Knowledge E
Engaging minds

Conference Paper

Key Factors in the Medical Examination Product Design and Development Using Human Cell Image Totems

Youn-Jien Lin[1], Sung-Lin Hsueh[2], and Han-Yi Chen[2]

[1]Department of Art Design and Creative Industry, Nanfang College of Sun-Yat-Sen University
[2]Graduate Institute of Cultural and Creative Design, Tung Fang Design of University

Abstract

The industry of cultural creativity has a significant influence on the overall economy of a country. The development and application of cultural and creative products in different fields are growing more diverse. In the field of medicine, cultural and creative products can deliver more than aesthetic functions. They can bring healing benefits for patients with different symptoms in different age groups. Creative product designs that combine medicine and cultural/artistic creativity can make medical products warmer and friendlier to users. Focusing on the creative design of medical examination products, this study aims to provide references for more creative and friendly design of medical examination products to help reduce the fear and anxiety of patients when using such products. In this study, micro images of human cells are converted into totems as design elements for the design and development of cultural and creative products. These image totems not only represent the lively cellular world inside human body but also add aesthetics to the product design and make the products look warmer and friendlier to users. The research methods of literature survey, expert interview survey, and analytic hierarchy process (AHP) to first find out the factors in the medical product design using image totems of human cell mutation and reproduction and then measure the relative weight of each factor. Hopefully, the findings of this study can provide references for the creative design and development of medical examination products and help to enhance the design effectiveness.

Keywords: cultural creativity industry, medical examination, products with healing effects, expert interview, analytic hierarchy process (AHP)

Corresponding Author:
Han-Yi Chen
eailo724@hotmail.com

Received: 29 August 2018
Accepted: 18 September 2018
Published: 11 November 2018

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the ICOI-2018 Conference Committee.

1. Introduction

Despite the continuous evolution and innovation of medicine and technology, people are still not free from aging, illness or death. In addition, the intensifying competition in all walks of life has made life more hectic and, consequently, caused a sense of disorder and imbalance in many people's lives. Failure to find proper ways to release stress and

long-term nervous tension has resulted in different kinds of health issues, particularly mental disorders. Data and images of clinical medical examinations are analyzed in this study and it is found that patients, particularly children and elders, exhibit responses of fear, alienation and indifference to medical examination devices and products. Therefore, images of human cells are converted into artistic image totems that can be used in medical product design with a view to helping reduce the nervousness and anxiety of patients in the process of medical examination.

Aging, illness and death are all inevitable. With growing stress from work and life and without proper methods to release pressure, people are suffering from both physiological and psychological disorders. However, to some people, going to medical settings and using medical products will cause extra stress. To effectively reduce such stress, designers must know patients' requirements of products used in medical examination and treatment in order to clarify the connections between the design attributes of products and their potential healing effects. In this study, the creative product design developed by the researcher using totems derived from micro images of human cells is used as an example to explore patients' requirements of medical examination experiences and find out the influencing factors in the design and development of medical examination products.

Most of the existing studies on cultural and creative products focus on the interconnections among consumption environment, consumer group, and cultural resonance. In addition, the evaluations of cultural and creative products are mostly based on perspectives of marketing, practicality or functionality. There are few cases of medical products combined with creative designs while there is a lack of research on the connections between consumers' psychological levels and healing effects. Therefore, this study is conducted to explore medical product design that combines creative design, medicine, and art in the hope of providing references for the future development of more creative and effective design for medical examination products.

Compared with the other industries, the medical industry relatively lacks in ambiences of warmth and joyfulness. By combining medicine with art and culture, it can help to change the general public's impression of the medical industry as a cold and indifferent industry. Examples can be found in the increasing integration of art and culture in medical spaces such as dental clinics, cosmetic medical clinics, and health examination centers. This study proposes to incorporate artistic designs into medical examination products to promote cross-disciplinary cooperation between visual art and medicine and encourage the application of art therapy so that art can play a facilitating role for medicine.

2. Literature Review

2.1. Medical products and healing

Medical products are mainly tools used in medical treatments, self-treatments and rehabilitation activities. Therefore, the marketing of such products focuses mostly on their functions and treatment benefits with little emphasis on the aesthetics of the product design. It is believed in this study that the aesthetics of medical products design is not considered as a priority in market competition for the following reasons:

1. Consumers focus on the treatment benefits and brands when shopping for medical products;
2. Medical products are not daily necessities and they are purchased only when needed;
3. Medical product designers are more trained in medical science than in graphic design aesthetics; and
4. Cross-disciplinary product design has not received sufficient attention and, as a result, there is a lack of related courses at school.

Currently, the trend of cross-disciplinary cooperation with art, culture and design in different fields has received a lot of attention. A growing number of well-known brands have incorporated artworks into their product designs as their major marketing strategies. The incorporation of artistic designs into medical products will make the products look not only more beautiful but also friendlier to users, which will in turn have a positive influence on their healing effects for the users.

Medically speaking, healing can be interpreted as health restoration; alleviation of pain, sadness and fatigue; feeling of safety; soothing and stabilization of emotions; and physiological and psychological relaxation. Healing effects can be found in a wide range of activities such as artistic appreciation, music therapy, hypnosis, massage, aroma therapy, Chi Kung, gymnastics, Yoga, forest bathing.... Even the designs of some garments, furniture and stationery are said to have healing effects. Broadly speaking, healing effects can be achieved through visual design that can inspire mental perceptions of beauty, comfort, pleasure and other positive mental perceptions that can help to soothe and stabilize the emotions of patients and achieve effects similar to medical treatment. Actually, there is no specific academic or regulatory definition of healing. Any product that can bring pleasure and relaxation to users can be seen to have healing benefits. There are significant business opportunities with such products.

2.2. Influencing factors in the creative designs of medical products

In this study, the images of human cell mutation and reproduction taken from medical examinations are used as design elements. According to Katie Cornish et al. (2015), the clearness and accessibility of visual images are of significant importance in graphic design [1]. In addition to the visual image, shape [2], material and expression form are all important product design elements that have an influence on the appeal and performance of a product. With continuous technological advancements, new materials have been developed and applied to enhance product competitiveness. Since designers are the major decision makers for material adoption while materials are a very important element for products [3], the design of medical products should pay more attention to the application of new materials and safe materials.

Courses on aesthetics are the cornerstone in the training of artists and designers. According to [4], design education can help students in their development of professional design capability while aesthetics is an important theoretic tool to help students explore their design potential. In addition, aesthetics should also be applied in product designs in order to win recognition and acceptance from consumers. Nowadays, consumers demand more than monotonous and static display of product design aesthetics. Diverse and dynamic aesthetic experiences can attract certain consumer behaviors (e.g. purchasing) and consumption behaviors (e.g. recycling) [5]. Since the image totems of human cell mutation and reproduction are like abstract art, they require aesthetic expression form to compensate for the monotony of them as design elements and make product designs using them more aesthetically appealing.

Totems derived from images of human cells are not merely totems derived from images of microorganisms. They also demonstrate the beauty of dynamic changes in the forms and colors. Based on the above-mentioned studies, the design elements and their attributes of creative designs for medical products are compiled and listed in Table 1.

3. Research Design and Methods

3.1. Methodology

In this study, literature survey, expert interview and Analytic hierarchy process (AHP) are applied to explore the factors in different dimensions of medical product design and measure the relative weight of each factor. This study is intended to provide

Table 1: Basic Elements of Creative Designs for Medical Products.

Element	Attribute
Visual Image	Beauty of the changing forms and colors of microorganisms
Shape	Diverse shapes and reproduction of microorganisms
Material	Types, models, and application quantity of medical materials
Medicine and Aesthetics	Correlations between medicine and aesthetic components in the construction of a derivative ecosystem of art

references for more creative and effective designs of medical products. The three research methods mentioned above are briefly explained as follows:

1. Literature survey and expert interview survey:

   According to Wikipedia, a literature survey is supposed to cover knowledge from the results of existing research and to make contributions to the theory and practice of a specific field [6]. The method of literature survey has been widely applied in the exploration of different issues such as power consumption of offices in business buildings [7] and development of guidelines for multidisciplinary clinical care practice [8]. Interview survey is a method in which researchers ask questions directly to interviewees in face-to-face communications in order to obtain helpful information for their research. It is a qualitative analysis method. Expert interview survey is a type of interview survey. In expert interview surveys, the interviewees must have certain amount of exposure and understanding of the investigated issues or have certain level of professional experiences in relevant fields. The forms of expert interview survey include telephone interview, mail interview, personal interview, group interview, and supervisor interview [9].

2. Analytic hierarchy process (AHP):

   Proposed by Thomas L. Saaty, Analytic Hierarchy Process (AHP) is a multi-criteria method for decision making based on quantitative analysis. It has been applied widely in many fields such as fisheries diversification [10], metadata quality comparison in open data portals [11]; and ranking of knitwear design options [12]. During its 36 years of development from 1982 to 2018, AHP has been proven an effective tool of quantitative analysis for policy making in academic and industrial scenarios. The quantitative evaluation steps in AHP are explained as follows:

   (a) Confirming the AHP hierarchical structure of the factors;

(b) Producing/sending/recycling of AHP questionnaires, completing the pair-comparisons of the dimensions, and completing the pair-comparisons of the factors in each dimension with all the pair-comparisons represented by nine scales;

(c) Calculating the valid questionnaire results to confirm the relative weight of each factor;

(d) Confirming that the calculation of the relative weight of each factor must pass the consistency test with the Consistency Index (C.I.) no higher than 0.1 (C.I.≦0.1) and the Consistency Ratio (C.R.) also no higher than 0.1 (C. R.≦0.1), and C.R.= C.I./R.I. with the R.I. (Random Index) value from the R.I. Table.

(e) Completing the above-mentioned steps to obtain the relative weight of each factor for the evaluation.

3.2. Research design

In this study, literature survey, expert interview survey, and AHP are applied with a view to confirming the key factors for the use of human cell image totems in the creative design for medical products. In the literature survey and expert interview survey of this study, in-depth interviews were conducted with ten interviewees who had professional backgrounds in medicine and six interviewees who did not have any medical background but had to visit medical organizations regularly for physical check-ups. In the in-depth interviews, the interviewees were asked to give their opinions on the basic elements of their attributes listed in Table 1. Their feedbacks were collected and compiled to find out the key dimensions and factors for the application of human cell image totems in the creative design for medical products as listed in Table 2.

Table 1 lists the basic design elements considered in the application of human cell image totems in the creative design of medical products. Consideration of these basic elements is mainly based on design concerns. However, when facing medical devices and environments, the general public often develop unexplainable misperceptions, such as discomfort, pain, fear, and anxiety due to the visual and environmental influences. Children in particular have direct and significant responses and associations. As a result, the public naturally develop negative mental responses to medical products, such as reluctance to use or face the products, rejection, and indifference to the products. As indicated by the expert interview survey results shown in Figure, there are three different dimensions of users' intuitive responses and perceptions: visual, misperception and mental. Therefore, by combining medicine and aesthetics in medical

Table 2: Dimensions and Factors of Medical Product Design.

Dimension	Factor	Description
Visual	Color	Elements including visual image, shape, material, and functionality
	Generality	
	Shape	
Misperceptional	Pain	Consumers' intuitive responses to medical products, which has a significant influence on the sales of such products
	Discomfort	
	Fear and Anxiety	
Mental	Reluctance	Consumers' actual mental perceptions during the use of medical products, which has an influence on the effectiveness of the use of such products
	Rejection	
	Indifference	

product design, it can help to effectively reduce patients' fear and anxiety in medical settings. The AHP hierarchical structure of all the dimensions and factors in this study is illustrated in Figure 1.

4. Analytic Hierarchy Process (AHP) Modeling

The AHP modeling of this study started with sending totally 46 AHP questionnaires. There were totally 36 returned questionnaires that passed the AHP consistency test and, therefore, were considered valid (78.3%). The software of Excel was used to calculate and rank the relative weight (Wi) of each factor as shown in Table 3.

Table 3: Relative Weight of Each Factor.

Level 1 W_i		Level 2 W_i		W_i	Ranking	C.R.	C.I.
(1-1)	0.39	(2-1-1)	0.29	0.1131	5	0.0332	0.0193
		(2-1-2)	0.24	0.0936	6		
		(2-1-3)	0.47	0.1833	1		
(1-2)	0.35	(2-2-1)	0.36	0.1260	4	0.0520	0.0301
		(2-2-2)	0.18	0.0630	8		
		(2-2-3)	0.46	0.1610	2		
(1-3)	0.26	(2-3-1)	0.59	0.1534	3	0.0465	0.0270
		(2-3-2)	0.25	0.0650	7		
		(2-3-3)	0.16	0.0416	9		
Overall W_i				1		R.I.=0.58	

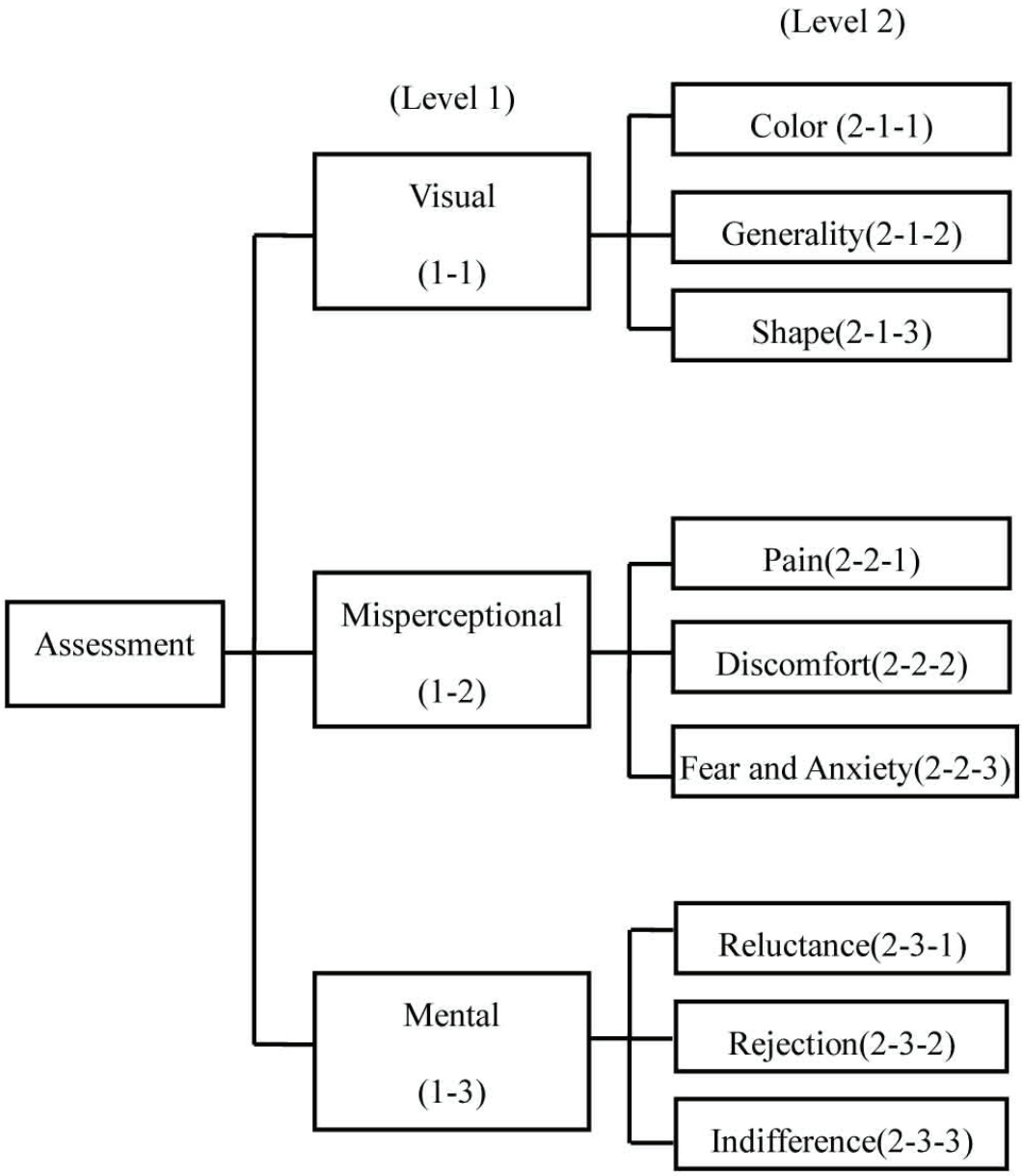

Figure 1: Hierarchical Structure of the Factors.

As indicated in Table 3, among the top five factors in the rankings of relative weights, the "shape" factor ranked the highest, followed by "fear and anxiety", "reluctance", "pain" and "color". This finding suggest that consumers develop immediate and intuitive responses to the exterior design of medical products. The devices and environmental ambiences at hospitals and clinics generally give an impression of coldness and, therefore, people tend to develop "fear and anxiety". Due to their lack of understanding or fear, people develop "reluctance" to use or face the medical products or behaviors that they have to encounter in medical settings or in medical treatment process. During physical examinations, some patients may experience real "pain" due to actual

physical discomfort or illusionary "pain" due to their negative mental reactions to the medical settings. The "color" of medical settings and devices is traditionally white, a cold color. Therefore, the addition of different colors, such as pink, yellow and other warm colors can help to reduce patients' discomfort with the white color in medical settings.

As illustrated in Figure 2, the AHP Model developed in this study for the policy making in the creative design for medical products using human cell image totems is composed of three dimensions: "visual", "mis-perceptional", and "mental" dimensions with totally nine factors: "color", "generality", "shape", "pain", "discomfort", "fear and anxiety", "reluctance", "rejection" and "indifference". This model is highly objective and can be applied in the evaluation of multiple designs for medical examination products in order to select the best option.

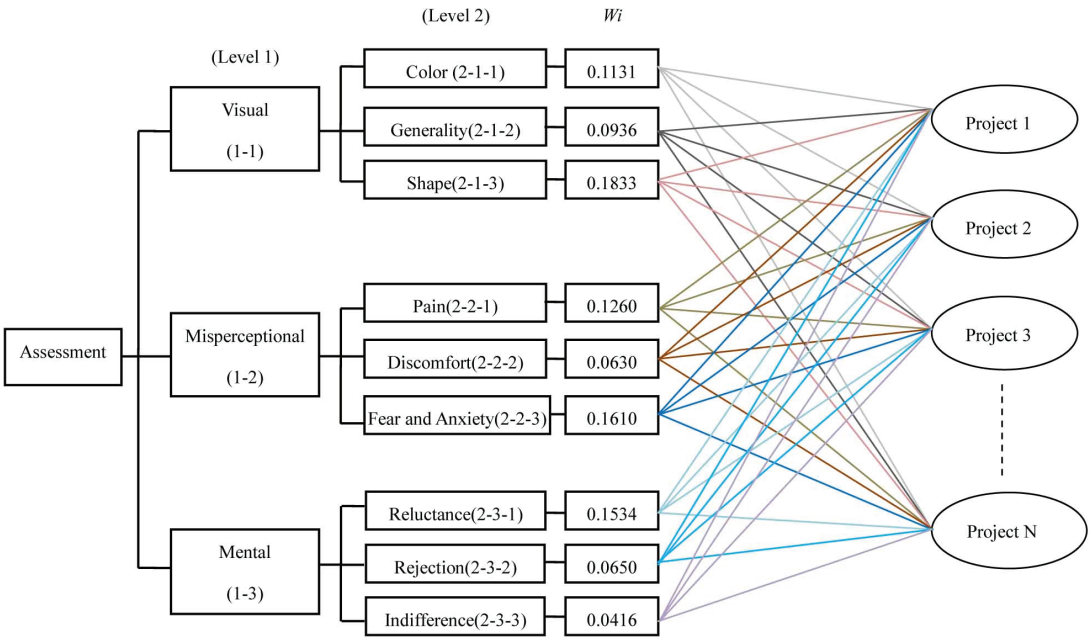

Figure 2: AHP Model for the Policy Making in the Creative Design of Medical Products.

5. Conclusion and Suggestion

In this study, micro images of human cells are converted into artistic totems as design elements for medical product design. The diversity of image totems of human cell mutation and reproduction can compensate for the monotony of repetitive design elements. After the in-depth interviews, the major dimensions and factors in the creative design for medical products were found in this study. These dimensions and factors

should be put into priority consideration for medical product design. An AHP model composed of three dimensions and nine factors was developed in this study and the relative weight of each of the factors was calculated. Hopefully, the AHP model of this study will provide helpful references for the creative design and development of medical examination products and also the improvement of design effectiveness.

For the creative design and development of medical products in the future, the human cell image totems with beautiful color changes and with the connotation of life reproduction can be used to combine medicine and aesthetics. These image totems not only represent the lively cellular world inside human body but also add aesthetics to the product design and make the products look warmer and friendlier to users. The influencing dimensions and factors of creative medical product design must be put into consideration to ensure the product design can help to reduce users' fear and anxiety when using the products, promote heart-warming and joyful ambiences in medical settings, and provide mental healing effects for users. The combination of visual art and medicine can not only promote cross-disciplinary cooperation but also encourage the application of art therapy.

References

[1] Cornish, K., Goodman-Deane, J., Ruggeri, K., & Clarkson, P.J., Visual accessibility in graphic design: A client–designer communication failure, Design Studies, Volume 40, 176-195. 2015.

[2] Gürsoy B., & Özkar, M., Visualizing making: Shapes, materials, and actions, Design Studies, Volume 41, Part A, 29-50. 2015.

[3] Gregory, S.A,. & Commander, M.W., New materials adoption study: some contributions to design knowledge, Design Studies, 1(2), 107-112. 1979.

[4] Stolterman, E., Guidelines or aesthetics: design learning strategies, Design Studies, 15(4), 448-458. 1994.

[5] Patrick, V.M., Everyday consumer aesthetics, Current Opinion in Psychology, 10, 60-64. 2016.

[6] Wikipedia,2017, Literature survey, visited on 2017/12/20, https://en.wikipedia.org/wiki/Literature_review.

[7] Kamilaris, A., Kalluri, B., Kondepudi, S., & Wai, T.K., A literature survey on measuring energy usage for miscellaneous electric loads in offices and commercial buildings, Renewable and Sustainable Energy Reviews, Volume 34, 536-550. 2014.

[8] Furman, M., Harild, L., Anderson, M., Irish, J., Nguyen, K., & Wright, F. C., The Development of Practice Guidelines for a Palliative Care Multidisciplinary Case Conference, Journal of Pain and Symptom Management, 55(2), 395–401. 2017.

[9] MBA lib, 2017, Interview Survey, visited on 2017/12/20, http://wiki.mbalib.com/zh-tw/(InterviewSurvey)

[10] Morgan, R., An investigation of constraints upon fisheries diversification using the Analytic Hierarchy Process (AHP), Marine Policy, 24-30. 2017.

[11] Kubler, S., Robert, J., Neumaier, S., Umbrich, J., & Traon, Y.L., Comparison of metadata quality in open data portals using the Analytic Hierarchy Process, Government Information Quarterly, 35(1), 13-29. 2018.

[12] Atkins M.H., & Gear, T.E., Case study application of analytic hierarchies to the ranking of knitwear design options, Design Studies, 3(2), 59-63. 1982.