評價消費者對瓶裝沐浴乳包裝視覺設計之複合情感反應

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摘 要

產品在市場上的成功，除了依靠產品的開發之外，亦需仰賴適切的包裝視覺設計表現，藉此與競爭品牌作有效的區隔、吸引潛在消費者的注意、提升他們對產品的有利印象，以刺激消費者購買意願，進而促進銷售的重要任務。這種現象在消費性瓶裝產品，如：沐浴乳、洗髮精與美妝品…等產品上特別明顯。就瓶裝沐浴乳包裝而言，如何於上市前，瞭解消費者對瓶裝沐浴乳視覺包裝可能的情感反應，及探討瓶裝沐浴乳視覺設計特徵對消費者情感反應的影響，作為設計出成功的瓶裝沐浴乳包裝的參考，即是一個值得探究的議題。因此，本研究透過一個問卷為基礎的調查，並藉由 27 個瓶裝沐浴乳樣本進行探討消費者對瓶裝沐浴乳視覺設計的情感反應，然後，經由聯合分析與 TOPSIS 方法，分析瓶裝沐浴乳視覺設計屬性/特徵對消費者情感反應的影響。此結果與方法將可提供包裝設計師有用資訊，理解消費者對瓶裝沐浴乳視覺設計的情感反應，以便瓶裝沐浴乳產品能因包裝的良善設計，而於上市後取得優勢或創造其產品在商業上的成功。

關鍵詞：瓶裝沐浴乳、包裝設計、視覺設計、消費者情感反應、設計特徵

Evaluation of Multiple Consumer Sentimental Responses to Visual Design of Bottled Shower Gel Packaging

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Abstract

The commercial success of a product depends not only on the product development process, but also on the packaging design since one of the main missions of the packaging is to enhance the initial impression of the product in the eyes of potential consumers and stimulate their purchasing desire. An effective packaging design enables a product to stand out from its competitors and create an initial impression which generates a favorable consumer psychological reaction. This phenomenon is conspicuous in the visual design of bottled products, such as shower gels, shampoos, cosmetics, and so forth. However, to create a successful bottled shower gel packaging design before the product is launched onto the market, it is essential to comprehend the consumers' likely sentimental responses regarding the visual design of bottled shower gel packaging and to explore the particular features which dominate these responses. Accordingly, the present study conducts a questionnaire-based investigation into consumers' sentimental responses to the visual design of 27 bottled shower gel packaging samples. The evaluation results are then analyzed using Conjoint Analysis and the TOPSIS algorithm to determine the critical attributes / features which govern the consumers' sentimental responses to the visual design of the bottled shower gel packaging. The results provide packaging designers with a useful insight into the psychological reaction of

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consumers toward bottled shower gel products, and are hence of significant benefit in improving the likely commercial success of the product once brought to the market.

Keywords: Bottled Shower Gel, Packaging Design, Visual Design, Consumers' Sentimental Response (CSR), Design Feature

Ⅰ. Introduction

In an increasingly global marketplace, manufacturers must continually seek to gain a competitive advantage over their rivals in order to maintain or strengthen their market position. A consumer's decision to purchase a particular product is motivated not only by their physical requirements for the product, but also by their psychological response to its physical appearance. Hence, satisfying consumers' psychological responses is an essential concern for almost every product manufacturer nowadays [1]. In general, the physical appearance of a product comprises two components, namely the visual design of the product and the packaging design. The packaging design is crucial to the success of the product in ensuring that it attracts consumers' attention and communicates information to the consumer [2]. Therefore, product packaging design is one of the most critical aspects of the whole product strategy since it effectively plays the role of a silent salesman in enhancing the initial impression of the product in the eyes of its potential consumers and influencing their purchase decisions [3]. Many researchers have shown that the label and packaging design play particularly important roles in attracting consumers' attention. For instance, the labeling of bottled products can evoke strong consumer perceptions such as refreshing, fragrant and healthful feeling [4–6]. Similarly, the container form of yoghurt packaging may inspire intense taste sensations and potency-related associations or perceptions [7]. Luo et al. (2012) argued that conspicuous and distinctive form design for bottled product packaging is necessary to attract consumer attention and increase brand identification [8]. Therefore, bottled product packaging with a strong label and form design is essential in setting a product apart from its competitors and generating a favorable consumer psychological response.

The present study considers the problem of a bottled shower gel product for illustration purposes since it is a mature consumer bath product, and hence the purchase decision and consumers' sentimental response (CSR) to the product are determined mainly by the packaging design rather than the intrinsic properties of the product itself. In evaluating consumers' responses to bottled shower gel packaging, it is necessary to explore both the consumers' response toward the visual design of the packaging and the visual design attributes / features which induce this response. Many systematic approaches have been proposed for modeling the correlation between the packaging attributes / features and the CSR [8–13]. Among these approaches, Kansei Engineering is a fundamental consumer-oriented systematic approach in which the consumers' feelings or sentimental perceptions (known as "Kansei" in Japanese) are expressed using carefully-chosen image descriptions [14]. However, the effectiveness of the Kansei Engineering methods are crucially dependent on the definition of the design features used to describe the product or packaging details and the choice of analytical technique used to examine the correlation between the design features and the corresponding CSR.

The design features of a product package are the first tangible physical attributes of the product apparent to the consumer. Thus, the attributes and features which govern the CSR toward the product must be identified as early as possible in the design process such that the designer can ensure that the product package design induces the desired consumer response and enhances the commercial viability of the product. In choosing a suitable analytical technique with which to model the relationship between the packaging design features and the CSR, conventional statistical analysis tools such as Quantitative Theory Type I [14–15], Regression Analysis [16], and

Conjoint Analysis [10, 17–18] are among the most commonly employed. Among these techniques, Conjoint Analysis (CA) is particularly useful for exploring the relationship between the product form elements and the CSR since it is computationally straightforward and easily implemented in computer code. However, CA is best suited to the evaluation of a single objective (i.e., a single CSR) rather than multiple objectives (multiple CSRs). As a result, it is of only limited use as a design tool for practical design tasks, in which it is generally necessary to generate product form designs which induce multiple CSRs simultaneously. Previous studies have suggested that this limitation can be overcome by integrating the CA technique with some form of optimization method, such as Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) [19].

Accordingly, this study proposes an integrated design approach based on CA and TOPSIS to determine a bottled shower gel packaging design which induces the target set of CSRs in multiple dimensions simultaneously. The remainder of this study is organized as follows. Section 2 reviews the related analytical techniques. Section 3 describes the research methods and implementation procedure. Section 4 presents analyzes the visual evaluation results. Section 5 verifies the applicability of research results. Finally, Section 6 provides some brief discussions and concluding remarks.

II. Review of Related Analytical Methods

This section briefly reviews the main analytical methods used in the present study, namely Conjoint Analysis (CA), Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).

1. Conjoint analysis (CA)

Conjoint Analysis (CA) is used mainly in the marketing research field. However, it has also been used increasingly in many other fields recently, including web browser typography [20], product design [21], icon design [22] and packaging design [5, 10, 17–18]. CA provides a powerful tool for modeling the relationship between consumers' preferences or opinions and particular product features, and predicting the likely acceptance or psychological response to a product. In the CA approach, the key characteristics of the product of interest are described in terms of attributes, and variations within these attributes are described as levels, where these levels represent the independent variables in the design process [23]. The CA model has the form

$$y_j=\beta_0+\beta_1x_{1j}+\beta_2x_{2j}+\beta_3x_{3j}+\ldots+\beta_nx_{nj}+e_j, \quad (1)$$

where y_j is the consumer evaluation of the product or its packaging (j=1,...,m) as observed by a specific individual, i=1,…, n ; β_0 is a constant; and $\beta_1,\ldots,\beta_6$ are weighting factors describing the relative influence of each feature (level) variation on the product or packaging sample evaluation. In addition, $x_{1,j},\ldots,x_{nj}$ are a set of dummy variables reflecting the effect-coding for the feature(level) combination of sample j. Finally, e_j is an exogenous stochastic nuisance term [21].

In implementing the CA model, a numerical utility value is computed for each level of each attribute; where larger values are assigned to the most preferred levels, while smaller values are assigned to the least preferred levels. The attributes with the largest utility range are then considered to be the most important in predicting the consumers' preferences or sentimental responses to the product / packaging. The utility estimates serve as a useful basis for predicting the choice probabilities of various combinations of attribute levels [20]. As a result, CA provides an effective means of predicting the likely response of a specific consumer group toward different product / packaging candidates during the conceptual stage of the product / packaging development process.

2. Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal

Solution Algorithm (TOPSIS)

Analytic Hierarchy Process (AHP) is a systematic method for structuring multi-criteria decision-making problems in the form of a hierarchy and then performing pair-wise comparisons of each element in the hierarchy in order to generate a set of alternative solutions, which are then evaluated using pre-calculated priorities. In the AHP method, the participants' verbal responses or preferences are generally captured using a nine-point scale, i.e., equally important (1), moderately important (3), strongly important (5), very strongly important (7), and extremely important (9) [24]. However, although this nine-point scale has the advantages of simplicity and ease of use, it does not take into account the uncertainty associated with the mapping of the participants' perception to a number. Accordingly, the TOPSIS method has been proposed as an alternative tool for dealing with multi-objective decision-making tasks [19]. The TOPSIS algorithm is based on the concept of a displaced ideal point from which the compromise solution has the shortest distance [25]. In particular, Yoon and Hwang (1995) proposed that the ranking of alternatives be based on the shortest distance from the (positive) ideal solution and the furthest distance from the negative ideal solution. In other words, TOPSIS simultaneously considers the distances to both the positive ideal solution and the negative ideal solution, and then generates a ranked preference order for the various competing alternatives based on a combination of both distance measures.

According to Kim et al., (1997) and Shih et al., (2007), TOPSIS has many advantages as an optimization tool. For example, it rationally presents human choice by means of objective investigation and computation and describes both the merits and the defects of the competing alternatives simultaneously [26–27]. Furthermore, it is computationally straightforward and easily programmed into a spreadsheet and permits an easy visualization of the measuring results of the attributes and associated levels of all the alternatives. As a result, it is commonly preferred to other relevant techniques such as Fuzzy Analytical Hierarchical Process (FAHP) [13], Preference Ranking Organization METhod for Enrichment of Evaluations (PROMETHEE) [28] and Elimination and Et Choice Translating Reality (ELECTRE) [29]. In recent years, TOPSIS has been widely applied in the fields of product design [18, 30–31], material design [32], icon design [23] and game design [33]. In general, the results have confirmed that TOPSIS provides an effective and highly versatile tool for solving the optimization problem associated with the multi-objective consumer-oriented product form design task.

III. Research Methods and Implementation Procedure

This section describes the research methods and overall implementation procedure including four parts: (1) the definition of bottled shower gel packaging design, (2) the evaluation samples design, (3) the selection of appropriate consumers' sentimental responses (CSRs), and (4) the visual evaluation of bottled shower gel packaging samples, respectively.

1. Definition of Bottled Shower Gel Packaging Design

This study commenced by collecting 80 bottled shower gel packaging pictures with similar view-angles. A focus group consisting of 5 experienced designers in the field of packaging / graphic design conducted a thorough morphological analysis of the collected shower gel packaging pictures in order to identify the attributes and associated features which collectively defined the generic shower gel packaging design.

Having conducted an extensive review of the 80 shower gel packaging designs, it was concluded that the generic design comprised three basic components, namely the Bottle Cap, the Bottle Body and the Vision Wholeness. As shown in Figure 1 and Table 1, a total of 8 attributes were identified, with each attribute having 2 or 3 features. In particular, the Bottle Cap was described using three attributes, namely "Type of pump head and nozzle (X1)", "Proportion of pump head width and nozzle length (X2)" and "Width-to-height proportion of

bottleneck (X3)". Each attribute was then further defined by means of three features. The Bottle Body was also described using three attributes, namely "Shape of bottle body (X4)", "Proportion of upper width-to-lower width for bottle body (X5)", and "Width-to-height proportion of bottle body (X6)", with each attribute having three features. Finally, the Vision Wholeness was described by two attributes, namely "Height proportion of bottle cap-to-bottle body (X7)" and "Label graphic design (X8)"; with the attributes being further described by three and two features, respectively.

In defining the attributes and features described above, the focus group applied the following principles:

(1) The attributes must be immediately cognizable as components of a bottled shower gel packaging.

(2) Any two attributes must be distinguishable from one another and collectively all of the attributes must capture all of the aspects of diversity associated with the bottled shower gel packaging.

(3) Each attribute must contain multiple features, where the relations between these features must be distinct and independent.

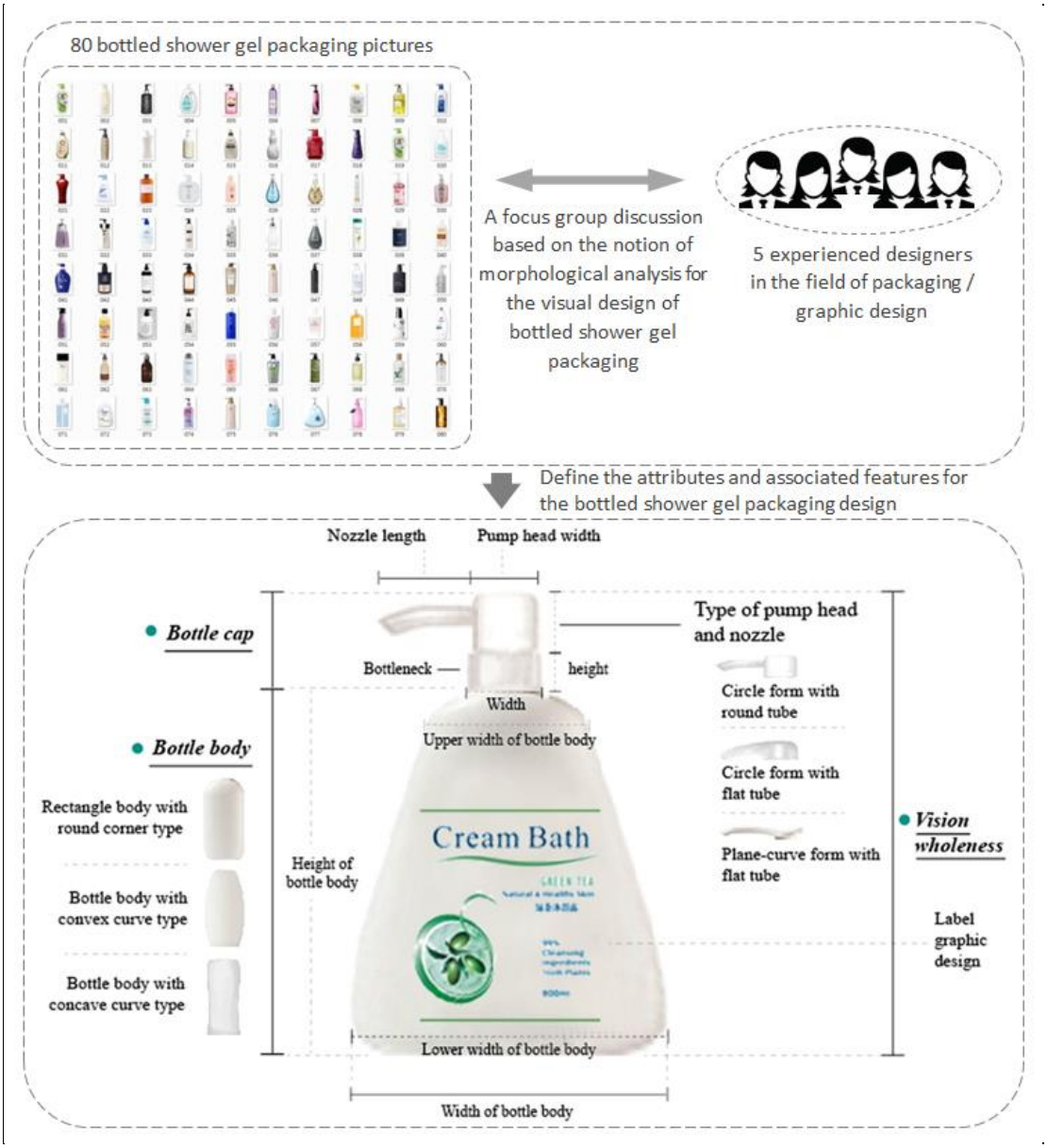

Fig. 1 Cognitive description and definition of bottled shower gel packaging.

Table 1 Definition results for shower gel packaging

Bottled shower gel	Attributes	Features		
		1	2	3
Bottle cap	Type of pump head and nozzle (X1)	Circle form with round tube (X11)	Circle form with flat tube (X12)	Plane-curve form with flat tube (X13)
	Proportion of pump head width and nozzle length (X2)	1:1 (X21)	1:2 (X22)	1:0.5 (X23)
	Width-to-height proportion of bottleneck (X3)	1:0.5 (X31)	1:0.8 (X32)	1:1 (X33)
Bottle body	Shape of bottle body (X4)	Rectangle body with round corner type (X41)	Bottle body with convex curve type (X42)	Bottle body with concave curve type (X43)
	Proportion of upper width-to-lower width for bottle body (X5)	1:1 (X51)	1:2 (X52)	2:1 (X53)
	Width-to-height proportion of bottle body (X6)	1:3 (X61)	1:1.5 (X62)	1:1 (X63)
Vision wholeness	Height proportion of bottle cap-to-bottle body (X7)	1:2 (X71)	1:3 (X72)	1:4 (X73)
	Label graphic design on bottle body (X8)	Label graphic design (X81)	No label graphic design(X82)	

Table 2 Orthogonal design of shower gel packaging samples

No	X1	X2	X3	X4	X5	X6	X7	X8
1	X11	X22	X33	X41	X51	X62	X72	X82
2	X13	X22	X32	X42	X52	X62	X72	X81
3	X11	X21	X32	X42	X51	X62	X72	X82
4	X12	X21	X33	X43	X52	X62	X72	X81
5	X13	X21	X31	X41	X52	X61	X72	X82
6	X12	X22	X32	X43	X51	X61	X71	X81
7	X13	X21	X33	X42	X51	X61	X71	X81
8	X13	X22	X31	X43	X51	X62	X71	X82
9	X11	X22	X31	X42	X52	X62	X71	X81
10	X11	X22	X33	X41	X53	X61	X73	X82
11	X11	X23	X33	X42	X53	X63	X73	X82
12	X13	X23	X32	X41	X53	X63	X73	X81
13	X12	X23	X31	X43	X53	X63	X73	X81
14	X13	X23	X32	X43	X53	X63	X72	X81
15	X11	X21	X32	X43	X52	X61	X71	X82
16	X11	X21	X31	X41	X52	X62	X71	X81
17	X11	X21	X33	X41	X51	X61	X72	X81
18	X12	X21	X32	X43	X51	X62	X71	X82
19	X12	X22	X31	X42	X52	X61	X72	X82
20	X11	X23	X31	X41	X53	X63	X72	X82
21	X12	X21	X32	X42	X53	X63	X73	X82
22	X12	X23	X32	X41	X53	X63	X73	X82
23	X13	X23	X31	X42	X53	X63	X73	X82
24	X13	X23	X33	X42	X52	X63	X73	X81
25	X12	X23	X33	X43	X51	X62	X73	X81
26	X13	X22	X33	X41	X52	X61	X71	X82
27	X12	X22	X31	X43	X51	X61	X72	X81

2. Evaluation Samples of Bottled Shower Gel Packaging

To accommodate the 8 attributes of the shower gel packaging design and their corresponding features, the orthogonal array scheme was conducted to generate the design conditions of evaluative shower gel packaging samples in this study. The orthogonal array scheme was a type of general fractional factorial design based on a design matrix, and allowed user(s)/researcher(s) to consider a selected subset of combinations of multiple factors (attributes) at multiple levels (features). Accordingly, the design conditions of 27 shower gel packaging samples shown in Table 2 were configured using the orthogonal array scheme. Three graphic designers, each with more than two years' of packaging design experience were invited to create evaluation samples of the different packaging designs configured in Table 2 using the attribute and feature definitions listed in Table 1. Having completed each design, the corresponding dataset (i.e., the set of attributes and features describing the design) was recorded in a design database. The 27 evaluation samples were then rendered in photoshop software and presented in an identical perspective condition, as shown in Fig. 2.

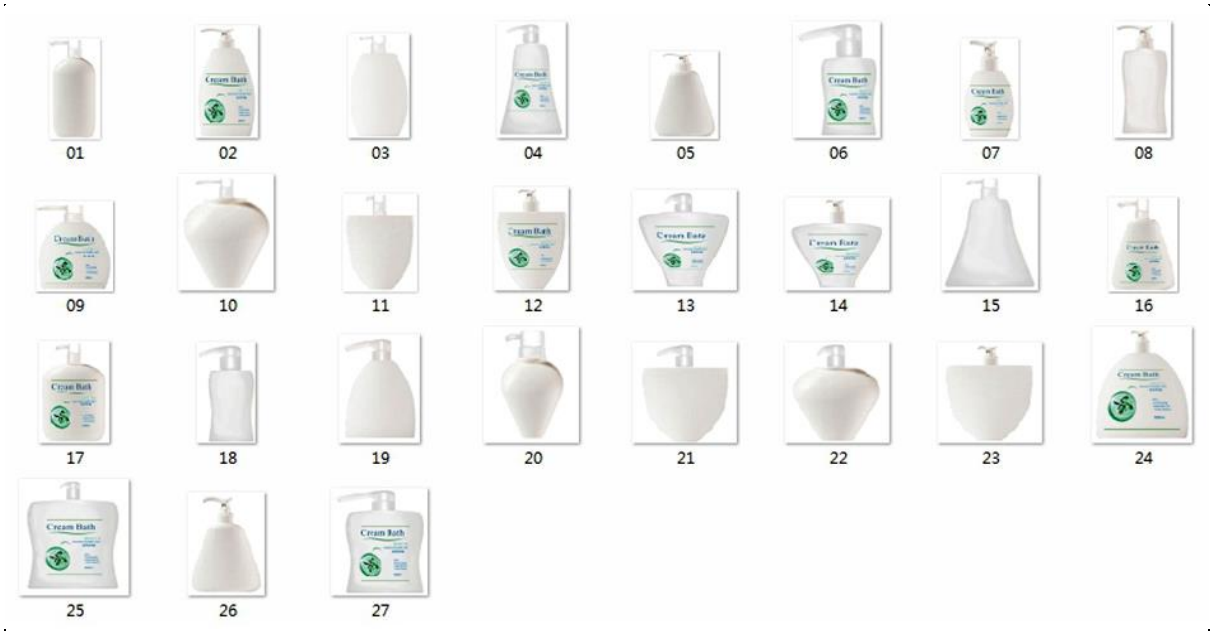

Fig. 2 27 bottled shower gel packaging samples for evaluation purposes

3. Selection of Appropriate CSRs for Bottled Shower Gel Packaging

Adjectives provide an explicit representation of psychological perceptions and personal experiences, and hence give consumers a convenient and effective means of conveying their sentimental responses to a particular product or packaging design. In this study, 60 adjectives relating to existing shower gel packaging designs were collected from commercial advertisements and were reviewed by a small focus group consisting of previous 3 graphic designers partaking in the creation of 27 evaluation samples and 2 individuals with a non-design background (as the representative consumers). The group was asked to identify a limited set of adjectives capable of capturing the potential responses of consumers to the 27 evaluation samples shown in Table 2. The review process yielded a total of 23 adjectives, as indicated in Figure 3. The adjectives were sorted into 3 groups in accordance with their semantic similarities using the Kawakida Jirou (K.J.) method [34].

Group 1 included such adjectives as "cozy", "refreshing", "youthful", "sprightly", "vigorous", "comfortable", "cheerful", "healthful", and so on. These adjectives relate in the main to the relaxation, spiritedness and fitness characteristics of the shower gel packaging samples. Therefore, these adjectives ''Cozy and Refreshing'' can be chosen as a representative CSR description to describe the majority of the adjectives within this group. Group 2

included such adjectives as “aesthetic”, “attractive”, “elegant”, “tasteful”, “meek”, “graceful”, “noble”, and so on. The majority of the adjectives in this group relate to the aesthetic properties of the shower gel packaging samples. Therefore, this group can be interpreted as an “aesthetic attraction group” and these adjectives “Aesthetic and Attractive” chosen as a representative CSR description to describe the majority of the adjectives within this group.

Group 3 included such adjectives as “convenient”, “easy”, “usable”, “common”, “handy”, “concise”, “popular”, and so on. The majority of the adjectives in this group relate to the usability trait of the visual feeling (i.e. look and feel a packaging sample whether easy to use or not) for the shower gel packaging samples. Therefore, this group can be interpreted as a “usability trait of visual perception” and the representative CSR description can be named as the “Easy to use” to describe the majority of the adjectives within this group. Finally, representative CSR descriptions were chosen for each group, namely “Cozy and Refreshing”, “Aesthetic and Attractive” and “Easy to Use”.

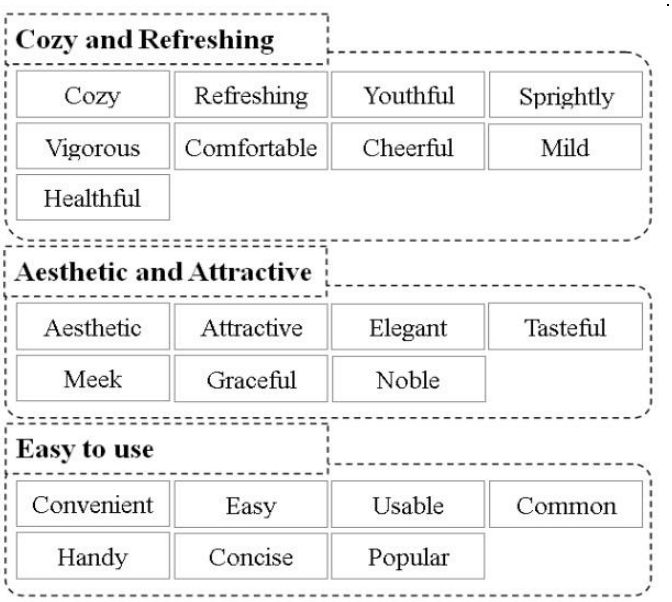

Fig. 3 Selection and classification of consumer sentimental responses (CSRs).

4. Visual Evaluation of Bottled Shower Gel Packaging Samples

In the visual evaluation procedure, the CSRs induced by each shower gel packaging sample were quantified using a questionnaire-type document based on 7-point Likert scales, with anchors ranging from “not at all (1)” to “intensely (7)” (see Fig. 4). The questionnaire was completed by 78 subjects, comprising 22 designers with a minimum of 2 years’ experience each in packaging or graphic design, and 56 individuals from a non-design background. The evaluation data were processed using CA and TOPSIS in order to explore the relationships between the CSR descriptions and the shower gel packaging features.

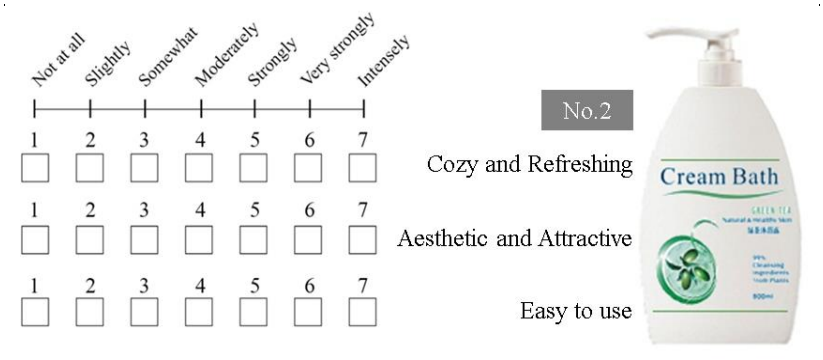

Fig. 4 Questionnaire items for illustrative bottled shower gel packaging sample.

IV. Analysis of Visual Evaluation Results

To analyze the bottled shower gel packaging evaluation results, two different analytical techniques (namely CA and TOPSIS) were used to construct predictive models relating the attributes/features of the bottled shower gel packaging design to the corresponding CSR. The details of each analytical model are described in the following sections.

1. Conjoint Analysis models

Conjoint Analysis (CA) is a common research technique for discrete choice analysis (Rohae, 2003) since it provides a convenient and intuitive means of modeling the relationship between the attributes and features of a product and the corresponding consumer evaluations (Sylcott et al, 2016). Referring to Eq. (1) in Section 2.1, the independent variables in the CA model correspond to the attributes / features of the bottled shower gel packaging design (see Table 1), while the dependent variables correspond to the 3 CSR descriptions used to characterize the consumer response to the design (see Fig. 3). Table 3 shows the CA models constructed for the 3 CSR descriptions. It is seen that the three models have adjusted R^2 values of 0.781 (Cozy and Refreshing), 0.828 (Aesthetic and Attractive) and 0.809 (Easy to Use), respectively. In other words, all three models provide a good overall fit. That is, they provide designers with a reliable tool for predicting the likely consumer response in each CSR domain given only a parametric attribute / feature definition of the proposed shower gel packaging design.

Table 3 Conjoint Analysis (CA) models for CSRs

CA models	R	R^2
"Cozy and Refreshing" model $= 4.061 - 0.276X_{11} + 0.383X_{12} - 0.105X_{13} + 0.142X_{21} - 0.073X_{22} - 0.066X_{23}$ $- 0.115X_{31} + 0.224X_{32} - 0.107X_{33} - 0.158X_{41} - 0.157X_{42} + 0.315X_{43}$ $+ 0.123X_{51} - 0.060X_{52} - 0.062X_{53} + 0.182X_{61} - 0.091X_{62} - 0.089X_{63}$ $- 0.072X_{71} + 0.144X_{72} - 0.070X_{73} + 0.436X_{81} - 0.436X_{82}$	0.884	0.781
"Aesthetic and Attractive" model $= 3.631 - 0.282X_{11} - 0.142X_{12} + 0.424X_{13} + 0.118X_{21} - 0.052X_{22} - 0.065X_{23}$ $- 0.149X_{31} - 0.148X_{32} + 0.298X_{33} - 0.214X_{41} + 0.431X_{42} - 0.216X_{43}$ $- 0.043X_{51} + 0.075X_{52} - 0.032X_{53} + 0.175X_{61} - 0.086X_{62} - 0.088X_{63}$ $- 0.067X_{71} + 0.133X_{72} - 0.066X_{73} + 0.476X_{81} - 0.476X_{82}$	0.910	0.828
"Easy to use" model $= 3.811 - 0.242X_{11} + 0.391X_{12} - 0.149X_{13} + 0.137X_{21} - 0.067X_{22} - 0.069X_{23}$ $+ 0.183X_{31} - 0.091X_{32} - 0.092X_{33} - 0.211X_{41} + 0.421X_{42} - 0.209X_{43}$ $- 0.047X_{51} - 0.046X_{52} + 0.092X_{53} + 0.145X_{61} - 0.071X_{62} - 0.074X_{63}$ $+ 0.164X_{71} - 0.081X_{72} - 0.083X_{73} + 0.162X_{81} - 0.162X_{82}$	0.899	0.809

2. Integration of CA-based models with TOPSIS algorithm

The CA models in Table 3 enable the designer to predict the likely CSRs induced by a particular bottled shower gel packaging design. In this section, the CA models for the individual CSRs are integrated with the TOPSIS algorithm [19] to determine the optimal packaging design which satisfies a particular set of CSR description targets simultaneously. In performing the integration process, the relative weights of the 3 CSR descriptions were determined using the Analytic Hierarchy Process (AHP) method [24] based on the pair-wise comparison results obtained from a group of 56 representative consumers. The AHP results revealed the following weights: "Aesthetic and Attractive" = 0.438, "Easy to use" = 0.313 and "Cozy and Refreshing" = 0.250. The CA models were then integrated with the TOPSIS algorithm by means of the following eight-step procedure:

Step 1: The TOPSIS decision matrix, *D*, i.e., the predictive values of the 3 CA models, was calculated as

$$D=\begin{bmatrix} P_{11} & P_{1j} & \cdots & P_{1n} \\ P_{21} & P_{22} & & P_{2n} \\ \vdots & \vdots & & \vdots \\ P_{m1} & P_{m1} & \cdots & P_{mn} \end{bmatrix}, \tag{2}$$

where P_{ij} is the predictive value of the i-th shower gel packaging sample (i=1, 2…m, where m = 27) for the j-th CSR description (j=1, 2,…n, where n = 3).

Step 2: The normalized predictive value of each sample over all the CSR descriptions, r_{ij}, was calculated as

$$r_{ij}=\frac{S_{ij}}{\sqrt{\sum_{i=1}^{m} S_{ij}^2}},\ i=1,\ldots,27,\ \ j=1,\ldots,3\ . \tag{3}$$

Step 3: The weighted normalized predictive values, v_{ij}, were calculated as

$$v_{ij}=w_j r_{ij},\ \ \sum_{j=1}^{3} w_j=1,\ \ i=1,\ldots,27,\ \ \ j=1,\ldots,3, \tag{4}$$

where r_{ij} are the normalized predictive values obtained from Eq. (3) and w_j is the weight of the j-th CSR obtained from the AHP analysis above. (i.e., the normalized weights are "Aesthetic and Attractive"=0.438, "Easy to use"=0.313, and "Cozy and Refreshing"=0.250, respectively.

Step 4: In the TOPSIS method, the ideal solution is the hypothetical design solution for which all of the CSRs attain their maximum values. Conversely, the negative ideal solution is the hypothetical design solution for which all the CSRs attain their minimum values. The two solutions, denoted as A^+ and A^-, respectively, were computed as

$$A^+=\{v1^+, v2^+, v3^+\}, \tag{5}$$

and

$$A^-=\{v1^-, v2^-, v3^-\}. \tag{6}$$

The solutions were found to have values of A^+ = (0.0399, 0.0681, 0.0411) and A^- = (0.0200, 0.0300, 0.0254), respectively.

Step 5: The distances of each shower gel packaging sample from the ideal solution, D^+, and negative ideal solution, D^-, respectively, were evaluated as

$$D_i^+=\sqrt{\sum_{j=1}^{n}(v_{ij}-v_j^+)^2},\ \ i=1,\ldots,27\ \ \ , \tag{7}$$

and

$$D_i^-=\sqrt{\sum_{j=1}^{n}(v_{ij}-v_j^-)^2},\ \ i=1,\ldots,27\ \ \ . \tag{8}$$

Step 6: The preference index (PI) of each shower gel packaging sample was computed as

$$PI_i=\frac{D_i^-}{D_i^-+D_i^+},\ \ i=1,\ldots,27\ . \tag{9}$$

Table 4 shows the calculation results for the distance D_i^+ between each shower gel packaging sample and the ideal solution, the distance D_i^- between each shower gel packaging sample and the negative ideal solution, and the PI value of each shower gel packaging sample.

Table 4 Predicted values of each CSR and corresponding values of D^+, D^- and *PI* for 27 shower gel packaging samples.

No.	Predicted values of CSR descriptions			D^+	D^-	*PI*
	Cozy and Refreshing	Aesthetic and Attractive	Easy to use			
1	3.187	2.909	2.838	0.039	0.096	0.709
2	4.163	4.684	4.133	0.014	0.224	0.939
3	3.734	3.278	3.674	0.031	0.159	0.835
4	5.221	4.287	4.002	0.016	0.227	0.936
5	3.655	3.717	3.627	0.027	0.172	0.864
6	5.577	3.614	4.259	0.023	0.219	0.904
7	4.503	5.443	4.551	0.008	0.256	0.971
8	3.607	2.966	3.453	0.036	0.136	0.792
9	3.653	3.977	4.314	0.023	0.198	0.895
10	3.061	2.982	3.191	0.038	0.111	0.746
11	2.798	3.351	3.601	0.034	0.137	0.801
12	4.171	3.918	3.388	0.024	0.184	0.884
13	4.791	3.349	4.204	0.027	0.196	0.879
14	4.858	4.115	3.392	0.020	0.203	0.908
15	4.080	2.810	3.507	0.036	0.142	0.798
16	3.867	3.502	3.887	0.028	0.176	0.863
17	4.547	4.292	3.582	0.019	0.207	0.918
18	4.647	2.571	3.923	0.037	0.158	0.810
19	3.927	3.626	4.594	0.026	0.198	0.885
20	3.003	2.458	3.247	0.043	0.077	0.638
21	3.994	3.228	4.441	0.030	0.182	0.859
22	3.785	2.400	3.604	0.041	0.118	0.741
23	2.961	3.610	3.969	0.030	0.163	0.844
24	3.843	5.116	3.880	0.015	0.225	0.939
25	4.982	3.787	3.793	0.022	0.204	0.901
26	3.232	3.794	3.393	0.029	0.160	0.848
27	5.454	3.813	4.288	0.021	0.223	0.915

Step 7: The utility of the *i*-th feature of the *j*-th attribute upon the *PI* was calculated by summing the *PI*s of all the conditions involving the *i*-th feature of the *j*-th attribute and then dividing the result by the number of *PI*s.

Step 8: The feature of each attribute having the greatest utility upon the *PI* was selected and added to the optimal set of features for the shower gel packaging sample.

Table 5 Feature utility and attribute importance

Attributes	Feature (utility)			Importance (%)
	1	2	3	
Type of pump head and nozzle (X1)	0.800	0.870	*0.888	**18.15%**
Proportion of pump head width and nozzle length (X2)	*0.873	0.848	0.837	7.36%
Width-to-height proportion of bottleneck (X3)	0.842	0.853	*0.863	4.43%
Shape of bottle body (X4)	0.801	*0.885	0.872	**17.50%**
Proportion of upper width-to-lower width for bottle body (X5)	0.862	*0.885	0.811	**15.43%**
Width-to-height proportion of bottle body (X6)	*0.872	0.853	0.833	8.24%
Height proportion of bottle cap-to-bottle body (X7)	*0.869	0.845	0.844	5.26%
Label graphic design on bottle body (X8)	*0.912	0.798		**23.65%**

The asterisk indicates the greatest utility.

Table 5 shows the utility of each feature of each attribute and the overall importance of each attribute upon the preference index (*PI*). It is seen that the "Label graphic design on bottle body (X8) (23.65%)", "Type of pump head and nozzle (X1) (18.15%)", "Shape of bottle body (X4) (17.50%)", and "Proportion of upper width-to-lower width for bottle body (X5) (15.43%)" have the greatest effect on the overall sentimental response of the consumers toward the shower gel packaging design since these attributes account for 70% of the correlation between the shower gel packaging and the multiple CSR descriptions. In other words, the designer should focus on these particular attributes when creating a new bottled shower gel packaging design. Furthermore, a detailed inspection of the utility values in Table 5 shows that the optimal shower gel packaging design should comprise a plane-curve form with flat tube (X13), a pump head width to nozzle length ratio of 1:1 (X21); a width-to-height proportion of the bottleneck ratio of 1:1 (X33); a bottle body with convex curve type (X42), an upper width-to-lower width ratio of the bottle body equal to 1:2 (X52), a width-to-height ratio of the bottle body equal to 1:3 (X61), a height proportion of the bottle cap-to-bottle body equal to 1:2 (X71), and a label graphic design on the bottle body (X81).

V. Verification

To verify the feasibility of the optimal shower gel packaging design suggestion, four new shower gel packaging examples were constructed in the verification process. One packaging example (v.1) was created in accordance with the optimal design suggestions (i.e. X13, X21, X33, X42, X52, X61, X71, and X81), and three packaging examples (v.2–v.4) were designed by three graphic designers to satisfy the 3 CSRs based on the definition of shower gel packaging shown in Table 1. Then, the four shower gel packaging examples shown in Figure 5 were displayed on a questionnaire-type document and were evaluated by a group of 30 subjects (12 male, 18 female; aged from 19–24 years old) using 7-point Likert scales, with anchors ranging from "not at all (1)" to "intensely (7)".

Fig. 5 Four verification examples.

Figure 6(a) shows the means of the 30 subjects' evaluations for each CSR for the 4 new shower gel packaging examples. Meanwhile, Figure 6(b) presents the variance of average evaluation values. The mean and standard deviation(SD) of verification evaluation results obtained for the v.1 example were as follows: Cozy and Refreshing: mean=5.245(SD=0.673); Aesthetic and Attractive: mean=5.513(SD=0.702); and Easy to Use: mean=5.118(SD=0.638). Comparing the mean evaluation of the v.1 example with those of the v.2–v.4 examples shown in Figure 6(a), it was clear that the mean evaluation of the v.1 (5.292) was found to be higher than that of v.2 (4.740), v.3 (5.201) or v.4 (4.923). From Figure 6(b), it can be seen that the evaluations of the v.1 example reveal only small variance values, while the variances of v.2, v.3 and v.4 examples are significantly higher. Therefore, it can be inferred that the optimal shower gel packaging design suggestion has a superior performance in the 3 CSRs compared to the others shower gel packaging examples. Additionally, it is observed that the variance

is relatively consistent for each of the CSRs in the case of the v.1, whereas it scatters more significantly for the examples v.2–v.4. Consequently, it can be inferred that the optimal packaging design suggestion consistently maintains a lower variation between different consumer evaluations. Overall, the verification results demonstrate the basic reliability of the optimal design suggestion in meeting the consumers' expectation of the bottled shower gel packaging in each of the 3 CSR domains.

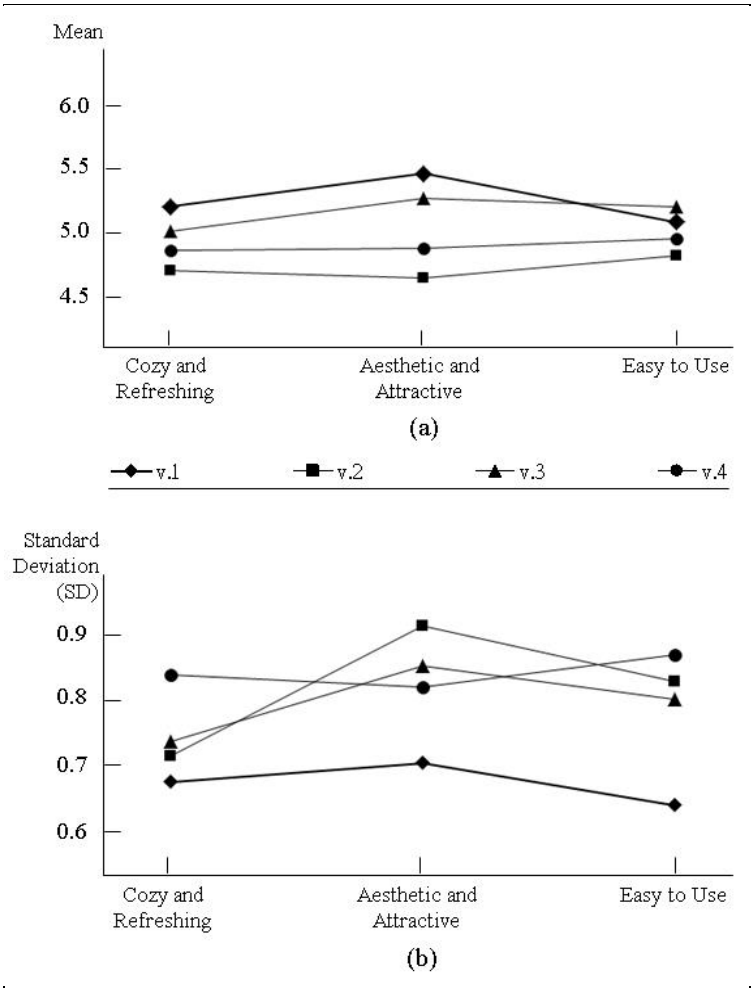

Fig. 6 Means and standard deviation(SD) of evaluation value for four verification examples.

VI. Discussions and Conclusions

This study has utilized a combined CA and TOPSIS approach to examine the relationship between consumers' sentimental responses (CSRs) toward a bottled shower gel packaging design and the corresponding design attributes and features. The major attributes / features of the bottled shower gel packaging have been identified such that the efficacy of the design process in developing a new shower gel packaging design that meets the target set of CSRs or consumers' psychological expectations is improved. In other words, the method proposed in the present study not only provides the designer with the ability to focus particularly on the attributes and features which dominate the consumer response, but also to develop new shower gel packaging designs which are "guaranteed" to satisfy the CSR requirements. Although this study has focused on the particular case of bottled shower gel packaging, the notions embodied in the proposed procedure are equally applicable to other packaging designs, such as laundry detergent, beverage, moisturizer, shampoo, and so on.

Although the methodology procedure of this study seems like the methods of the previous Kansei Engineering,

there are some noticeable differences between Kansei Engineering analysis method [1, 13, 16, 31] and the methodology proposed in the present study. One of the differences between the methodology and previous Kansei Engineering analysis methods consists in the visual evaluation scales and the implementation time. Conventional Kansei Engineering method procedure depends upon a large number of samples to ensure their accuracy. By contrast, this methodology procedure requires fewer evaluation samples by using the orthogonal array scheme and a lesser number of evaluation scales. Hence, the methodology procedure proposed in the present study reduces the implementation time required to complete the visual design evaluation. Further, Previous Kansei Engineering analysis methods, e.g. Quantitative Theory Type I [31], Fuzzy theory [1], Multiple Regression and Back-Propagation Neural Networks [16], tend to be highly complex since they are based on precise mathematical models. Accordingly, complex these analysis methods do not yield adequately perceivable results and lack the flexibility which allows the research results to be applied to diverse markets. Conversely, this methodology provides a straightforward and effective technique for determining the optimal parameters for the multi-consumers' response design problem. Furthermore, previous Kansei Engineering studies use these analysis methods to establish the relationship between the independent variables (e.g. product or packaging design elements) and the dependent variables (e.g. consumers' response). However, these analysis methods provide designers with no more than a single predictive consumers' response to a product or packaging. Consequently, a process of subjective conjecturing must still be applied when considering multiple consumers' responses simultaneously. By contrast, the methodology proposed in this study provides designers with the ability to directly identify the set of optimal product or packaging parameters which satisfy multiple consumers' responses requirements simultaneously. Overall, the discussions suggest that compared to such Kansei Engineering methods, the methodology proposed in this study seems to be able to provide an uncomplicated and efficient evaluation means to assess a product or packaging for satisfying a specified set of multiple consumers' responses requirements.

Finally, several limitations of the study should be noted. First, the CSRs of a bottled shower gel packaging are both changeable and intricate over time. In other words, consumers are almost certain to experience a different sentimental / psychological response when presented with the same shower gel packaging repeatedly over time. Furthermore, the CSRs to a shower gel product involve multiple senses, not only vision. In other words, the CSRs are governed not only by the physical appearance of the product, but also by its material, usability, roughness or hardness (tactile sense), fragrance (smell sense), and so on. As a consequence, there is no certainty that the design result obtained using the proposed method will satisfy all customers for all time (both now and in the future).

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