0.6417	1
34	L25	0.54	0.54	0.55	0.78	0.71	0.71	0.6383	0
35	L50	0.71	0.54	0.74	0.55	0.54	0.75	0.6383	0
36	L58	0.63	0.65	0.66	0.63	0.63	0.63	0.6383	0
37	L66	0.54	0.77	0.72	0.73	0.54	0.53	0.6383	0
38	L44	0.74	0.75	0.53	0.52	0.51	0.77	0.6367	0
39	L57	0.70	0.52	0.54	0.54	0.74	0.75	0.6317	0
40	L33	0.54	0.71	0.72	0.53	0.53	0.71	0.6233	0
41	L17	0.66	0.57	0.55	0.70	0.53	0.72	0.6217	0
42	L39	0.55	0.74	0.55	0.76	0.55	0.54	0.6150	0
43	L18	0.53	0.55	0.55	0.70	0.73	0.53	0.5983	0
44	L65	0.53	0.53	0.56	0.52	0.71	0.72	0.5950	0
45	L48	0.52	0.54	0.53	0.54	0.73	0.71	0.5950	0
46	L2	0.62	0.68	0.48	0.49	0.67	0.50	0.5733	0
47	L63	0.55	0.55	0.55	0.54	0.54	0.56	0.5483	0
48	L9	0.52	0.56	0.54	0.55	0.54	0.56	0.5450	0
49	L0	0.48	0.85	0.44	0.49	0.50	0.51	0.5450	0
50	L37	0.56	0.55	0.54	0.54	0.54	0.53	0.5433	0
51	L21	0.54	0.54	0.53	0.58	0.52	0.55	0.5433	0
52	L52	0.55	0.54	0.57	0.54	0.54	0.52	0.5433	0
53	L59	0.52	0.54	0.57	0.53	0.54	0.56	0.5433	0
54	L20	0.54	0.52	0.55	0.53	0.54	0.56	0.5400	0
55	L51	0.50	0.54	0.53	0.55	0.54	0.53	0.5317	0
56	L14	0.47	0.5	0.63	0.46	0.61	0.52	0.5317	0
57	L7	0.51	0.46	0.45	0.47	0.85	0.44	0.5300	0
58	L3	0.49	0.49	0.5	0.5	0.67	0.48	0.5217	0
59	L8	0.50	0.50	0.50	0.64	0.46	0.47	0.5117	0
60	L5	0.50	0.48	0.51	0.50	0.50	0.50	0.4983	0
61	L6	0.49	0.50	0.49	0.50	0.49	0.49	0.4933	0
62	L30	0.50	0.47	0.42	0.55	0.58	0.43	0.4917	0
63	L9	0.50	0.50	0.44	0.49	0.54	0.47	0.4900	0
64	L22	0.48	0.45	0.46	0.42	0.55	0.54	0.4833	0
65	L23	0.43	0.42	0.44	0.42	0.55	0.51	0.4617	0
66	L13	0.44	0.42	0.43	0.41	0.43	0.44	0.4283	0

Figure 7: Most recommended pictures with all the adjective grey relational coefficients >0.8.

Figure 8: Recommended pictures with grey relational grade >0.8, but not all adjective grey relational coefficients >0.8

equal weights of all factors, was used for this research. According to the following formula, the calculated grey relational grade of each picture is shown in columns 9 of Table 3.

$$r(x_0,x_i) = \frac{1}{n}\sum_{k=1}^{n} r(x_0(k),x_i(k))$$

Analysis Step 5: Determine grey relational order: Rank pictures according to the grey relational grades, as shown in column 1 of Table 3.
Analysis Step 6: Select suitable series. Select the recommend pictures according to the result of GRA.

Again, two criteria were adopted to recommend relevant pictures based on the result of GRA. The first criterion is the grey relational grade (column 9 in Table 3) of a picture higher than 0.8 and there 13 pictures met the criterion includingL12, L11, L56, L46, L28, L47, L29, L31, L55, L62, L16, L4 and L27 in order of grey relational grade, as shown in Figures 7 and 8. The second criterion is pictures with the total number of grey relational coefficients of adjectives higher than 0.8(shown in columns 10 of Table 3) equal to 6 (all grey relational coefficients of adjectives>0.8) and there are 9 pictures that met the criterion includingL12, L11, L6, L46, L28, L47, L29, L31 and L55in order of grey relational grade, as shown in Figure 7. The 9 pictures screened by the second criterion certainly also met the first criterion; thus, they are regarded as the most recommended pictures for LOHAS image here. The other 4 pictures including L62, L16, L4 and L27, as shown in Figure 8, which only met the first criterion but not the second one, are regarded as recommended pictures for LOHAS image.

With regards to the individual image adjective, with the criterion of grey relational coefficient higher than 0.8, 16 pictures for healthy, 12 for environmentally friendly, 17 for sustainable, 14 for nature, 15 for simple and 14 for ecological are recommend, respectively, as shown in Table 4.

DISCUSSION

According to the demographic data of volunteers and subjects recruited on-line for this study, males are more than the females, it reflects that males may be more active in cyber world or more passionate to be volunteers for survey activities. The valid 219 LOHAS subjects screened out from 290 volunteers demonstrates that 75.51% volunteers can be classified as LOHAS consumers in this study. This high rate as well as the fact that most of the subjects are well educated people with independent and strong economic ability, implies the huge commercial opportunities existingfor taking the LOHAS as the target consumer group. In addition, the subjects screened out from volunteers of male (57.24%) are higher than that of female (42.76%); it seems to mean that males are more involved LOHAS than females.

Among the 16 recommended pictures by the analysis of averaged SD assessments (as shown in Figures 5 and 6),which also include all13 recommended pictures by GRA, 5 pictures were selected from the16 designers' proposed pictures (L1 and L16) and 12 from the 50 proposed pictures by LOHAS representatives (L17 to L66).By

comparing the rate of designers' proposed pictures been selected of 0.31 (5/16) to that of LOHAS representatives with the value of 0.22 (11/50), it may be concluded that the proposed pictures by designers are more suitable for expressing LOHAS image than those by LOHAS representatives. However, if the 9 most recommended pictures by GRA (Figure 7)are examined, which are also mostly recommended by the analysis of average value, 2 pictures from the proposed pictures by designers are found,whereas 7pictures are from those by LOHAS representatives. The selecting rate of the proposed pictures by designers 0.125 (2/16) is slightly lower than that of LOHAS representatives with the value of 0.14 (7/50).Thus, both proposed pictures by designers and by LOHAS representatives may be equally effective for retrieving pictures to express LOHAS image in an image board.

By examining the contents of the recommended pictures, it was found that most of them are about natural scene, animals, plants, fruit and static objects, implying the characteristics of the LOHAS, such as respecting and complying with nature, importance attached to organic living environment and distaste on artificial objects. They prefer green, yellow green and inherent color of objects. The characteristics of the LOHAS identified above can be applied to further expand the picture database for LOHAS image board if needed.

To compare the results of picture recommendation by two different analysis approaches, with the analysis of averaged SD assessments and by GRA, the cross relationship of these results were summarize in Table 5. In this table,the 3 columns denote the 3 levels of recommendation: most recommended, recommended and proposed (not recommended) of the 66 pictures been classified into by the analysis of averaged SD assessments, while the 3 rows denote those by GRA. Then, each picture can be filled into one of the 9 cells of this table according to its corresponding recommending classification by the two approaches. From this table,it is found that all the 13 recommended pictures by GRA are a subset of the 16 recommended pictures by the analysis of averaged SD assessments and all the 9 most recommended pictures by GRA are also a subset of the 12most recommended pictures by the analysis of averaged SD assessments. On the other hand, pictures L4, L16 and L1 are most recommended by the analysis of averaged SD assessments, but are only recommended by GRA(L4 and L16) or even not recommended (L1) by GRA. Thus, it canbe concluded that the screen criterion of GRA adopted in this study for picture recommendation is stricter than that of analysis of averaged SD assessments.

To integrate the results of picture recommendation by two different analysis approaches, a finer recommendation strategy with 5 recommendation levels were developed based on Table 5. The first recommended pictures are the 9 pictures most recommended by both the analysis of averaged SD assessments and GRAs including L12, L11, L6, L46, L28, L47, L29, L31 and L55, as shown in Table 5. The second recommended pictures are pictures mostly recommended by one approach but only recommended by another approach, including L4 and L16, which are mostly recommended by the analysis of averaged SD assessments but are only recommended by GRA. The third recommended pictures are pictures recommended but not mostly recommended by both approaches (L62 and L27 shown in Table 5), or pictures mostly recommended by one approach but not recommended at all by another approach, as shown in Table 5.L1 is mostly recommended by the analysis of averaged SD assessments but not recommended by GRA. The forth recommended pictures are pictures recommended by one approach but not recommended by another approach, as shown in Table 5, L60 and L35 are recommended by the analysis of averaged SD assessments but not recommended by GRA. The other 50 pictures are not recommended by both approaches which are regarded as the fifth recommended pictures or proposed pictures in this study. In summary, there are 9 first recommended pictures, 2 second recommended pictures, 3 third recommended pictures, 2 forth recommended pictures and 50 proposed pictures suggested by this study for LOHAS image according to the above recommendation strategy.

In the same manner, the results of picture recommendation by two different analysis approaches for individual image of the six key adjectivescan be compared and integrated. For example, Table 6 was compiled to describe the cross relationship of the pictures recommended by the analysis of averaged SD assessments and by GRA for healthy image. Again, from this table,it can beconcluded that the screen criterion of GRA adopted in this study for picture recommendation is stricter than that of analysis of averaged SD assessments, since the 16 recommended pictures by GRA is the subset of the 20 recommended pictures by the analysis of averaged SD assessments. By integrating both results of picture recommendation, recommended pictures can be further classified into two levels: the most recommended pictures, which are the 16 pictures recommended by both the analysis of averaged SD assessments and GRA, and the recommended pictures, which are the 4 pictures recommended by the analysis of averaged SD assessments but not by GRA, as shown in Table 6.

Conclusion

To establish a user-driven picture database for LOHAS image, this study recruited LOHAS representatives to collect and determine 50 pictures for expressing LOHAS image. To include the designers' view in the database, another 16 pictures were added to the pool. The design experts were also asked to identify 6 key adjectives for expressing LOHAS image from a pool collected by ordinal people, LOHAS representatives and designers. By adopting these 6 key

adjectives as assessing scale, 219 LOHAS subjects were recruited to assess the total 66 pictures in the SD assessment survey. With the analysis of the averaged SD assessment, by GRA or by integrating the results of these two analyses, relevant pictures were recommended with various recommending levels for expressing LOHAS image or for expressing image of individual key adjective of LOHAS, respectively.

The result of this study can establish picture database to be operated in an e-webpage platform, which is to be constructed by the researchers, to help designers or related people effectively create an image board of LOHAS. There are three operation modes to be equipped in the e-webpage platform. In the first mode, the users can retrieve pictures for expressing LOHAS image by selecting the criterion of averaged SD assessment, the criterion of GRA or the integrated criterion; then, the corresponding recommended pictures with various recommending levels will appear on screen for further operation. In the second mode, the users can retrieve pictures for expression of image of individual key adjective of LOHAS in the same manner. In the third mode, the users can call out all 66 proposed pictures on screen and select the demanded one from them, then the parameters of this picture relevant to LOHAS image, including the average scores/ranks of the six key adjectives, the grand average scores/ranks of LOHAS image, the grey relational coefficients/ranks of the six key adjectives, the grey relational grade/rank of LOHAS image and the recommendation levels by different criteria, will be displayed.

To establish a more comprehensive picture database for image board construction, the researchers are exploring pictures suitable for expressing images of other types of lifestyle and their corresponding adjectives. On the other hand, while the equal weights of six key adjectives were assumed for calculation of the grand averaged value of SD assessment and the grey relational grade for each picture in this study, the authors tried to test whether adopting different weights of adjectives determined by appropriate method, such as AHP or entropy, can screen out pictures to better meet the expected image of consumers. It is expected that the very tool developed can be effectively used in new product R & D and product marketing of enterprises, and for development of professional designers in education circle.

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