2018

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Recommended Citation
Lei Jiang, Kang Zhang. Apparel Brand Overlap Based on Customer Perceived Value and Eye-Tracking Technology. Tsinghua Science and Technology 2018, 23(1): 47-64.

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Apparel Brand Overlap Based on Customer Perceived Value and Eye-Tracking Technology

Lei Jiang and Kang Zhang

Abstract: Competition in the apparel market has developed from preliminary price competition, quality competition, and scale competition to the current state of brand competition. The phenomenon of brand overlap cannot be avoided by apparel enterprises during the process of building and manufacturing their brands. This paper has selected nine identification elements of three dimensions, which we used to construct an apparel brand overlap identification model. This model is based on the theories of customer perceived value and brand identity and was constructed by taking consumer perspectives as the starting point. Two apparel brands from the representative international E Company have been selected as our empirical research objects. An apparel brand overlap identification model has been constructed based on questionnaire analysis and a cognitive experiment involving eye-tracking technology. In addition, the overlap elements among apparel brands, as well as the cognitive situation of consumers with regard to brand overlap, have been analyzed.

Key words: eye-tracking technology; customer perceived value; brand overlap; brand identity; apparel brand

1 Introduction

Nowadays, with increasingly fierce market competition, it is difficult for apparel products to stand out in competition with similar brands. Most apparel products have no obvious distinctions or uniqueness. As such, it is difficult for customers to recognize the differences between competitive brands and the phenomena of product homogeneity and brand overlap become widespread. The concept of “brand overlap” originated from brand ecological management and was developed based on theories in ecology. Based on the research method of brand positioning used in management sciences, this paper defines “brand overlap” as a state of intersection in the market resources adopted by competitive brands. The phenomenon of brand overlap occurs when two brands use the same market resources or when two or more brands share other resource variables. At the moment, the established methods of evaluating brand overlap apply a formula to calculate the ecological niche among competitive brands and quantify the competitiveness of brands for market share. However, few brand studies have been conducted from the perspective of a target customer group.

Because there are differences between brand markets and resources, consumers, especially with regard to the views of the target customer group, will inevitably be involved if we want to clarify the differential positioning among competing brands. In addition, the identity of a brand itself is of great significance when researching brand overlap. Therefore, this paper has set brand overlap as its research core to validate the theory of customer perceived value through eye-tracking experiments. In addition, from the consumer perspective, we analyze apparel brands by constructing an apparel brand overlap identification model. We then
offer an optimization scheme and strategic directions to apparel enterprises looking to develop their own brand strategies and understand their market positioning.

2 Brand Overlap Identification Mechanism

2.1 Customer perceived value

Since the end of the 1980s, Western scholars have been conducting intensive research into consumer value composition, mostly by focusing on quantitative statistics and model construction. Nearly all studies in Asia are based on Western theories and focus on concept study. We have learned from previous studies that customer perceived value is the subjective understanding of products by customers\(^{[3]}\). Perceived value is based on the economic functions and psychological benefits provided by products. It is also related to the purchasing experience of consumers as well as the brand commitment of the sellers\(^{[4]}\). Perceived value not only includes consumers’ evaluations of products, but also the psychological experiences of those consumers\(^{[5]}\). Based on the perceived value theory, this paper establishes three dimensions for customer perceived value: (1) product identity, (2) brand image, and (3) customer experience.

2.2 Brand identity theory

A brand has the same characteristics as a living body. Each brand has a unique personality, which is the objective condition for brand identity. The conditions of brand survival appear from the subjective perception, that is, the concept of brand identity. Studies on brand identity start from the viewpoint of the enterprises that produce those brands. As such, research focuses on the connotation, identity elements/dimensions, and brand identity as well as brand image, brand personality, brand positioning, brand value, etc. Few exploratory studies have been conducted from the consumer perspective.

A brand can be regarded as a combination of both physical and psychological factors. Brand identity comprises three aspects: (1) product property, (2) brand anthropomorphic personality or image, and (3) the differences between one brand and its competitors from the customer’s point of view\(^{[6]}\). By combining the classic model of brand identity, this paper intends to identify similar brands from the consumer perspective. In addition, we make a comparative analysis between brands from different dimensions in order to confirm the recognition views and cognition degree of target customers with regard to brand overlap.

2.3 Apparel brand overlap identification model based on customer perceived value

As the key link of all relationships between customers and brands, the extremely outstanding properties of any product will leave an impression of high quality or high value on target consumers. In Jean-Noel Kapferer’s brand identity prism\(^{[7]}\), the four-element theory of brand identity proposed by Schmitt and Simonson\(^{[8]}\) and the four-level theory of brand identity proposed by Aaker\(^{[6]}\), all have classified products as one level of brand identity. Therefore, product identity is an important dimension of brand identity. As pointed out in the customer value hierarchy model proposed by Woodruff\(^{[9]}\), customers form expected value and specific goals when purchasing. During the product purchasing process, they not only consider the specific attributes and attribute effectiveness of different products, but they also consider the likelihood of each attribute realizing the expected results. Therefore, the unique attribute of a product is an important factor for customers when it comes to perceiving a brand’s image. This paper takes the four-level theory of brand identity proposed by Aaker\(^{[6]}\) as the hierarchical classification of a product brand. This theory combines the specific attributes and subdivides the selected apparel products into the three elements of (1) product category, (2) product feature, and (3) product price.

Brand image is the assembly formed psychologically between consumers. Brand marketers hope that consumers will be affected by image perception, subjective feelings, perception methods, and perception background\(^{[10]}\). In an environment of increasing product homogeneity, the differences between rival brands are decreasing. Market competition is gradually changing from product competition to brand competition. In addition, the market position of a brand will ultimately be determined by the overall image of that brand. Furthermore, we can see from existing consumer perceived value and psychology research that most consumers prefer to choose brands similar to, or somehow match, their own personality\(^{[11]}\). Consumers also expect to attain social value and a flattering evaluation (or self-evaluation) in concordance with the brand’s image in order to express their (the consumer’s) true self, ideal self, and social self\(^{[12]}\). As a sign of the awareness of cultural psychology and the identification of cultural identity, a brand can help consumers show their cultural identity through
the brand’s image and maintain their sense of group belonging through the consumption of that brand\cite{13}. Therefore, it is essential to consider brand image as one dimension of evaluating apparel brand overlap. Based on the specific demands for research on brand overlap, this paper has divided apparel brand image elements into (1) brand positioning, (2) brand personality, and (3) dissemination image.

An article published in the *Harvard Business Review* written by Pine and Gilmore\cite{14}, predicted the coming of an “experienced economy era” in the 21st century. In the experienced economy era, the attention of consumers will transfer from traditional functional factors (such as product quality and prices) to emotional factors, such as the pleasant sensations experienced during the consumption process, good consumption experiences, etc.\cite{15} In such an economy, brand operators will only win over consumers by providing them with a pleasant experience through the unique culture and value of their brands, thereby producing positive consumption memories. From the perspective of consumption demands, based on Maslow’s Hierarchy of Needs, emphasis on the brand consumption experience is an inevitable trend in the increase of the hierarchy of human needs\cite{16}. Schmitt’s customer experience dimension division has been extensively recognized and applied in studies of the customer experience dimension both at home and abroad\cite{8}. This paper further divides the customer experience dimension into (1) relationship experience, (2) emotional experience, and (3) interactive experience. This division is based on Schmitt’s classification method, as well as the relationship between customer and brand and by combining specific content of apparel brand overlap research.

In summary, this paper sets the framework of a brand overlap identification model as a triangle, with reference to related empirical studies. Our triangle includes the three dimensions of (1) product identity, (2) brand image, and (3) customer experience. Figure 1 is the constructed apparel brand overlap identification model based on customer perceived value, taking the three factors of each dimension as the support content.

### 2.4 Applicability of the model and relevant hypotheses

As the main purchasers of apparel products, female consumers pay closer attention to and have a higher degree of acceptance for apparel brands. Compared with men’s and children’s wear brands, the brand shopping experience of female consumers is richer and the brand cognition deeper. At the same time, based on the wide variety of demand for female products as well as the characteristics of female consumption psychology, competition in the women’s wear market is extremely fierce. In this market, the overlap degree is the highest, especially with regard to the middle and low-end women’s wear brands occupying market resources. Therefore, taking the female consumers in the domestic market as research objects is of greater significance and provides more representative value when researching the overlap identification of middle- and low-end apparel brands.

Because there are grade changes in the perceived value of consumers for each component of a brand’s identity, we make a judgment on the value of each factor in that brand’s identity and finally choose the products (or brands) that can provide the maximum value. We have learned that in the hierarchy of the perceived value of apparel brand overlap identification elements (which are the corresponding values of each element in the customer’s mind), the degree of importance is not the same. The consumer will evaluate the apparel brand perceived value, which includes the three dimensions of brand overlap identification. The consumer will then select the most important factor with the greatest power in terms of influence. The following model-related hypotheses are proposed:

**H1.** One attribute system can be used to describe multiple apparel brands. In addition, consumer cognition of a brand’s attributes means consumers can identify differences between brands, and the cognition of consumers for apparel brands with overlap
brand attributes means consumers can identify brand similarities.

H2. The importance degree of the three dimensions of our apparel brand overlap identification model (based on customer perceived value from low to high) are (1) the brand image dimension, (2) the product identity dimension, and (3) the customer experience dimension.

H3. The three dimensions of our apparel brand overlap identification model (based on customer perceived value) are independent and cannot be replaced.

H4. Differences exist in the cognition of consumers for each dimension of the apparel brand overlap identification model based on the product identity dimension.

H5. Consumers’ psychological features have an obvious influence on apparel brand overlap identification.

3 Empirical Research of Apparel Brand Overlap Identification

3.1 Questionnaire

Our market research adopts a convenience sampling method to select samples. We selected 250 young female consumers, aged between 18 and 30, who are relatively familiar with apparel brands. These participants are also sensitive to fashion and have an understanding of or have purchased the investigated apparel clothes. We took E and EW (two apparel brands from the international E Company) as the empirical research objects and designed a three-part consumer investigation questionnaire: Part I studies the apparel brand identity; Part II contains questions regarding the apparel brand overlap measurement scale; and Part III asks for basic information. Parts I and II adopt a five-segment scale, with 1 being the lowest grade and 5 being the highest. Specifically, 1 represents “totally disagree”, 2 “disagree”, 3 “neutral”, 4 “agree”, and 5 “totally agree”. The questions are randomly ordered in order to improve the authenticity of the questionnaire and avoid static consumer thinking.

Part I of the questionnaire studies the brand identity of E and EW (two brands). Based on the brand identity six-prism model proposed by Kapferer[7] and the brand identity prism in “Brand Strategy and Enterprise Growth-Theoretical Research and Case Study”[17], we designed questions related to consumer brand identity. We then compiled the responses, which are presented in Table 1, following the suggestions of professionals with regard to the scale and structure of the wording.

Part II of the questionnaire aims at identifying the E and EW brand overlap. The brand overlap scale is based on the apparel brand overlap identification model constructed in the previous section. Our design also refers to the four-level theory of brand identity[6], the brand personality dimension and scale[12], the localization research on brand personality dimension[18], customer experience theory[8], the brand relationship theory[19], and other relative mature research methods. The final set of statements and the respondents’ degree of agreement with those statements are shown in Table 2.

3.2 Result analysis

Our researchers sent out a total of 250 questionnaires, of which 232 were completed, yielding a response rate of 92.8%. Of the 232 returned questionnaires, 219 were valid, giving an effective response rate of 87.6%.

The questionnaire data was analyzed using SPSS, which allowed us to attain the statistical results of the sample
Table 2 Apparel brand overlap index based on customer perceived value.

| Product identity dimension |  |
|----------------------------|---|
| Product category | ii1. Product categories of E and EW brands are similar. (Part II 3) |
|                     | ii2. Key products are the most important ones, which other brands find difficult to beat. Key products of E and EW brands are similar. (Part II 1) |
| Product feature | ii3. Styles of E and EW brands are similar. (Part II 8) |
| | ii4. Fabrics of E and EW brands are similar. (Part II 13) |
| | ii5. Classic colors of E and EW brands are similar. (Part II 5) |
| | ii6. Decorative means (e.g. lace) of E and EW brands are similar. (Part II 15) |
| Product price | ii7. Prices of E and EW brands are similar. (Part II 17) |

| Brand image dimension |  |
|-----------------------|---|
| Brand positioning | ii8. With elegant, simple, romantic, sweet, ladies, pastoral, Bohemian and other words used to describe the style of clothing, the styles of E and EW brands are similar. (Part II 19) |
| | ii9. With formal wear, casual wear, streetwear, sportswear, home wear and other words used to describe the style of clothing, the styles of E and EW brands are similar. (Part II 9) |
| | ii10. The target consumers of E and EW brands are similar. (Part II 4) |
| Brand personality | ii11. Brand personalities of E and EW brands are similar: (Part II 12) |
| | ii11.1. Happy, lucky, confident, positive, fashionable. |
| | ii11.2. Natural, kind, warm, honest, pragmatic. |
| | ii11.3. Professional, mature, trustworthy, leadership, cultural. |
| | ii11.4. Elegant, romantic, tasty, gorgeous, charming. |
| | ii11.5. Brave, decisive, bold, innovative, straightforward. |
| Dissemination image | ii12. Product promotion of E and EW brands is similar. (Part II 7) |
| | ii13. Advertising image of E and EW brands is similar. (Part II 2) |
| | ii14. Packing of E and EW brands is similar. (Part II 10) |

| Customer experience dimension |  |
|-------------------------------|---|
| Relationship experience | ii15. Reliabilities of E and EW brands are similar. (Part II 16) |
| | ii16. After-sales services of E and EW brands are similar. (Part II 11) |
| Emotional experience | ii17. Shopping enjoyment of E and EW brands is similar. (Part II 18) |
| | ii18. Effects of improving the image of E and EW brands are similar. (Part II 20) |
| Interactive experience | ii19. Shopping services of E and EW brands are similar. (Part II 14) |
| | ii20. Member activities of E and EW brands are similar. (Part II 6) |

features. The final sample quantity is 219, thus, the effective value is 219 and the absence value is 0.

3.2.1 Descriptive statistics

The largest group of respondents (51.6%) comprised respondents aged between 24 and 26 years. This age bracket was followed by females aged between 18 and 23, which accounted for 46.1% of the total sample. Consumers in both age groups are the target customers for E and EW brands. The subjects were asked for their understanding of the E and EW brands prior to the investigation. All subjects who presented effective questionnaires stated that they had purchased or at least had known of the E and EW brands and their related products. This fact indicates that the sample is strongly representative. In addition, the reliability and authenticity of our investigation results have been ensured.

We construct a radar chart using the E and EW brands identity model based on the empirical results of the brand identity scale (Fig. 2). The positioning of both the E and EW brands is similar, with similar target customer groups. Therefore, a certain amount of confusion exists with regard to the identity and cognition of consumers for these two brands. The evaluation value of the consumers for these two brands is basically the same, with only very small differences. This finding indicates that a certain overlap exists in virtually every aspect of these two brands and verifies that the apparel brand can be described by an attribute system. In addition, the differences between brand attributes can be presented in the cognition of consumers. The cognitions of consumers for overlapped apparel brand attributes are similar, which is consistent with Hypothesis H1.

The statistical analysis of the empirical results shows that consumers believe that the customer
experience dimension is the highest brand overlap of E and EW (average value 3.4863). The customer experience dimension is followed by the product identity dimension (average value 3.1142) and the brand image dimension (average value 3.0805). These results are in line with Hypothesis H2.

3.2.2 Reliability and validity tests

We measure the uniformity between different projects under conditions of the same theory, with the adoption of Cronbach’s alpha. Under these conditions, the Cronbach’s alpha coefficients of the E and EW brand identity are 0.903 and 0.908, respectively, and brand overlap is 0.771. This finding confirms that the scale can pass the reliability test and the test results are relatively reliable and stable. We adopt the KMO and Bartlett tests. The KMO values of the three scales in this paper are 0.857, 0.866, and 0.717, respectively, which are all greater than 0.5. However, all of the significance levels of the Bartlett test are 0.000. This finding confirms that the scale validity coefficient is good and that the sample is suitable for factor analysis[20].

3.2.3 Factor analysis

We adopt a principal component analysis to verify the brand overlap dimension elements specified in the previous sections. When conducting the principle component analysis of the 20 problems of brand overlap variables, a maximum variance orthogonal rotation method was adopted. In total, eight factors were selected. Of these, the cumulative variance is 61.542% (shown in Table 3). The indexes of “similar personality” (happy, lucky, confident, positive, and fashionable) and “similar member activity of E and EW brands” are 0.404 and 0.427, respectively. All the test indexes are above 0.5, indicating that, in terms of the factor analysis, the extraction degree for common factors is adequate. Our findings also confirm the internal conformity between factors.

We classified the eight extracted components and attained eight main factors by comparing those factors with each variable in the questionnaire. The “similar apparel price” variable is in the X1 factor. The X1 factor, in turn, belongs to the product identity dimension, together with the product category. It indicates the consistency between the apparel product price and the product category in the brand overlap dimension. The “advertisement image” and “product packaging” categories originally belonged to the dissemination image of brand factor. In our factor analysis, the customers include brand image into factor X2, which consists of apparel style and the brand decoration method. This amalgamation of factors explains that the settings of these problems have great similarity and can be considered to be combined in the same product features dimension in the following research. In addition, the “similarity of personality” (happy, lucky, confident, positive, and fashion) question can be included in factor X3. The mean scores of the similarity of personality question and the “after-sales service” question are the highest, at 3.5388 and 3.7808, respectively. The trust of brands and the consumer shopping experience are usually attained by the brand’s widespread activities. Both the brand promotion methods and the expression of a brand’s personality will affect the consumer relationship experience with any given brand. In view of this fact, it is reasonable to combine the brand image and customer experience dimensions. However, in view of the overall brand overlap evaluation, we consider them as independent factors, thereby strengthening the evaluation system’s internal structure. For this reason, this paper takes the brand image and customer experience as two independent factors and analyzes each aspect independently. Both factors X5 and X8 include two personality questions related to the two brands. The answers to the four relevant questions revealed significant differences in opinion. However, the evaluation of subjects in terms of these four questions is low. We can consider deleting these answers to more accurately reflect the variables in the following study. The above result is not in line with Hypothesis H3. That hypothesis explains that the three dimensions of the apparel brand overlap identification model, based on customer perceived value, are low in their degrees of independence, and overlap exists in the internal structure. Comparing the eight extracted main components with the variable elements in the questionnaire, we confirm a total of six factors. We then
Table 3  Rotational component matrix and principal component of brand overlap factor.

| Factor                        | Variable | Component | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     |
|-------------------------------|----------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
|                               |          |           | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     |
| Product category X1           | ii1      | 0.825     |       |       |       |       |       |       |       |       |
|                               | ii2      | 0.838     |       |       |       |       |       |       |       |       |
|                               | ii7      | 0.846     |       |       |       |       |       |       |       |       |
| Product feature I X2          | ii3      | 0.583     |       |       |       |       |       |       |       |       |
|                               | ii6      | 0.639     |       |       |       |       |       |       |       |       |
|                               | ii8      | 0.527     |       |       |       |       |       |       |       |       |
|                               | ii13     | 0.662     |       |       |       |       |       |       |       |       |
|                               | ii14     | 0.626     |       |       |       |       |       |       |       |       |
| Communication relationship X3 | ii11.1   | 0.404     |       |       |       |       |       |       |       |       |
|                               | ii12     | 0.709     |       |       |       |       |       |       |       |       |
|                               | ii15     | 0.657     |       |       |       |       |       |       |       |       |
|                               | ii16     | 0.726     |       |       |       |       |       |       |       |       |
|                               | ii20     | 0.427     |       |       |       |       |       |       |       |       |
| Emotional interaction X4      | ii17     | 0.679     |       |       |       |       |       |       |       |       |
|                               | ii18     | 0.736     |       |       |       |       |       |       |       |       |
|                               | ii19     | 0.514     |       |       |       |       |       |       |       |       |
| Brand personality I X5        | ii11.4   | 0.820     |       |       |       |       |       |       |       |       |
|                               | ii11.5   | 0.735     |       |       |       |       |       |       |       |       |
| Product feature II X6         | ii4      | 0.673     |       |       |       |       |       |       |       |       |
|                               | ii5      | 0.710     |       |       |       |       |       |       |       |       |
| Brand positioning X7          | ii9      | 0.739     |       |       |       |       |       |       |       |       |
|                               | ii10     | 0.725     |       |       |       |       |       |       |       |       |
| Brand personality II X8       | ii11.2   | 0.892     |       |       |       |       |       |       |       |       |
|                               | ii11.3   | 0.502     |       |       |       |       |       |       |       |       |
| Eigen value                   |          |           | 4.327 | 2.337 | 1.889 | 1.657 | 1.311 | 1.146 | 1.099 | 1.003 |
| Explanatory variance (%)      |          |           | 18.030| 9.739 | 7.872 | 6.906 | 5.462 | 4.776 | 4.579 | 4.179 |
| Cumulative variance (%)       |          |           | 18.030| 27.769| 35.640| 42.546| 48.008| 52.783| 57.362| 61.542|

Notes: Extraction method is Principal Component Analysis; Rotation method is Orthogonal rotation method with Kaiser standardization; and Rotation is after 17 iterations of convergence.

adjust the apparel brand overlap identification model.

Figure 3 is the apparel brand overlap identification model after adjustment. Among the variable elements of the model’s three dimensions, overlap occurs on a two-to-two basis. We find this because the concept connotation of the three elements of brand positioning, brand features, and communication relationship crosses the two-dimensional identity content. Moreover, customers displayed similar cognition in these two dimensions. Therefore, we made a corresponding adjustment to increase the conformity of the model’s internal structure.

3.2.4 Cluster analysis

We produced a two-step cluster analysis for the 24 questions relating to brand overlap variables. We divided the surveyed participants into two groups. Group I comprised 134 people, accounting for 60% of the total sample size. Group II contained 85 people, accounting for the remaining 40%. Having analyzed the frequency of brand overlap in these two classes
of consumers, we are able to identify each variable selection question and discover differences in consumer cognition in terms of apparel brand overlap. Hypothesis H4, therefore, is partially supported.

At the same time, we made a mean packet comparison, based on the results of cluster analysis. The results of this analysis clearly indicate that there are great differences in identifying the overlap of the E and EW brands by these two groups of consumers. The mean score of Group II consumers for each question is significantly higher than that of Group I consumers. Specifically, there are far greater differences in product identity and customer experience results. These differences indicate that a consumer’s psychological features have significant influence on the identification of apparel brand overlap. Group II consumers believe that there is a significant overlap between brands E and EW. Group I consumers believe that there is only a small overlap between the two brands. This result indirectly indicates that Group I consumers are greatly affected by the leading factor of brand identity. These consumers have a higher degree of overlap recognition for apparel brands, which is in line with our Hypothesis H5.

The differences between these two groups of consumers in identifying the overlap of E and EW brands are mainly with respect to apparel patterns, colors, and styles. Therefore, this paper also investigates the visual psychology of these two groups of consumers based on a consumer category analysis. We also use eye-tracking technology to analyze the accuracy rate and key characteristics of these two groups of consumers for identifying different brand products.

4 Eye-Tracking Experiments

4.1 Eye-tracking technology

4.1.1 State-of-the-art

Along with the rapid developments in consumption psychology, an increasing number of market researchers have come to realize the importance of this field. Numerous advanced research methods and tools have been applied. Of these, eye-tracking technology is one of the more important tools. Early eye-tracking was mainly used for psychological research (such as reading research) and to assist the disabled. More recently, eye-tracking technology has been applied to image compression and human-computer interaction. The eye movement tracking analysis method has important psychological value as well as an ability to attain many theoretical and practical results. Eye-tracking has also been widely applied in many other fields (see Table 4)[21].

Eye-tracking is a research method used to track, record, and analyze each eye movement in the watching process. The technology then reveals the psychological processing and regularity of people[22]. Yang[23] also believed that eye movement data provide good evidence for the evaluation of the brand extension process. An eye movement index is the ideal index for evaluating the brand extension effect. Eye-tracking is one of the most effective methods of studying consumers and evaluating the brand extension effect.

At the moment, the five kinds of representative eye movement recording methods are as follows[24]:

1. Direct observation method: to visually observe the eye movements of subjects.
2. After image method: to study the eye movements of people with an adoption of the illusion produced after a highly bright flash from a flash lamp.
3. Mechanical recording method, which includes the head fulcrum lever, pneumatic, and corneal absorption ring methods.
4. Current recording method, which includes the current recording method and the electromagnetic induction method.
5. Optical recording method, which includes the reflection recording, film and television, corneal reflection, and photoelectric recording methods.

4.1.2 Eye movement data

The three basic forms of eye movement include (1) fixation, (2) saccades, and (3) pursuit of movement[25]. Fixation is expressed as the stay of an eye on an observed object. Fixation lasts at least 100–200 ms. During the watching process, the eyes are not absolutely still. The eyeballs continuously shake (slightly) in order to watch the objects clearly. The range of movement is less than one degree. Most of the relevant eye-tracking information can only be acquired during the watching process followed by data processing.

Saccades are the changing of either the fixation point...
or the fixation direction. These changes cannot usually be detected by individuals. The speed of saccades is fast at up to 450 degree per second. During saccades, the eye twitching range is from 2° to 20°. Stimulated temporal and spatial information can be acquired during twitching, but stimulated images cannot be clearly formed. Therefore, saccades can indicate quick searching for vision purposes and information selection for stimulation purposes.

Pursuit movement happens when relative motion exists between the observed object(s) and the viewer’s eyes. Pursuit movement ensures that the eyes continuously focus on and follow the movements of the target object. Pursuit movement is usually accompanied by large saccades and subtle twitching. Pursuit movement is “a servo motion with continuous feedback caused by the eyes following an object, when the speed information of the object’s motion is input into the central nervous system”. Therefore, pursuit movement cannot proceed without a clear objective.

The above three forms of eye movement frequently mix together. The eyes’ aim is to select information, focus the attention stimulus at a central area, and form a clear image. Eye movement can reflect the selection mode of visual information, which is of great significance in terms of revealing the cognitive psychology mechanism of subjects.

In view of the research situation both at home and abroad, eye movement research has become an important method of basic empirical psychological research. Eye-tracking technology is being used to make fine recordings of and to analyze visual information processing. Eye-tracking also provides insight into the deep psychological and physiological mechanisms of human activities simply by analyzing the behavioral features that occur during visual information processing. With regard to the application of eye-tracking analysis, very few studies on apparel that include the use of such technology have been published to date. The number of references, therefore, is extremely limited; thus, this paper will conduct exploratory research in the form of an eye movement cognitive experiment for apparel products.

4.1.3 Eye-tracker

Our experiments use eye-tracking equipment from SMI of Germany. The working principle is to capture the eye images of subjects with an infrared camera. Those images are then input into a computer for image data collection and analysis after MPEG coding. In addition, the computer calculates the real-time horizontal and vertical movement time, displacement distance, speed, pupil diameter, and fixation position of each subject’s eyes. Both a fixation analysis and statistical analysis can be made at the same time. A fixation analysis is used to display the movement path of the subject’s fixation point during visual stimulation as well as the eyes’ residence location and time spent watching moving or still images. Fixation analysis can also divide the subject’s points of interest and then attain the residence time of each interest area, and statistics for multiple-watch situations.

SMI has three eye-tracker models: the HED model (head-mounted), RED model (desktop), and high-speed model (for when a high sampling rate is required). We utilized the RED desktop eye-tracker model with the system structure shown in Fig. 4. The equipment we used included an iView PC testing computer, Stimulus PC image display computer, and two sets of infrared lights with a camera installed below computer screen. Subjects watch images on the Stimulus PC in front of them. Testers controlled the images displayed on the Stimulus PC via the iView PC testing computer. The camera installed underneath the Stimulus PC screen captured the subjects’ eye images. Those images are then transferred to the iView PC testing computer, which collects and analyzes eye movement data. The Stimulus PC screen can work with LCD through a projector or on paper. The RED 250 sample rate can reach 250 Hz. The advantage of the RED eye-tracker is that subjects do not need to wear any equipment or instruments. Their heads can move freely within a certain range, so the subjects feel comfortable and can endure long-term tests.

Calibration of the RED eye-tracker takes about 30 seconds. This model can be set for two-point, five-point, or nine-point calibration. The subjects are instructed to watch the light spots displayed on the computer screen. The images watched by subjects can be a still text chart or an ad page; they could also be a dynamic webpage or video images. The RED eye-tracker sets the display time and image order through Experiment Center software. The eye-tracker then triggers the change of displayed images via a setting threshold.

![Fig. 4 System structure of SMI iView X™ RED.](image-url)
The iView X software in the eye-tracker records the length of time that images are watched or glanced at as well as the position coordinates and pupil size. BeGaze analysis software is then used to analyze the moving track of the subject’s fixation point, the fixation time at different positions, and the regional distribution (the area within which the fixation stays). We then sketched the area(s) of interest and obtained each fixation staying time of each interest area as well as the total staying time and the in and out times. By analyzing the resulting data, we learned the subjects’ visual habits and attention distribution when watching the images. Our comprehensive database includes the related experimental synthetic data and visual records of multiple subjects. In addition, all the recorded data can be output in a standard file format for performing follow-up analysis. The technical parameters of the RED eye-tracker are shown in Table 5.

### Table 5 Technical parameter of SMI iView X™ RED

| Technical indicator                  | Technical parameter       |
|-------------------------------------|---------------------------|
| Sampling rate                       | 50/60 Hz-250 Hz           |
| Tracking resolution                 | 0.1 deg. (typ.)           |
| Gaze position accuracy              | 0.5–1 deg. (typ.)         |
| Operating distance, subject to camera | 0.4–1.0 m               |
| Head tracking range                 | 40 cm × 40 cm at 80 cm distance |

4.2 Experiment setup

#### 4.2.1 Hypotheses

This study intends to select the brands of women’s wear with the biggest market share and greatest brand awareness. To decrease the uncontrollable factors of our research, this paper has chosen apparel brands of the same category and at the same level with regard to the overlap of target customer groups. The brands are sold under the same brand name of the researched business. We also checked the application of the evaluation system of apparel brand overlap as proposed in this paper. Therefore, the E and EW women’s wear brands, sold by French E Company, were selected for empirical research.

The differences between Group I and Group II consumers in terms of the evaluation overlap of the E and EW brands mainly lie in relation to apparel pattern, colors, and style. Through the use of eye-tracking technology, this paper intends to conduct and analyze an eye movement cognitive experiment examining the visual psychology of these two kinds of consumers. The experiment is based on category analysis and analyzes the accuracy rate and key feature areas of these two types of consumers with regard to the identification of different brand products. Therefore, the following hypotheses have been proposed with regard to this experiment:

- **H6.** The accuracy rate of Group I subjects in terms of apparel brand identity is higher than the rate of Group II subjects.
- **H7.** Consumer classification factors have an obvious influence on apparel brand overlap identification.
- **H8.** Apparel category elements have an obvious influence on apparel brand overlap identification.
- **H9.** Group I subjects are highly efficient in the classification processing of product identity.
- **H10.** There are obvious differences between Group I subjects in the target area and interference area.
- **H11.** There are obvious differences between Group II subjects in the target area and interference area.

#### 4.2.2 Experimental subjects

We determined that the eye-tracking experiment should be conducted within a specified period of time. The time constraints are necessary to ensure that the subjects are representative and the experimental data is both authentic and effective. We were also restricted by time and environmental factors.

Based on previous eye-tracking experiments conducted by scholars both at home and abroad, subjects or samples must be restricted and meet certain specific requirements before participating in the experiment. Therefore, these experimental samples are not random. The experiment can properly decrease the sample content due to time, cost, and experimental operation restrictions. To ensure that the subjects are representative, the proportion of the aforementioned two types of subjects should be in line with the proportions found in the cluster analysis. Before the experiment commenced, the subjects were given a simple explanation on what was about to take place. To minimize individual differences between the subjects, we selected school students as the subjects of this experiment.

Because our experiment studies two types of subjects (based on the above principles), we select 50 school students of each type to participate in our questionnaire. The vision or corrected vision of all subjects is required to be normal. In addition, the subjects should not have a similar experimental experience. Based on these parameters, we finally selected 100 subjects for this experiment (after removing unqualified candidates), including 54 Group I and 46 Group II subjects.
4.2.3 Brand images
As a brand identity research on apparel products, our study requires the experimental images be representative. The market’s level of acceptance of the apparel products used in this experiment should be high and the consumers should have certain brand familiarity with these types of apparel products. To ensure the conformity of the image attributes and to decrease the influence of differences caused by the artificial bias of eye movement, the images were selected carefully from the official website of E Company.

We divided the apparel products into 10 categories by analyzing the product categories of these two brands. We then selected top five clothing products of these two brands and numbered the corresponding images.

Before the formal experiment, we conducted a pre-survey of the experiment images and finally selected the brand images for each category. Twenty female consumers, 10 professionals and 10 non-professionals, were chosen to select the images. We determined in the pre-survey that all subjects were loyal customers of E or EW.

The respondents made a preliminary selection of various clothes and three images (out of five) most relevant to the brand’s identity, based on the subject’s understanding and cognition of the brand. The top three images from each category have been confirmed based on data statistics (as shown in Table 6).

4.2.4 Experimental steps and Key Performance Indicators (KPIs)
(1) When testing individuals, the subjects hold their heads 50 cm in front of the instruments. We ensure this by sitting each individual down and then fixing his/her head at a horizontal position 50 cm from the display.

(2) Necessary eye calibration is performed.

(3) We present our experimental instructions and explain to each subject what is about to occur. The instructions read: “Hi, this is a single choice test. For each question, there will be two images of E and EW apparel. You need to select the E brand apparel from the two. The selection time is limited; we hope you can finish the task quickly and successfully. If everything is clear, please inform the tester.”

(4) The main tester starts by inquiring whether or not the subject understands all the relevant details. The formal experiment starts after this is confirmed. The tester controls the program of presenting experimental images. Clothing of the same color category and same series of E and EW brands were displayed during the experiment. The subjects were asked to select the E brand apparel and the experimental program automatically recorded the subjects’ answers and reaction time. The accuracy of the reaction time is within one millisecond.

In the formal experiment, the subjects first observe the image. The display time of each image is 8000 ms. Each subject then selects the correct answer using the mouse. The experiment then automatically moves to the next question. The subject answers the remaining questions, one-by-one, until the test is finished.

The eye movement cognitive portion of our experiment includes the following two aspects: (1) apparel brand identification probability and (2) eye movement cognitive data. The research into apparel brand identification is generally performed from the two perspectives of subjects and apparel categories, with the KPIs as shown in Table 7.

4.3 Results
4.3.1 Subjects’ information and AOI division
We compiled the statistics relating to the consumption behavior of the 100 subjects. The average frequency of these two groups of subjects entering E and EW

| Apparel category | E brand (Selected probability) | EW brand (Selected probability) |
|------------------|--------------------------------|---------------------------------|
| T-shirt          | E02 (100%)                     | EW02 (60%)                     |
| Shirt            | E08 (70%)                      | EW09 (70%)                     |
| Sweater          | E12 (60%)                      | EW14 (90%)                     |
| Twinset          | E17 (60%)                      | EW15 (70%)                     |
| Coat             | E22 (70%)                      | EW19 (90%)                     |
| Skirt            | E27 (80%)                      | EW24 (70%)                     |
| Dress            | E33 (70%)                      | EW30 (70%)                     |
| Shorts           | E37 (70%)                      | EW38 (50%)                     |
| Pants            | E43 (70%)                      | EW43 (80%)                     |
| Jeans            | E48 (60%)                      | EW49 (70%)                     |
Table 7 KPI and the meaning of experimental data.

| KPI | Unit | Meaning |
|-----|------|---------|
| Sequence | – | Arranged in average of first fixation moments. The smaller the mean the higher the regional order. |
| Entry time | ms | Average first fixation moment in AOI of all selected subjects. |
| Dwell time | ms | Average value of the total fixation and saccade time in AOI of all selected subjects. |
| Dwell time ratio | % | \( \% = \frac{\text{dwell time} \times 100}{(\text{last fixation moment in AOI} - \text{first fixation moment in AOI})} \) |
| Fixation | – | The number of subjects who at least one time fixated on AOI. |
| Hit ratio | % | \( \% = \frac{\text{Fixation}}{\text{Number of subjects}} \) |
| Revisitors | – | The number of subjects who more than twice fixated on AOI. |
| Average fixation | ms | Average fixation time in AOI of all selected subjects. |
| First fixation | ms | Average first fixation time in AOI of all selected subjects. |
| Fixation count | – | Average fixation count in AOI of all selected subjects. |

brand stores and purchasing apparel products has been obtained. In total, 61% of subjects stated that they go shopping at least once or twice each season. Of those, 17% stated that they went to E and EW stores at least once per season. In addition, 20% of the subjects were unsure about their precise shopping habits. However, nearly 20% of all subjects reported that they bought clothes of these two brands every season. There were no significant differences between the two groups for these two questions. In addition, the distribution is consistent with the general trend.

We divide the experimental pictures into E-AOI (Areas of Interest) and EW-AOI as shown in Fig. 5. We define E-AOI as the target area, and EW-AOI as the interference area, and EW-AOI as the interference area. Tables 8 and 9 contain the eye movement data of the two groups in the two defined areas.

4.3.2 Probability of identifying apparel brands

4.3.2.1 Subject element

(1) Descriptive analysis

Through SPSS data analysis, the rates of the correct answers of Group I and Group II (with regard to apparel brand identification) are 62.0370% and 60.8696%, respectively. The rate of Group I’s correct answers is higher, which is in line with our experimental Hypothesis H6. However, the differences from Group II are insignificant. In general, when the subjects make a brand identification choice for either E or EW apparel products, the rate of correct responses is only 61.5% on average. This finding indirectly explains why a certain overlap exists in the product identity of these

![Fig. 5 Example of E-AOI and EW-AOI.](image-url)
Table 8  Experimental data in AOI of tops.

| Apparel category | AOI | Group | Sequence | Entry time (ms) | Dwell time (ms) | Hit ratio (%) | Number of revisits | Number of revisitors | Average fixation (ms) | First fixation (ms) | Number of fixations |
|------------------|-----|-------|----------|----------------|----------------|---------------|-------------------|---------------------|---------------------|--------------------|-------------------|
| T-shirt          | E   | I     | 1        | 634           | 2949           | 100           | 2                 | 52                  | 210                 | 182                | 11                |
|                  |     |       | 2        | 633           | 3453           | 100           | 2                 | 41                  | 222                 | 166                | 13                |
|                  | EW  | I     | 2        | 645           | 2811           | 96            | 3                 | 51                  | 223                 | 205                | 10                |
|                  |     |       | 1        | 616           | 2497           | 100           | 2                 | 42                  | 225                 | 200                | 9                 |
| Shirt            | E   | I     | 1        | 504           | 3311           | 100           | 3                 | 50                  | 219                 | 232                | 13                |
|                  |     |       | 2        | 173           | 3418           | 100           | 3                 | 46                  | 234                 | 256                | 12                |
|                  | EW  | I     | 2        | 1270          | 2445           | 91            | 2                 | 49                  | 221                 | 177                | 9                 |
|                  |     |       | 2        | 1456          | 2837           | 100           | 2                 | 45                  | 262                 | 222                | 10                |
| Sweater          | E   | I     | 1        | 177           | 3295           | 100           | 2                 | 52                  | 227                 | 255                | 12                |
|                  |     |       | 2        | 93            | 3148           | 100           | 3                 | 45                  | 234                 | 233                | 11                |
|                  | EW  | I     | 2        | 1097          | 2713           | 94            | 2                 | 49                  | 243                 | 205                | 9                 |
|                  |     |       | 2        | 1440          | 2770           | 100           | 2                 | 44                  | 278                 | 246                | 9                 |
| Twinset          | E   | I     | 1        | 268           | 3229           | 100           | 2                 | 50                  | 223                 | 235                | 12                |
|                  |     |       | 2        | 203           | 3298           | 100           | 3                 | 45                  | 237                 | 231                | 12                |
|                  | EW  | I     | 2        | 1396          | 2705           | 93            | 2                 | 46                  | 236                 | 204                | 9                 |
|                  |     |       | 2        | 1412          | 2867           | 100           | 2                 | 39                  | 269                 | 226                | 10                |
| Coat             | E   | I     | 1        | 212           | 3151           | 100           | 2                 | 53                  | 236                 | 226                | 11                |
|                  |     |       | 2        | 111           | 3539           | 100           | 3                 | 46                  | 257                 | 246                | 12                |
|                  | EW  | I     | 2        | 1366          | 2939           | 98            | 2                 | 47                  | 261                 | 195                | 10                |
|                  |     |       | 2        | 1145          | 3086           | 100           | 2                 | 45                  | 266                 | 256                | 10                |

Table 9  Experimental data in AOI of bottoms.

| Apparel category | AOI | Group | Sequence | Entry time (ms) | Dwell time (ms) | Hit ratio (%) | Number of revisits | Number of revisitors | Average fixation (ms) | First fixation (ms) | Number of fixations |
|------------------|-----|-------|----------|----------------|----------------|---------------|-------------------|---------------------|---------------------|--------------------|-------------------|
| Skirt            | E   | I     | 1        | 285           | 2993           | 100           | 2                 | 49                  | 231                 | 233                | 11                |
|                  |     |       | 2        | 73            | 3409           | 100           | 2                 | 45                  | 238                 | 242                | 13                |
|                  | EW  | I     | 2        | 1549          | 2961           | 98            | 2                 | 50                  | 240                 | 230                | 10                |
|                  |     |       | 2        | 1333          | 2859           | 100           | 3                 | 45                  | 268                 | 252                | 10                |
| Dress            | E   | I     | 1        | 528           | 3098           | 100           | 2                 | 50                  | 212                 | 246                | 12                |
|                  |     |       | 2        | 273           | 3162           | 98            | 3                 | 44                  | 226                 | 249                | 12                |
|                  | EW  | I     | 2        | 1313          | 2815           | 96            | 2                 | 48                  | 230                 | 201                | 10                |
|                  |     |       | 2        | 1308          | 2817           | 100           | 2                 | 42                  | 260                 | 217                | 10                |
| Shorts           | E   | I     | 1        | 348           | 2922           | 98            | 2                 | 50                  | 225                 | 239                | 11                |
|                  |     |       | 2        | 93            | 3224           | 100           | 3                 | 45                  | 234                 | 234                | 12                |
|                  | EW  | I     | 2        | 1152          | 3000           | 96            | 2                 | 51                  | 225                 | 218                | 11                |
|                  |     |       | 2        | 1096          | 3134           | 100           | 2                 | 44                  | 247                 | 201                | 11                |
| Pants            | E   | I     | 1        | 353           | 2742           | 100           | 3                 | 51                  | 215                 | 229                | 11                |
|                  |     |       | 2        | 78            | 2986           | 100           | 3                 | 44                  | 224                 | 251                | 11                |
|                  | EW  | I     | 2        | 1227          | 2987           | 98            | 2                 | 50                  | 229                 | 218                | 11                |
|                  |     |       | 2        | 1079          | 2758           | 100           | 2                 | 44                  | 262                 | 229                | 10                |
| Jeans            | E   | I     | 1        | 68            | 3052           | 98            | 3                 | 52                  | 215                 | 231                | 12                |
|                  |     |       | 2        | 131           | 2911           | 98            | 3                 | 44                  | 217                 | 252                | 12                |
|                  | EW  | I     | 2        | 1188          | 2910           | 98            | 2                 | 51                  | 244                 | 214                | 10                |
|                  |     |       | 2        | 921           | 3050           | 100           | 2                 | 46                  | 259                 | 236                | 11                |

There is a similarity in product design, leading to confusion for consumers.

(2) Normality test and homogeneity test of variance

A normality test for the apparel brand identity data for the two groups generates the Sig (significance probability) values of 0.061 and 0.074, respectively, and both higher than 0.05. Hence, the tested experimental data meet the normal distribution standards. The P value
of the homogeneity test of variance of this experimental data is greater than 0.05, which indicates no obvious difference in these two sample variances.

(3) One-way ANOVA

The $P$ value of the ANOVA test ($\text{Sig} = 0.768$) is greater than 0.05, implying that the analysis result is not in line with experimental Hypothesis H7. In our brand overlap identification experiment, the subject groups did not have an obvious influence on the results of brand overlap identification. This finding indirectly indicates that the subjects’ cognitive states in terms of brand overlap have certain universality not limited to one type of subject.

4.3.2.2 Apparel category element

(1) Descriptive analysis

Certain differences exist between the two groups’ accuracy rates in terms of the brand identification of the various types of apparel products. Among the Group I subjects, pants and jeans had the highest brand identity rate (72.2% on average). Skirts had the lowest brand identity rate (55.5%). Among the Group II subjects, jeans again had the highest brand identity rate (76.1%) while shirts had the lowest rate (41.3%). In combination, the identity rate of jeans was the highest (74%) while that of shirts was the lowest (49%). Among the Group I subjects, there were no significant differences in the accuracy rates of identifying various apparel products. The rates average at 60%. However, significant differences were detected in the identity rates of Group II, which fluctuate between 40% and 70%.

(2) Homogeneity test of variance

The $P$ value ($\text{Sig}=0.509$) in the homogeneity test of variance is greater than 0.05, which indicates that the two sample variances are the same. In addition, the one-way ANOVA is of statistical significance.

(3) One-way ANOVA

Assume there is no obvious difference between apparel category factors and brand overlap identification. The variance analysis results have shown that the $P$ value ($\text{Sig} = 0.763$) is greater than 0.05. This finding is not in line with our Hypothesis H8. This, in turn, indicates that if we divide the apparel products into 10 categories, the influence on the two subject groups in a brand overlap identification experiment is not obvious. The accuracy rate of Group I judging of various apparel brands is different from that of Group II. However, this fact does not affect the overall identification of the apparel products. This finding also shows that the phenomenon of brand overlap is not simply expressed in one type of apparel products. Rather, brand overlap is common in all types of product designs.

4.3.3 Experimental data analysis of eye movement cognition

4.3.3.1 Recognition area analysis

(1) Dwell time of AOI

Figures 6 and 7 are the statistical charts of dwell time and the average fixation time of the two types of subjects for the AOI area of each kind of product. As indicated in the figure, in the view of the subject factors, the dwell time and average fixation time of Group II of each category in the two AOI areas are longer than those of Group I. In view of the AOI area division, the dwell time of these two types of subjects on the E-AOI area is greater than that on the EW-AOI area. However, the duration is exactly the opposite. This finding indicates that Group II needs more time to discriminate apparel brands. These two groups of subjects can be offered more dwell time for the target area, but would watch the interference area for a longer period of time. Group I’s accuracy rate in terms of brand identification is higher than that of Group II. This finding indirectly indicates that Group I has a higher degree of efficiency in terms of the classification cognition of product identity. This finding is in line with Hypothesis H9. At the same time, the finding explains why there is a high degree of similarity in the image’s interference area and objective area and why the brand overlap of apparel brands is quite large.
(2) Focus range of AOI

Table 10 shows the heat map of the two types of subjects relative to the hot spots on shirts, dresses, and jeans. It demonstrates the correct probability rate for shirts to be the lowest (49%), whereas the correct probability for jeans is once again the highest (74%). There are small differences in the heat maps of the shirt images, whereas there are significant differences in the heat maps of the jeans images. The heat map with the biggest differences in these two subjects is the dress image. This finding indicates that when subjects conduct brand identity for apparel products, their eyes primarily focus on the middle and upper parts of the products. The sight gathering area of Group I is more disperse, whereas that of Group II is relatively concentrated. This finding indicates that when identifying a brand, Group II subjects prefer to differentiate apparel based on precise details, whereas Group I subjects prefer to differentiate based on the overall appearance of the apparel products.

4.3.3.2 Eye movement index analysis

(1) Homogeneity test of variance

We conducted a homogeneity test of variance for the eye movement cognitive experiment data for the two groups. Except for the hit ratio and revisits, all remaining eye movement indexes are with homogeneity of variance, which meets the paired T-test requirements. In addition, our data analysis confirms statistical significance (as in Tables 11 and 12).

(2) Paired samples T test The analysis of eye movement cognitive data from the two groups is consistent with a normal distribution.

We also conducted a data transfer for the sample of variance heterogeneity and a paired T-test for the eye movement cognitive experimental data of the two AOI areas of the same subject type. We can assume no obvious difference between the two overall averages and a statistical table of the eye movement cognitive experimental data paired with a T-test of the two groups can be obtained accordingly (as in Tables 13 and 14). The tables show obvious differences in eye movement data in both the target area and interference area between the two groups. This finding is in line with experimental Hypotheses H10 and H11.

| Table 10  | Experimental data in AOI of bottoms. |
|-----------|--------------------------------------|
| Apparel category | Group I | Group II |
| Shirt | ![Heat map](image) | ![Heat map](image) |
| Dress | ![Heat map](image) | ![Heat map](image) |
| Jeans | ![Heat map](image) | ![Heat map](image) |
5 Conclusion

This study has constructed an apparel brand overlap identification model. We have conducted an empirical study and an eye-tracking experiment by selecting two apparel brands from the representative international E Company and reached the following conclusions:

1) The difference between brands can be expressed by the perception of consumers with regard to a brand’s attributes. This is consistent with the consumers’ attribute cognition of overlapped apparel brands. The positions of E and EW brands are similar. The brands, therefore, take up similar market resources in consumer groups. Certain confusion exists among consumers with the recognition and cognition of brands. In addition, the evaluation values for these two brands are essentially the same, indicating that the two brands are overlapped in product identity, brand image, and customer experience.

2) Sixty percent of the consumers who participated in our questionnaire investigation believed that there is no obvious overlap between the two chosen brands while 40% believed that there is an obvious overlap between these two brands, especially in the aspect of product identity. However, the identification degree of the two groups of consumers is more consistent in the aspect of customer experience. The main differences in brand overlap evaluation lie in apparel pattern, color, and style. This finding indicates that when influenced by psychology and other aspects, different consumers have different brand cognitions, which, in turn, causes certain differences in the recognition effect of brand overlap under the function of self-perceived value.

3) By conducting a brand identification test using eye-tracking technology, we discovered that no obvious differences exist between the two subject groups. When the apparel products of the E and EW brands are combined, approximately 60% of product brands could be accurately identified by the subjects. This means, however, that the error rate is as high as 40%. These findings indicate that these two brands are seriously homogenized in their products. Our investigation reveals that some consumers even think that EW is merely a series of leisure products of the E brand. Consumers psychologically mix these two brands up, implying that both these brands need to differentiate their corresponding product lines.

| Table 11 Normality test of experimental data of Group I. |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| KPI             | Levene statistic | df1  | df2  | Sig.     | Result         |
| Entry time      | 0.147           | 1    | 18   | 0.706    | Homoscedasticity |
| Dwell time      | 0.068           | 1    | 18   | 0.797    | Homoscedasticity |
| Hit ratio       | 4.967           | 1    | 18   | 0.039    | Heteroscedasticity |
| Revisits        | 5.684           | 1    | 18   | 0.028    | Heteroscedasticity |
| Revisitors      | 0.750           | 1    | 18   | 0.398    | Homoscedasticity |
| Average fixation| 0.970           | 1    | 18   | 0.338    | Homoscedasticity |
| First fixation  | 0.006           | 1    | 18   | 0.939    | Homoscedasticity |
| Fixation count  | 0.116           | 1    | 18   | 0.737    | Homoscedasticity |

| Table 12 Normality test of experimental data of Group II. |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| KPI             | Levene statistic | df1  | df2  | Sig.     | Result         |
| Entry time      | 2.595           | 1    | 18   | 0.125    | Homoscedasticity |
| Dwell time      | 0.497           | 1    | 18   | 0.490    | Homoscedasticity |
| Hit ratio       | 47.250          | 1    | 18   | 0.000    | Heteroscedasticity |
| Revisits        | 216.000         | 1    | 18   | 0.000    | Heteroscedasticity |
| Revisitors      | 1.000           | 1    | 18   | 0.331    | Homoscedasticity |
| Average fixation| 0.142           | 1    | 18   | 0.711    | Homoscedasticity |
| First fixation  | 0.009           | 1    | 18   | 0.923    | Homoscedasticity |
| Fixation count  | 0.000           | 1    | 18   | 1.000    | Homoscedasticity |

| Table 13 Paired samples T-test of experimental data of Group II. |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | Entry time (ms) | Dwell time (ms) | Hit ratio (%)    | Number of revisits | Number of revisitors | Average fixation (ms) | First fixation (ms) | Number of fixations |
| E               | 186.10          | 253.90          | 0.40            | 2.60             | 44.50             | 232.30           | 236.00           | 12.00             |
| Std. deviation  | 169.38          | 207.03          | 0.97            | 0.52             | 1.43              | 11.17            | 26.09            | 0.67              |
| EW              | 180.60          | 867.50          | 100.00          | 2.00             | 43.50             | 259.60           | 228.50           | 10.00             |
| Std. deviation  | 266.88          | 186.90          | 0.00            | 0.00             | 2.01              | 14.55            | 19.49            | 0.67              |
| Paired samples correlation coefficient | Correlation coefficient | Sig. | 0.063 | 0.733 | – | – | 0.289 | 0.415 | 0.497 | 0.000 |
| Paired samples T-test | t | 7.996 | 4.133 | 1.964 | 3.674 | 1.500 | – | 6.081 | 1.007 | 6.708 |
| df               | 9               | 9               | 9               | 9               | 9               | 9               | 9               | 9                 |
| Sig. (2-tailed)  | 0.000           | 0.003           | 0.081           | 0.005           | 0.168           | 0.000           | 0.340           | 0.000             |
Table 14 Paired samples T-test of experimental data of Group I.

|                | Entry time (ms) | Dwell time (ms) | Hit ratio (%) | Number of revisits | Number of revisitors | Average fixation (ms) | First fixation (ms) | Number of fixations |
|----------------|-----------------|-----------------|---------------|-------------------|----------------------|----------------------|---------------------|---------------------|
| E Mean         | 337.70          | 3074.20         | 99.40         | 2.30              | 50.90                | 221.30               | 230.80              | 11.60               |
| Std. deviation | 174.48          | 179.98          | 0.97          | 0.48              | 1.29                 | 8.55                 | 19.19               | 0.69                |
| EW Mean        | 1220.30         | 2828.60         | 95.80         | 2.10              | 49.20                | 235.20               | 206.70              | 9.90                |
| Std. deviation | 241.09          | 172.27          | 2.44          | 0.32              | 1.75                 | 12.24                | 14.59               | 0.74                |
| Paired samples correlation coefficient | | | | | | | | |
| Correlation coefficient | 0.435 | −0.775 | −0.245 | −0.218 | 0.010 | 0.676 | 0.035 | −0.732 |
| Sig.           | 0.210           | 0.008           | 0.495         | 0.545             | 0.978                | 0.032                | 0.923               | 0.016               |
| Paired samples T-test | t         | 7.890 | 2.340 | 4.014 | 1.000 | 2.486 | −4.871 | 3.216 | 4.019 |
| df             | 9               | 9               | 9             | 9                 | 9                    | 9                    | 9                   | 9                   |
| Sig. (2-tailed)| 0.000           | 0.044           | 0.003         | 0.343             | 0.035                | 0.001                | 0.011               | 0.003               |

(4) The brand images in the eye movement experiment include various kinds of products. Our data analysis shows that there are certain differences between the two subject groups in identifying various products. However, the difference value is low, implying that the individual products of the E and EW brands are highly similar. The experiment pictures are all the best-selling products of each product type, downloaded from the Company’s social websites. Therefore, even the products of these brands are similar. They are difficult to distinguish with any degree of accuracy. However, the degree of acceptance among consumers is high; thus, brand similarity would apparently not affect sales negatively in the short-term. Such familiarity of brands would inevitably cause cannibalization of the E and EW brands if the present situation continues.

Various apparel brands have similar characteristics and obvious homogenization, which cause extremely fierce competition in the domestic apparel market. Therefore, apparel enterprises need to strengthen their own competitiveness through innovative brand design and management. They also need to adopt scientific positioning strategies for their apparel brands and implement differentiation strategies.

Acknowledgment

This paper was supported by Planned Project of Tianjin Art Science (No. C14057).

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